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Practical WIRELESS

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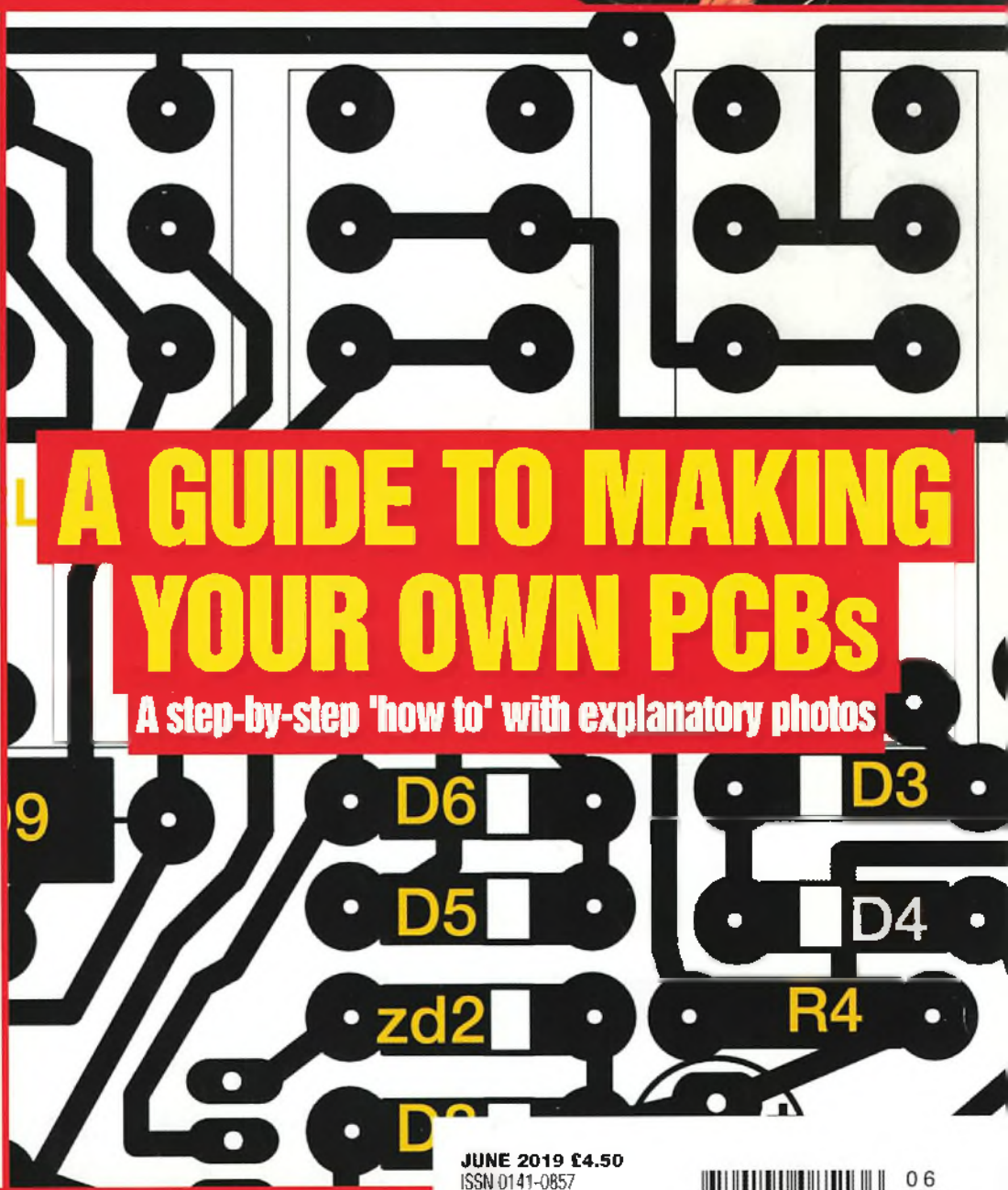
A tale of derring-do!

Valve & Vintage
An unusual PMR set



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Europe's HAM RADIO STORE

International Ham Stores - the sign that means a GREAT DEAL!

By the time you are reading this we should be well towards summer and a great time to update antenna systems. We probably carry the largest range of antennas in the ham ratio industry and lots of associated accessories - too many to list in a paper advert. Our web site is a good starting point. We can offer antennas for small gardens ad well as the larger plots. Wire, guys, rotators, feeder cable - we have the lot. Maybe you are not sure what you need or what to chose from our wide selection. The answer is easy: just pick up the phone and dial 01702 206835 and speak to our sales staff. All of them, like myself, are active ham operators.

Peter Waters G3OJV

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FT-8900E	Dual VBand Mobile	£289.00
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FTM-400XDE	Digi Mobile	£419.00
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FT-65E	Handy Dual Band	£89.00
VX-6E	Handy Dual Band	£149.00
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Peter Waters G3OJV, operates the first FT-DX101 to come into the UK.

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IC-7610 £3499

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IC-7610	HF-6m 100W	£3,499.00
IC-7410	HF-6m 100W	£1,489.00
IC-7100	HF-70cms	£999.00
IC-9100	HF-70cms	£2,799.00
IC-7700	HF-6m	£4,789.00
IC-7851	HF-6m Flagship	£9,899.00
IC-9700	2m-23cms	£1,799.00
IC-V80E	2m Handy	£129.95
ID-51E	Dual Band D-Star	£378.00
IC-2730E	2m/90cms Mobile	£279.00
ID-4100E	Mobile D-Star	£299.00
ID-5100E	Mobile D-Star	£574.00

IC-9700

The new IC-9700 transceiver will be with us in the next few weeks. It offers 2m, 70cms and 23cms at an amazing price. SDR on 2m and 70cms with down convertion on 23cms. Great part exchange deals. Call Now. **£1795**

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DMR with Dual band 2m/70cms and GPS. Colour screen and easy operation. Includes UK CD data channel program to get you on the air immediately.

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Here is a traditional analogue 30 Amp variable voltage power supply. Heavy, rugged and noise free!

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2 YEAR WARRANTY

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The K3S offers great value for money. Still the best analogue transceiver currently in production, it has great versatilty. Its lightweight makes it easy to carry on DXpeditions. Its performance is legendary and beats any comparable transceiver, regardless of cost. You are protected against obsolescence by virtue of regular firmware updates and replacement modules. And you only pay for what you need! A wide range of options allow you to add a wide range of features to.

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K3S/100-F	100W Transceiver Ready Built	£2849.95
K3S/10-F	10W Yransceiver Ready Built	£2329.95

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There is something very special about the KX3. It out-performs any similar transceiver and almost all of the base stations. You can run it at 100mW or increase to any power up to 15W (a bit less above 20m). You can add 2m or 4m, Add a narrow roofing filter or auto ATU. No other rig can match it.

Kit: £1099 Built: £1149

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- DC Lead £11.95
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- 4m Transvert £309.95
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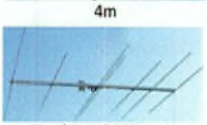
100W PA for:
- KX3 • KX2
- FT-817

- FT-817/818 option £11.95

Kit: £899.95 Built: £949.95

2/70cms

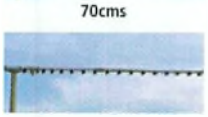
4m



Dual Band 2/70cms

2m

70cms



23cms

DUAL Antenna Range from DUAL

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PA5070-11-6	6m 5el 4m 6 el 6m boom	£249.95

4M Yagis

PA70-5-3	4m 5 element Yagi 3m boom	£129.95
PA70-6-4	4m 6 element Yagi 6m boom	£169.95

Dual Band 2/70cms

PA144-432-13-1.5	2m 5 element 70cms 9 element	£109.95
PA144-432-17-2	2m 6 element 70cms 12 element	£139.95
PA144-432-19-3-2C	2m 7 element 70cms 12 elements	£199.95
PA144-432-21-3	2m 7 element 70cms 14 element	£189.95

2M Yagis

PA144-5-1.5	2m 5 element Yagi 1.5m boom	£89.95
PA144-6-2	2m 6 element Yagi 2m boom	£104.95
PA144-8-3	2m 8 element Yagi 3m boom	£125.95
PA144-9-5A	2m 9 element portable 4.67m	£164.95
PA144-11-6BG	2m 11 element Guyed 5.72m	£194.95

70cms Yagis

PA432-8-1.2R	70cms 8 element Yagi 1.2m boom	£79.95
PA432-14-3	70cms 14 element Yagi 3m boom	£135.95
PA432-23-6	70cms 23 element Yagi 6m boom	£185.95
PA432-29-8	70cms 29 element Yagi 8m boom	£259.95

23cms Yagis

PA1296-13-1R	23cms 13 element 1m Rear mount	£89.95
PA1296-18-1.5AR	23cms 18 element 1.5m Rear mount	£129.95
PA1296-36-3RG	23cms 36 element 3m RG Balun	£159.95
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PA1296-70-6RG	23cms 70 element 6m RG Balun	£214.95
PA1296-70-6UT	23cms 70 element 6m Teflon Balun	£229.95

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This is a great antenna for the small garden.

£249.95

6 Bands 20m - 6m rated to 300W. 9ft per side with 6ft turning radius. Includes ferrite balun.

MFJ-1836H .....1.5kW version.....£299.95

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The classic triband Yagi that will handle up to 1.5kW.

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MFJ Loops for small places

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30m - 10m continuous. 1m Diameter. 150W with controller. £479.95

MFJ-1788X
40m - 10m continuous. 1m Diameter. 150W with controller. £529.95

MFJ-1846 Hex Beam

6 Bands 20m - 6m with 2 elements on each band.

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This antenna will handle 2kW yet will fit into many gardens. Turning radius 11ft and forward gain approx 6dB.

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Here's a compact rotary dipole that will fit in most gardens and covers 40m to 2m.

£395.95

AV-12AVQ 20m-10m

It's a classic and a great way to get on the the DX bands. Can be ground mounted and will handle up to 1kW. Self supporting.

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Hygain DX-88 80-10m

t's one of our best selling ham radio verticals, not least because it covers so many bands.The eight bands covered are 80-40-30-20-17-15-12-10m. Will handle up to 250W on all bands.

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Plug and Play USB

The easy way to interface your PC and radio for data operation. It comes with a USB lead to match your radio. Just tell us which radio you have and we will supply the necessary lead.

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- SSB FM AM
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- Attenuator
- Band Scoper
- MW Bar Antenna
- Signal Meter
- Lots More!

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1kW End Fed Design

MyAntenna USA

No ATU Needed

EFHW-4010 66ft 40-20-15-10m

EFHW-8010 132ft 80-40-30-20-17 15-12-10m

Peter Waters G3OJV says, this has to be the perfect wire antenna solution for many. End fed makes installation easy. No ATU is a big plus. I use one myself and it beats the pants of the old G5RV.

MyAntenna EFHW-4010 .....£149.95
MyAntenna EFHW-8010 .....£159.95

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Diamond CX-210A	2 Way PL £49.95
Diamond CX-210N	2 Way N £79.95
Diamond CX-310A	3 Way PL £88.95
Diamond CX-310V	3 Way N £116.95
Watson CX-SW2N	2 Way N £41.94
Watson CX-SW2PL	2 Way PL £34.95
Watson CX-SW3N	3 Way N £59.95
Watson CX-SW3PL	3 Way PL £54.95
Watson CX-SW4N	4 Way N £79.95
Watson CX-SW4PL	4 Way PL £69.95

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A great range of 6m, 2m and 70cms light weight Yagi antennas rated at 100W with Japanese engineering

A-502H8R	6m 2 El. Phased 6.3dBi 400W £81.95
A144S10R	2m 10 Element 11.6dBi 2.13m boom £89.95
A144S5R	2m 5 Element 9.1dB 1m boom £49.95
A-430S10R	70cm 10El, 13.1dB 1.19m boom £49.95
A-430S15R	70cm 15 El. 14.8dB 2.24m boom £73.95
A-1430S7	Dual 2m/70cm 7/9dBi 1.25m boom £111.95

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There are times when you need a simple VSWR meter that you can take out portable or pop in the car. The Avair range are a very cost effective answer.

AV-20	AV-40
• 1.8 - 200MHz	• 144 - 470MHz
• Scale 30W / 150W	• Scale 15W / 150W
• 3W for FSD	• 3W for FSD
• Cross Needle	• Cross Needle
• SO-239	• SO-239

£49.95

DIAMOND for IC-9700 Radio

X-5000

2m / 70cms / 23cms
A fibre glass vertical with N connection.

- Auto band select
- 1.8m long
- 100W rated
- Gain: 4.5 / 8.3 / 11dB

£119.95

SpiderPoles 'Easy Up' Masts

Strong, fibre glass telescopic masts for wire antennas and verticals. A dream answer for back garden or portable.

12-HD ....12m long •1.18m collapsed • Diam. 55m to 8mm • Weight 3.3kg....£99.95
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GB-12m ..Guy belt for 12-HD.....£12.95
GB-18m ..Guy belt for 18-HD.....£19.95

Ameritrons Remote Switches

RCS-4LX	4 Way with static protect £216.95
RCS-4X	4 Way standard £179.95
RCS-10LX	8 Way with static protect £237.95
RCS-10L	8 Way standard £229.95
RCS-8VX	5 Way standard VHF £183.95
RCS-8VNX	5 Way standard VHF N £193.95
RCS-12X	8 Way auto band sensor £334.95
RCS-12LX	As above + static protect £377.95

Hustler HF Verticals

4BTV
40m - 10m 4 Band vertical that will handle full legal power and can be ground mounted
Height is 6.52m. £209.95

5BTV
The ever popular 5-band model that covers 80m to 10m. This is a great backyard antenna that can be ground mounted.
The height is 7.64m
£269.95

6BTV
This antenna is identical to the 5BTV above buthas the 30m band added. Again it handles full legal power and stands 7.3m high. £289.95

All antenna are rated at 1kW

Diamond HF Mobile Whips

Here is a great range of single band whips that have PL-259 bases and an easily adjustable upper tuning section for quick hand adjustment.

HF-10FX	10m whip 1.1m long £49.95
HF-12FX	12m whip 1.1m long £49.95
HF-15FX	15m whip 1.2m long £49.95
HF-16FX	17m whip 1.2m long £49.95
HF-20FX	20m whip 1.2m long £49.95
HF-30FX	30m whip 1.4m long £49.95
HF-40FXW	40m whip 1.4m long £49.95
HF-80FX	80m whip 1.4m long £49.95

W-300S Magnetic Mount

This is a 3-way mount that is great for HF operation. SO-239 socket and 4.5m cable terminated in PL-259

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Practical Wireless June 2019 • Volume 95 • Number 6 • Issue 1345

On Sale 9th May 2019

WARNERS GROUP PUBLICATIONS plc

Keylines

Don reports on his recent activities, has an overview of this month's issue and reflects on the amateur radio publishing scene.

I enjoyed something of a change to my usual DX-ing and contest activity this month by helping at one of the check-points on the annual Three Towers Hike, a Scout-organised event across the Berkshire Downs. The Reading radio club has taken care of the communications for this one for many years. It was fun and satisfying to be part of this and my congratulations to those who set up the radio network, which used three bands and several rebro (rebroadcast) facilities to ensure 100% coverage of the various checkpoint locations. I was reminded of how much more effective such a network can be compared with, say, using mobile phones – being able to listen in to the traffic between the various checkpoints and the HQ station allowed the many volunteers to have a constant picture of where the various teams were, any issues arising (such as walkers dropping out for medical and other reasons) or simply to feel part of the bigger picture while sitting in the middle of nowhere waiting for the next group of walkers to arrive. Such activities do a lot for the image of amateur radio and definitely contribute to our self-training in terms of station setup and operating procedures.

My other outing of the month was to Stirling and the GMDX Convention. The attendance was a record at just over 100 and a great time was had by all, with some interesting talks, not least by **Jonathan MM0OKG** and **Col MM0NDX** about their Islands on the Air activation of Telengbe Island in Liberia. This one involved a number of physical challenges of access, negotiating with the local people for permission to land and stay on the island, some extreme weather and more. There truly are some intrepid adventurers in our hobby!

Books and Magazines

Many of you will recall the various magazines that have come and gone over the years. I started my writing activities in 1983 by contributing a monthly HF column to *Amateur Radio* magazine and for a while I was also writing a data modes column for the same magazine (this was when packet TNCs started to appear and packet radio was all the rage as FT8 is currently). I later wrote for *Ham Radio Today* and then the RSGB's *RadCom*, before taking up the *PW* editorial role.

But there were others such as *Wireless World*, *Radio Constructor*, *Short Wave Magazine*, *Radio Active* and more (some had come and gone in the inter-war years).

Times have changed, partly as the hobby has changed although largely, I suspect, because there is now so much available on the internet, whether on websites, YouTube videos, podcasts or programmes such as TX Factor. But where to start looking? Hopefully, that's where we can continue to help and provide pointers, especially if you are new to the hobby.

And there's still, to my mind, nothing that can replace books as a one-stop reference on key subjects such as antennas or circuit design.

The UK is well served in respect of amateur radio books and magazines, with the RSGB commissioning and publishing some excellent books while this magazine is now in its 87th year and still going strong, especially as the digital version once again means it is an economical read for overseas amateurs who have nothing similar available locally. Germany, the USA, Japan and, I believe, Russia have thriving amateur radio magazines but, sadly, many national amateur radio societies no longer have the resources to publish anything beyond a basic newsletter. That said, there are some excellent club publications out there, albeit the UK is probably in the forefront here too – the UK Six Metre Group, CDXC (the UK DX Foundation), G-QRP Club, BATC and others have high quality publications aimed at their specialist memberships. Long may it continue.

This Month's PW

This is another packed issue, which I trust you will all enjoy. **Mike Richards G4WNC** apologises for the lack of his regular *Data Modes* column but he was unavoidably held up in Florida at the end of a family holiday and has been unable to make the progress that he had intended with the Es'hail satellite. Fear not, though, he will be back next month.

Meanwhile, do enjoy what we have, from fabricating PCBs to building your own antenna rotator. I am constantly amazed at the ingenuity shown by some of our contributors (and, no doubt, by many of our readers) – who says that amateur radio is only about off-the-shelf black boxes nowadays!

Don Field
G3XTT

Practical Wireless

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Components for PW projects
In general, all components used in constructing *PW* projects are available from a variety of component suppliers. Where special, or difficult to obtain, components are specified a supplier will be quoted in the article.

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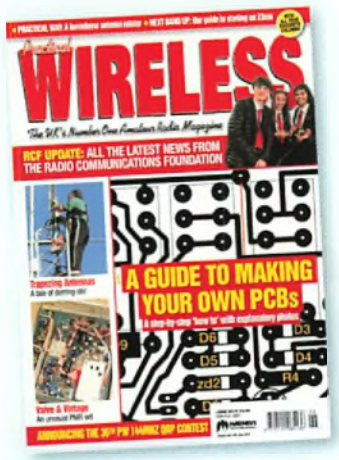
Technical Help
We regret that due to Editorial timescales, replies to technical queries cannot be given over the telephone. Any technical queries are unlikely to receive immediate attention so, if you require help with problems relating to topics covered in *PW*, please either contact the author of the 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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E-mail: practicalwireless@warnersgroup.co.uk

Gemini 70-1K

The DX Shop Limited have announced the release of the all new Linear Amp UK Gemini 70-1k, a 1000W output 432MHz solid-state linear amplifier. Covering 430 to 440MHz the amplifier requires 20W drive for full output. It shares the same operating functionality as the 144MHz 1.2k version, with built-in preamp control, full sequencing and a large heatsink with temperature-controlled fan cooling, making it ideal for digital modes. Priced at £2199 inc. VAT the Gemini 70-1k is available to order now. Full details are available from The DX Shop Limited on 01588 620126 or here: www.thedxshop.com

News from Martin Lynch & Sons

After many months of waiting, Icom Japan have finally released their new all mode 2/70 & 23cm base station.

In other ML&S news, one of their accounts ladies, **Kim White**, asked whether ML&S would sponsor her son **Daniel's** local under-12's football team, the Haliford Colts. They did and the team won their first outing in ML&S sponsored shirts. Martin Lynch says, *"Must be the old Lynchy Luck but more so the young lads worked and trained very hard to get to the final from an original entry of 81 teams. Kim's involvement in the club? She's the treasurer! We're working on her to get her M7..."*

The photo shows the Under 12's Haliford Colts winning the Dudley G Harper U12 Cup. Kim's son Daniel is their goalkeeper in purple.
https://tinyurl.com/y5e3a593

LDG Talking Wattmeter

The TW-1 Talking Wattmeter returns to LDG's product line-up and is now available from authorised UK amateur radio retailers, including Martin Lynch & Sons, for around £160.

Intended primarily for visually impaired radio amateurs, this unique instrument speaks the RF power level and SWR aloud over a self-contained speaker.

On command, this wattmeter speaks the forward or reverse power level in watts, or the SWR. A constant Tone Mode is also available, indicating the power or SWR as a varying pitch, making the TW-1 ideal for tuning manual antenna tuners or valved transmitters or amplifiers. It's also great for mobile operation, allowing the user to tune screwdriver-type antennas while safely watching the road.

MIT Ham Club puts Radio Studies Online

(from *Amateur Radio Newsline*) The Massachusetts Institute of Technology's Radio Society is making a series of programmes about radio available online through the school's Independent Activities Period. W1MX, MIT's amateur radio club, has arranged for nine lectures to be made available on YouTube. These are intense courses and cover such subjects as software-defined radio, propagation, radio astronomy and radio history, for starters. If you want to attend (virtually, of course) visit the website at: w1mx.mit.edu/iap-2019

Free Raspberry Pi Magazine

Issue 80 of *MagPi* is an amateur radio special that features, on pages 62 to 75, various articles with an amateur radio theme. Download the free PDF version from: www.raspberrypi.org/magpi/issues/80

HEMA Activity Evening

There will be a HEMA (HuMPs Excluding Marilyns Award) Activity Evening on May 23rd from 1800 to 2030UTC (for more information on HEMA, see April *What Next*). For further information: www.hema.org.uk

Exercise Blue Ham 19

Flt Lt David Webb M0SKT, RAFAC, BH19 Exercise Co-Ordinator reports on the recent Exercise Blue Ham.

Cadet Units from around the UK took part in Exercise Blue Ham, which was run over the weekend of March 16/17th using the 5MHz (60m) shared band. Cadets who took part would have had to pass their Blue and Bronze Radio Operator Modules as a minimum and the 'on-air' time would also count towards their Foundation Licence. The exercise was introduced to enhance the Cadet experience of radio operation and to reach out to radio amateurs who may wish to join the Cadet Organisations as radio instructors.

Units set up and operated radio stations on the Band for the purpose of making contact with radio amateurs and exchanging specific information during their QSOs. The Exercise format was contained in a brief sent out to all of the participating Units so that planning could begin in order to maximise the use of the band by using the right antenna configuration and radio setup. With HF working conditions as they are at the moment, this was going to be a challenge for all taking part. Looking back over previous Blue Ham exercise data showed quite a variety of different and diverse antenna and radio setups with several stalwart radio amateurs even operating out in the field. This does not normally occur on this band because most operate from their home QTH.

Two weeks before the exercise Units were allocated special MRE (Exercise or Event) callsigns for the duration of the activity so that they could practice using them prior to the start. Outwith the exercise, other MR callsigns may be worked on 5MHz. However, to comply with RAFAC operating instructions no location information is given. The MRE is normally only used during the period of the exercise; this as always provided some interesting callsigns in everyone's logbooks!

Units from all of the cadet forces set up stations around all corners of the UK. Between the cadet stations they managed to log some 665 calls during the period of operation, which is about on par with other exercises.

Cadets and Staff operated and logged each of the QSOs, recording the callsign, Maidenhead Locator, power, signal report and type of antenna. At times amateurs and cadets struggled to exchange information due to some non-military phonetic alphabet being used, which cadets were not used to. Examples like Baker instead of Bravo and Texas instead of Tango were used. However, both sides appeared to enjoy the phonetic exchanges and it got everyone thinking. As the exercise progressed different information was exchanged between the stations such as radio types and the weather.

The Blue Ham Team would like to thank the effort and time put in by all who participated in the Exercise. Another one is planned for the weekend of June 8/9th so if you missed the chance to work the cadet stations and get some different callsigns in the log, then this will be your opportunity.

OTN129 out now

RAOTA's magazine is OTN (*Old Timer News*). It is published four times a year and is the main point of contact with all of RAOTA's members. OTN129 (cover date Spring 2019) includes:

- More on the Future of RAOTA AGMs by G3ZPF.
- The Marcuse Memorial Bench by G3ZPF.
- Just a short note about my first encounter with 'Heathkit' by G2BKZ.
- How much receiver performance does a DXer NEED? Part 1 by G3RZP.
- A Short Vertical Whip for reception in Noisy Locations by G3FEW.
- Yarmouth to Weymouth in 15 mins without wires by M0ABY.

For more information about RAOTA please go to:
www.RAOTA.org

SADARS Trophy Winners

Bedfordshire's Shefford Amateur Radio Society closed their 70th Anniversary Year with the AGM on March 21st at which their Chairman Ken Amos G4YRF presented club trophies, one of which has been renamed in memory of their Vice Chairman Bryan Bourne M0BIK, who had passed away shortly after his managing to attend the Society's celebration party.

The rededicated 'Brian Bourne Quiz Trophy' was awarded to the successful four-man 'Brewery Tapers' team, winners of the club's 2018 quiz. It was for that popular annual event that Bryan had gained a truly phenomenal reputation with his extraordinary grasp of general knowledge and a seemingly photographic memory.

SADARS welcomes all radio amateurs and meets in the Shefford Community Hall every Thursday evening at 7.30 for 8pm to enjoy radio-orientated lectures, practical presentations, traditional Junk Sales, 'Rag Chews' and refreshments. Club information and programme details are to be found on the club website in the amateur radio press.

The photo shows the SADARS 'Brewery Tapers' team: Don G4LOO, Brian G8GHR and Richard G3NII (Paul G8IUG not present).
www.sadars.org

Cricket World Cup Radio Marathon 2019

The RSGB is hosting an International Amateur Radio Marathon on the HF bands to celebrate the Cricket World Cup, which is being held in England and Wales.
The Marathon will run from May 30th to July 14th 2019. Special UK and international callsigns will be active on nine HF bands using SSB, CW and digital modes. The UK will be activating 31 special callsigns with 11 for the cricket grounds in England and Wales and ten for the tournament teams. There are also callsigns for Scotland, Northern Ireland, Jersey, Guernsey and the Isle of Man. All UK callsigns start with the prefix GB19.

The Marathon will encourage HF operation with an opportunity for all those who operate the special stations to enjoy being a sought after callsign.Award certificates will be available based on the number of QSOs achieved with the Special stations. The RSGB is using the Hamlogs system to store the logs from all the special callsigns. Progress can be tracked towards the awards.

Each callsign has a QRZ.com page, which has a schedule showing when the callsign will be used. The callsigns are as follows:
GB19CWC: 2019 Cricket World Cup HQ England, GB19OT: Old Trafford, Manchester, GB19RG: Riverside Ground, Chester-le-Street, GB19HL: Headingley, Leeds, GB19EB: Edgbaston, Birmingham, GB19LL: Lord's, London, GB19KO: Kennington Oval, London, GB19RB: The Rose Bowl, Southampton, GB19BG: County Ground, Bristol, GB19TG: The Cooper Associates County Ground, Taunton, GB19TB: Trent Bridge, Nottingham, GB19AFG: Afghanistan, GB19AUS: Australia, GB19BAN: Bangladesh, GB19ENG: England, GB19IND: India, GB19NZ: New Zealand, GB19PAK: Pakistan, GB19SA: South Africa, GB19SL: Sri Lanka, GB19WI: Windies, GB19CNI: 2019 Cricket World Cup HQ Northern Ireland 1, GB19CGI: 2019 Cricket World Cup HQ Northern Ireland 2, GB19CS: 2019 Cricket World Cup HQ Scotland 1, GB19CGM: 2019 Cricket World Cup HQ Scotland 2, GB19CW: 2019 Cricket World Cup HQ Wales 1, GB19CGW: 2019 Cricket World Cup HQ Wales 2, GB19SG: Sophia Gardens, Cardiff – operated from Wales, GB19CG: 2019 Cricket World Cup HQ Guernsey, GB19CJ: 2019 Cricket World Cup HQ Jersey, GB19CIM: 2019 Cricket World Cup HQ Isle of Man

The full rules, how to operate with a special event callsign and details of how to apply for the awards can be found at:
https://tinyurl.com/y39g3qny

Requesting a QSL Card

(from *Daily DX*) **Charles M0OXO** says recent QSL requests have made him wonder *"Do we really know how to make a QSL card request?"* He realises newcomers to the hobby may find the process confusing. He has put together some tips, answering common questions: https://tinyurl.com/y4snouqa

Over-the-Horizon Radar QRM

The January issue of the IARU Region 1 Monitoring System (IARUMS) newsletter reports the Russian Sunflower coastal radar, located east of Vladivostok, is being heard at night on 3,716kHz and 6,860 to 7,005kHz, as well as on several 60m frequencies. A Chinese wideband over-the-horizon (OTH) radar also appeared on 7,000kHz in early January.

"Once again we have problems with shortwave radars" said the Deutscher Amateur Radio Club (DARC) Monitoring System. It said the interference appears as a deep hum. The Sunflower radar employs Frequency Modulation on Pulse (FMOP) at 43 sweeps per second to detect aircraft and, over water, vessels.

DARC continued, *"The system is so successful that the Chinese operate several 'sunflowers' on the east coast. Chinese OTHs work almost daily in the 20m band. In the mornings, we can often receive them with high field strengths."* DARC said the Chinese OTHs cause worse interference than the Russian radars.

DARC mentioned other OTH radars operating on 40m: *"At the moment we have extreme problems with the 'Container' radar from Russia."* IARUMS has often reported problems from this radar.

In December, IARUMS also reported an OTH radar active on 21,170kHz from the Sovereign Base areas of Akrotiri and Dhekelia, a British Overseas Territory on the island of Cyprus.

While 60m and 80/75m are shared bands, the 7,000 to 7,200kHz segment of 40m is allocated exclusively to the Amateur Radio Service worldwide. Some domestic amateur radio HF allocations outside Region 2 (the Americas), such as 7,200 to 7,300kHz, are either shared with other services or not available to radio amateurs. On HF allocations such as 30 and 60m, amateur radio is secondary to other users. The 20, 17, 15, 12 and 10m bands are exclusively available to the Amateur Radio Service worldwide.

URE 70th Anniversary

This year marks the 70th anniversary of the Union de Radioaficionados Espanoles (URE, the Spanish national radio society). To commemorate this event, URE have announced a Special Prize to all licensed radio amateurs and SWL from all over the world. A medal and various certificates are available (details on the website, below). Contacts can be made using any mode or band from 160 to 6m with the 14 different AM70 special stations. The suffixes of the 14 stations are each one of the letters of the UNION DE RADIOAFICIONADOS ESPANOLES, except the one with the letter N, which will be replaced by the URE headquarters special station AM70URE.

The special callsigns are: AM70URE (Union de Radioaficionados Espanoles), AM70A, AM70C, AM70D, AM70E, AM70F, AM70I, AM70L, AM70N, AM70O, AM70P, AM70R, AM70S and AM70U.

Dates: From April 1st to June 9th 2019 (2359UTC).

https://70aniversario.ure.es

Another Mountain Goat

John Burton G4TQE from Shropshire has achieved the coveted SOTA Mountain Goat award, for achieving 1000 activator points. This was attained with an activation of Waun Fach GW/SW-002 in the Brecon Beacons, South Wales, on March 20th. He was accompanied on the expedition by existing SOTA Mountain Goat Allan Jones GW4VPX.

John, like quite a few radio amateurs, spent a number of years inactive in the hobby before being tempted to get back on air because of the SOTA, Summits on the Air, scheme. He is an accomplished mountaineer, having completed all the Munros, Nuttalls and Wainwrights.

Speaking after his Mountain Goat triumph, John said, "I cannot thank SOTA enough for encouraging my return to amateur radio". The photo shows John on the summit of Waun Fach GW/SW-002. www.sota.org.uk

Corrections

In the March issue, page 57, a sharp-eyed reader spotted that the three lead acid cells for the BC-221 should be 2.1V each, not 1.1V (three times 2.1 makes the required 6.3V). Also, a couple of corrections related to the Advanced Licence feature. First, it seems that the 'official' designation is now Full Licence although the two terms seem to be used interchangeably. Second, the caption for Fig. 7 should, of course, refer to a spectrum analyser rather than an oscilloscope. Our apologies.

Ron Stone GW3YDX notes that, with respect to his review (last month) of the Kenwood TS-890, he has since discovered that the internal relays can be switched off for extremely silent QSK. The paragraph where he wrote about noisy relays in QSK mode is therefore not accurate.

And in last month's *Doing it by Design* (bottom of page 43), the reference should be to a clean 10MHz sinewave (not 1MHz as in the text).

Belarus Games

Bringing attention to the 2nd European Games, MINSK 2019, taking place from June 21st-30th the following stations will be active:
Sports: EV19BAD (badminton); EV19BAS (basketball); EV19BOX (boxing); EV19FRS (fight); EV19CYC (cycling); EV19GYM (gymnastics); EV19ROW (rowing); EV19JUD (judo); EV19KAR (karate); EV19ATH (athletics); EV19SAM (sambo); EV19ARC (archery); EV19SHO (shooting); EV19TEN (table tennis); EV19BSO (beach Soccer).
Sports arenas: EV0MA (Minsk Arena); EV0CA (Chizhovka Arena); EV0SD (Dynamo).

Essex News

After a winter break, Essex Ham's regular field events resumed with a busy afternoon at Galleywood Common in late March. For many, this was the first chance to dust off the portable kit and try a few new things. By mid-afternoon, seven different antennas were in the air, being tested, tuned, or radiating, with activity on several bands.

Galleywood Gatherings tend to be a great meeting place for locals to try new things, or to seek advice from more experienced amateurs. More events are planned, and locals are encouraged to keep an eye on Essex Ham's Twitter and Facebook feeds for details of last-minute events.

• E-mail: military1944@aol.com

A PMR Set with a Difference

As well as the latest museum news, Bernard Nock G4BXD describes a rather unusual set that recently crossed his path.

A very warm welcome to this Valve & Vintage column coming from the Military Wireless Museum once again. It's been a quiet winter, very little snow, one or two intrepid visitors and even a couple of donations, which are of real quality. I'm looking forward to the warmer weather to get on with the preparation for operations up to the new geostationary satellite launched earlier in the year. Poles need inserting in the ground to carry the required dish antennas and so on.

Old PMR Sets

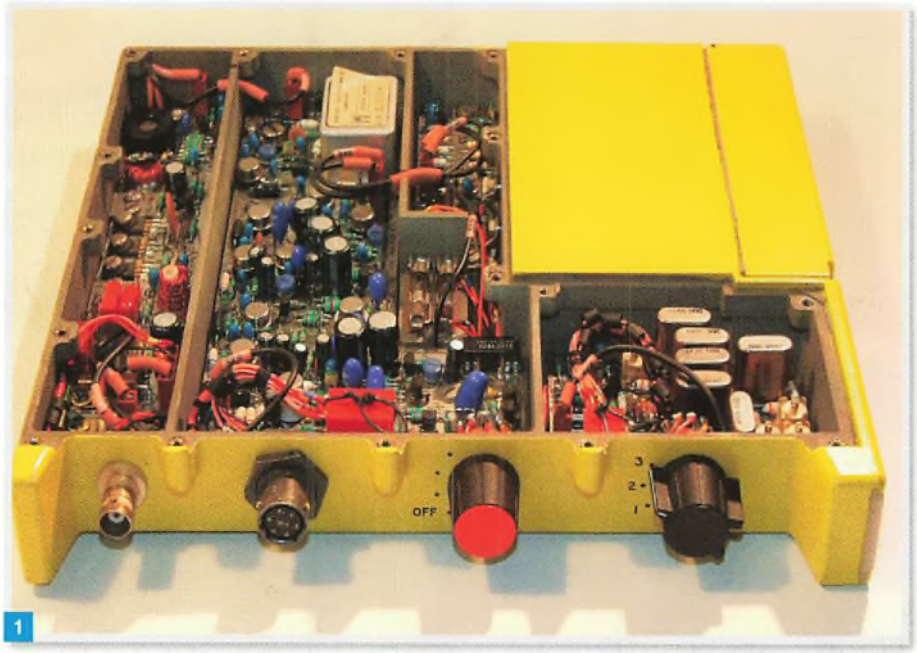
Following on from my recent three articles on the Pye range of vintage PMR sets, it has to be remembered that most radio amateurs in the 1960s, '70s and into the '80s often played with ex-Police, Fire or Taxi radios, re-crystalling them, converting the tuning range and modifying them to amateur use in many other ways.

The big names were Pye, Burndept, Storno, Marconi, Philips and many others. Ex-Police sets usually converted to the 2m or 70cm bands while a lot of Fire service equipment seemed to be on the VHF low band so was suitable for the 4m amateur band, the 6m band, of course, not being available to UK amateurs at that time.

A recent donation to the museum was a most unusual ex-Fire Service set, in use or at least being trialled around the mid-1970s but with rather an unusual role and frequency coverage. The equipment was kindly brought over by **Mr Alan House**, Trust Chairman of the Hampshire Police and Fire Heritage Collection, located within the Solent Sky museum in Southampton

Documentation that came with the set describes field trials of a system, code named Figaro, starting in five Brigade regions, London, West Midlands, Greater Manchester, Merseyside and Glasgow.

The system was apparently a development between the Home Office and Plessey and was intended to give reliable communication in areas where VHF and UHF communications were severely affected by screening. The equipment operates on three specific channels in the 3MHz band with the trial's objective to evaluate the effectiveness in providing reliable two-way communication between the man on, or under, the ground and a controlling station.



1

Fig. 1: The personal radio set.

It is stated in the documents that initial trials of the low frequency system had given promising results in underground environments and within buildings and even ships. The equipment itself comprises three main units, the chief features of which I'll outline.

The Personal Set

The man-carried set, **Fig. 1**, comprises a three-channel receiver transmitter with a rechargeable battery contained in a sturdy diecast aluminium housing. An antenna socket, headset socket, on/off volume and channel switch are the only controls along the edge of the set.

To make the equipment easy to use, a voice operated transmit system (VOX) was employed, the set being in receive mode until the user, wearing a throat microphone, spoke, at which time the set went into transmit mode. This 'hands free' operating gave the user greater flexibility.

The crystal-controlled equipment, **Fig. 2**, also had a self-adjusting volume control enabling the operator to receive constant volume without having to fiddle with knobs. Initial trials were with the throat microphone while other options were being evaluated – microphones and earpieces fitted inside the breathing apparatus face mask for instance.

When in use, the man-carried portable set received a constant 'beep beep' in the headphones, a 'confidence signal' transmitted by the base station between speech to let the user know the communication link was indeed still operating.

Due to the low frequency of operation, 3MHz, the use of small antennas, whips and the like was not technically possible. The solution was to use a comparatively large loop antenna, which was stitched inside a body-worn jerkin, **Fig. 3**. This also held the man-pack set in an upper pocket. The jerkin could be worn either on the rear of front of the man depending on other equipment being carried, such as breathing apparatus for instance.

Fig. 2: The crystals fitted to the personal set. Fig. 3: The body jerkin with set fitted in top pocket. Fig. 4: The base station. Fig. 5 Internal view. Fig. 6: The transmitter unit. Fig. 7: The receiver unit.

The Base Station

The portable base station, **Fig. 4**, contains a receiver, transmitter and battery supply. A telephone-style handset is used but there is an additional socket for a headphone connection for use in noisy locations and in place of the front-mounted loudspeaker. Controls are simple: on/off or charge, volume, channel selection and receive and transmit antenna connections.

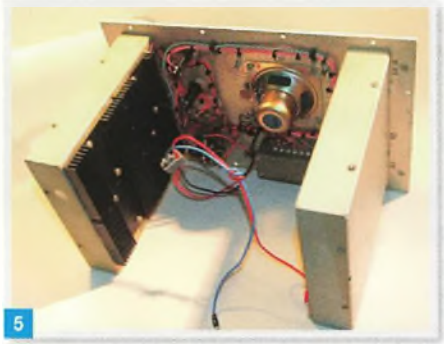
Internally there is a lot of free space, **Fig. 5**, inside the box. I was surprised when I opened it to find just two sub-units bolted to the front and a few switches and the loudspeaker also mounted on the front panel.

The right-hand unit is the transmitter, **Fig. 6**, with its three crystals marked 2903kHz, 2938kHz and 2966kHz, which give the three operating frequencies. The system seems to be a 9MHz USB generator mixed down to give the 3MHz output. The base station transmitter is generating about 8W of RF into the antenna socket on my power meter.

The receiver unit on the left side, **Fig. 7**, mirrors the unit in the man-carried set – again, three crystals mixed up to 9MHz, a crystal filter, various low frequency stages and then demodulated.

Base Station Antenna

The base station antenna, **Fig. 8**, consists of a lightweight collapsible framework loop design. Two actual loops are provided, one for transmit, one for reception. The unit, when folded, is kept in a bag for transport and storage.

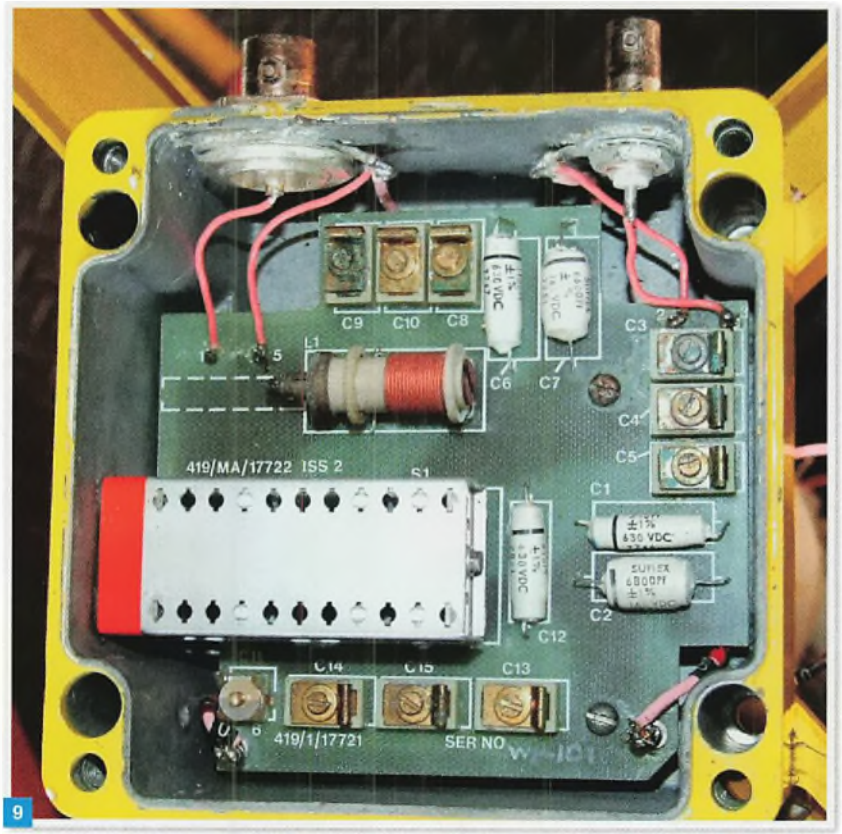


The antenna opens out to a square configuration sitting on four legs. At the base is a box, **Fig. 9**, with connectors to the set and a switched tuning unit matching the three preset frequencies. The loops are formed from the tubular sections with flexible wire shorting straps across the plastic joints. The equipment apparently came with two sets of antenna cables, three metres and 30m, to enable the antenna to be positioned close to the area to be covered.

I attached the loop antenna to my MFJ antenna analyser, which showed a good SWR dip at the 2.9MHz frequency but with an impedance of 100Ω. I don't have any technical information on the set, circuit diagrams and the like, so maybe a 100Ω cable was indeed used between set and antenna.

Results in Practice

The report goes on to say that the prototype field trials had shown good performance when used in buildings, basements and tunnels where electrical wiring, plumbing or other metalwork, because of the inductive nature of the system, helps the spread of radio energy.



Figs. 8 & 9: The base station antenna.

It continues by saying that tests in underground tunnels, sewers and mine shafts demonstrated that two-way communications could be effective over many hundreds of metres when cables, piping or rails were present to conduct the signals but in tunnels containing no wiring or metal and where the tunnel diameter was small compared to the wavelength of Figaro, working range was reduced to a few tens of metres.

To overcome this the production version of the set had a talk-through facility where the signals could be relayed through several base station sets. Tests on cliffs with the base station at the top and personnel at the cliff base also proved successful.

One incident of note was the 1975 Moorgate train disaster when the equipment provided reliable two-way communication between a base station at street level down to personnel in the tunnels some 21m underground.

And Finally

I'm looking forward to the warmer weather as I said because I have lots of antenna-related jobs that need doing and, of course, the opening of the museum for the 2019 season. As I also said, I am busy assembling the parts needed to communicate with the new geostationary satellite recently launched and it will exciting to send the museum's callsign through the ether and beyond into space, a huge technology gap between the earliest sets in the collection and today's high-tech approach. I look forward to working you via the satellite. Cheerio.

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VHF/UHF/23CM All-Mode SDR Transceiver

The IC-9700 is our latest transceiver utilising Direct Sampling and Software Defined Receiver (SDR) technology for VHF and UHF operators.

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It's Contest Time Again!

The 36th Annual Practical Wireless 144MHz QRP Contest

Colin Redwood G6MXL, our QRP Contest adjudicator, introduces the 2019 event, which takes place on Sunday 9th June 2019.

The popular *PW* 144MHz QRP Contest is the ideal way for newcomers to the VHF bands and contesting to get a good feel for many aspects of amateur radio contests. It is an excellent way to experience the thrill of making contacts over many kilometres on the 2m band.

Power

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

Equipment

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

Location

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

You'll need to find the six-character IARU locator (sometimes referred to as the Maidenhead Locator) for your station's location, for example IO92KL. I think the easiest way to find your locator is to visit: http://tinyurl.com/ycec66pg

Contest Exchange

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

Exchange Example

Imagine your callsign is M7GFD/P and you are located in IO92KL and have a contact with M6VTH/P as your fourth contact. You might transmit, "*Mike six Victor Tango Hotel Stroke Portable from Mike seven Golf Foxtrot Delta Stroke Portable, you are five and six, zero zero four, in India Oscar nine two Kilo Lima*". Using phonetics will make sure that similar sounding letters (e.g. B, D, P, V) are clearly understood by the station you are in contact with.

Hints and Tips

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

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

Directional Antennas

If you use a directional antenna, then I would strongly recommend that you rotate it from time to time to point in different directions during the contest (e.g. South-West England, Northern Ireland, the Republic of Ireland and Scotland). This will not only enable you to make more contacts but will likely increase the number of different locator squares you contact, which is a part of your overall score.

Batteries

Many entrants use rechargeable batteries for power. Make sure you have enough power to run your station for the full duration of the contest. I'd suggest making three diary entries: the first a couple of days before the contest as a reminder to charge your batteries, the second for the day of the contest (Sunday June 9th 2019), and the third a few days after the contest to remind you to submit your entry.

The rules appear on the next page. The contest website is also a valuable source of information and has a link for downloading log sheets and an online entry form (known as a cover sheet). www.pwcontest.org.uk

Submitting an Entry

Don't forget to submit your entry after the contest. Although electronic entries via e-mail are much preferred and make the task of adjudication easier, paper entries are also welcome. Please note the correct e-mail address for logs for 2019: entries@pwcontest.org.uk

Have a Go

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

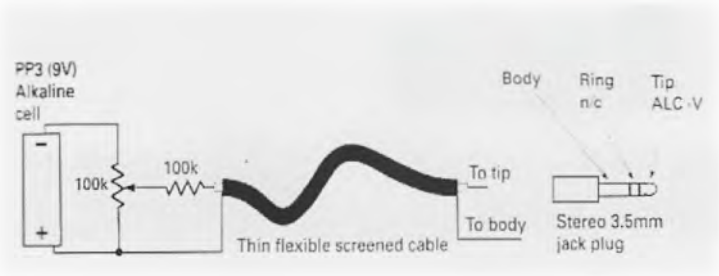

Fig. 1: A useful technique to reduce power to 5W on higher power transmitters.

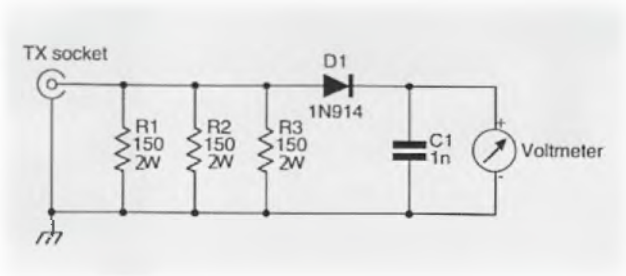

Fig. 2: A small power meter, to verify the power output. A21.7V level indicates 5W output. 2W metal film resistors are available from CPC (Farnell).

The 36th Annual *Practical Wireless* 144MHz QRP Contest Rules

www.pwcontest.org.uk

1. General: The contest is open to all licensed radio amateurs operating fixed or portable stations, using SSB, CW, AM or FM in the 2m (144 to 146MHz) band. Entries may be from individuals or from groups, clubs and similar bodies. The duration will be from 0900 to 1600UTC on **Sunday June 9th 2019**.

All stations must operate within the terms of their licence. Entrants must observe the bandplan and must keep clear of normal calling frequencies (144.300MHz and 145.500MHz), even for CQ calls.

Entrants must allow other band users to carry out their activities without hindrance. Please avoid frequencies used by GB2RS (145.525MHz), ATV talkback (144.525 and 144.750MHz) and any other frequency that is in use for non-contest purposes.

Your station must use the same callsign throughout the contest and may not change its location.

2. Contacts: Contacts will consist of the exchange of the following minimum information:

(i) callsigns of both stations **(including any /P suffixes)**
(ii) signal report, standard RS(T) system
(iii) serial number: a three-digit number incremented by one for each contact starting at 001 for the first contact
(iv) locator (the full six-character IARU universal locator for the location of the station)

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

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

Contacts via repeaters or satellites or using digital modes (including D-STAR, Fusion, DMR and EchoLink) and data modes or machine-generated modes, such as FT8, JT65, PSK31 and RTTY, are not permitted. Neither is use of the DXCluster, ON4KST chat, social media and similar.

3. Power: The output power of the **transmitter** or **transverter** final stage must not exceed 5W peak envelope power (PEP). If the equipment in use is capable of a higher power, the power must be reduced and measured by satisfactory means. With most modern transceivers, power can be reduced by using a menu setting. An alternative is to apply a (variable) negative voltage to the transmitter ALC line reached via the accessory socket, **Fig. 1**. Stations cannot rely on feeder loss to meet the 5W power limit.

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

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

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

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

5. The Log: Logs must contain the following information for each contact:

(i) time **(UTC – not BST)**
(ii) callsign of the station worked **(including any /P suffix)**
(iii) report sent (e.g. 56)
(iv) serial number sent
(v) signal report received (e.g. 54)
(vi) serial number received
(vii) locator received (or location)

The preferred form of a log is a computer file in REG-1TEST, .log, .adi or .edi formats sent by e-mail. This may be generated by contest logging software such as MINOS or EI5DI's SDV, provided it contains all the information listed above. Alternatively, a file in any other suitable format (such as the spreadsheet available from the contest website or in plain text) provided each of the items above is separated by a separating character such as a comma or tab. Give the file a name, including the station callsign (e.g. g6mxl-p.log), and send as a standard e-mail attachment to:
entries@pwcontest.org.uk

If there is any problem with your entry, you will be contacted by e-mail.

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

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

(i) name of the entrant (or of a club or similar in a group entry) as it is to appear in the results table and on the certificate
(ii) callsign you transmitted during the contest, **including any /P suffix** (e.g. G6MXL/P)
(iii) name and address for correspondence
(iv) location of the station during the contest
(v) full six-character locator you transmitted during the contest
(vi) whether single- or multi-operator (a single-operator is an individual who received no assistance from any person in operating the station, which is either his/her permanent home station or a portable station established solely by him/her); if multi-operator, include a list of operators' names and callsigns
(vii) a full description of the equipment used, including transmitted PEP output power
(viii) if the transmitting equipment (including any transverter employed) is capable of more than 5W PEP output in the 2m band, a description of the methods used to (a) **reduce** and (b) **measure** the 2m output power
(ix) antenna used and the approximate station height in metres above sea level (ASL)
(x) if you receive or send a report of poor-quality signals (e.g. wide/splattering), full details of the complaint, including time, callsign, nature of complaint and actions taken **during** the contest to investigate and resolve
(xiii) the following declaration must be included in the e-mail text or written and signed by the entrant: *"I confirm that the station was operated within the rules and spirit of the event and that the information provided is correct"*.

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

Entries & Other Information

Entries by e-mail must be sent to:
entries@pwcontest.org.uk

Paper entries should be sent to: Practical Wireless Contest, c/o Colin Redwood G6MXL, 53 Woodpecker Drive, Poole BH17 7SB. **Entries must be received no later than Tuesday July 2nd 2019. Late entries will be disallowed.**

Any other comments about the station, the contest and conditions during it are welcome along with photographs. Please note that these cannot be returned (though, in any case, electronic images are preferred) and may be used for publication in *Practical Wireless* or on the contest website. Please send them by separate e-mail or post, **to arrive by Tuesday July 16th 2019**.

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

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

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

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

If after making the checks above, you are certain that another station that is participating in the contest is radiating poor quality signals, please call the station, giving your callsign, and tell them about the problem. You cannot expect a station with a poor signal to do something about it if they are unaware!

If you receive or send a report of poor-quality signals, you must record on the cover sheet full details of the complaint including time, callsigns of stations involved, nature of complaint and actions taken **during** the contest to investigate and resolve.

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

• E-mail: practicalwireless@warnersgroup.co.uk

The Radio Communications Foundation

By way of a follow-up to our In Focus feature in the June 2016 PW, Steve Hartley GOFUW has an update on the RCF's activities.

The Radio Communication Foundation (RCF) has been around for 15 years now but we are still often asked questions such as *"what is the RCF?"*, *"what does it do?"* **and** *"what is its relationship with the RSGB?"*. This article it intended to help answer those questions.

RCF is a Charity

The RCF was set up as a charity to encourage and make the most of donations and legacies made by radio amateurs. Income is entirely from donations received from radio amateurs and related organisations. Being a charity allows us to claim Gift Aid to maximise the benefit from donations at no further cost to donors.

The strategy of the RCF is quite simple: to bring the benefits of radio to young people; and to encourage the use of technology.

The charity is run by a board of volunteer Trustees. All but one of the current Trustees are radio amateurs and between them they have a wide range of experience of radio communications and wireless technology. Some work, or have worked, in the RF industry, some are 'just' amateurs, but all have experience in senior management positions.

RCF Projects

Some of the projects we have funded are quite small with costs of just a few hundred pounds, others run into the thousands. We are keen to do more and are always open to applications for funding from projects that support our aims.

One of our regular commitments has been to sponsor two or three Arkwright Scholars every year. We have seen a number of our scholars take up amateur radio as a result of our association and several are now studying electronics at university. Some of their stories are on our website.

Linked to our association with the Smallpeice Trust and the Arkwright Engineering Scholarships we have been funding Connect Days, which are open to all Arkwright Scholars, not just those we sponsor. The idea is to show how amateur radio can help formal education through learning new practical skills and experimentation.

This year's event took place in March with 16 scholars from across the UK coming to Bletchley Park for the day. They were each given a Foundation Licence textbook two weeks ahead of the day and asked to study it before the event. On the day they were split into four groups of four and cycled around activity sessions to complete all of the practical assessments. In the afternoon they sat the exam and all 16 passed. The RCF funded the books and exams, the RSGB provided access to the National Radio Centre, assessors and invigilators and Bletchley Park provided us with classrooms; a real team effort.

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Fig. 1: RCF Trustee Professor Cathryn Mitchell M0IBG with the 2019 RCF sponsored Arkwright Scholars, Harry, Samir and George

Scholars from previous events have gone on to pass all three amateur radio exams and to champion amateur radio at university.

Another regular commitment is the RCF support for the prizes awarded to university students by the UK Electronic Skills Foundation (UKESF). Every year the UKESF awards prizes for the best undergraduate projects and the RCF sponsor the prize for the best RF project. Last year's winner was **Jonathan Rawlinson M0ZJO**, who says he would not now be working in the satellite industry had it not been for his discovery of amateur radio leading him to an interest in electronics. Jonathan has since helped out with another RCF event in support of British Science Week.

RCF and British Science Week

Last year the RCF Trustees thought it would make sense for the charity to sponsor something specifically aimed at schools and British Science Week seemed to provide an

excellent opportunity to do that. Working in collaboration with the RSGB's Schools Link project team the idea was to support a number of events centred on the building of a simple radio, suitable for first time builders.

The RSGB managed to secure the support of ten clubs/groups/individuals who had links to schools to run a pilot event in 2019. Walford Electronics had supported a similar event in support of **Tim Peake's** Principia mission and agreed to build on that experience by providing the radio kits. In all, around 150 Spaxton radio kits were distributed around the various events.

Some events were simply a kit building workshop, others incorporated other radio activities, but the universal feedback was that it was a great success. The challenge now is to build on this year's pilot and see how many schools we can get involved in 2020 and beyond. We are looking to promote the event through conferences and seminars but a number of schools who could not take part this year have already signalled their desire to join in next time around.

The RCF and the RSGB

The RCF and the RSGB are two separate organisations but there are some overlaps and many links that are important for the collaborative projects outlined above.

Most of the Trustees are members of the RSGB; as radio amateurs that should not come as too much of a surprise. Our Secretary is an RSGB employee; **Jackie Tite** is the RSGB's budget manager and is an ideal person to keep the RCF's finances in order.

We maintain close links with RSGB HQ staff and its volunteers. We could not deliver anything like as much as we do without them. The RCF has money but few people to make things happen. So, being able to work with the likes of **Martyn Baker G0GMB** and his team at the National Radio Centre along with **Steve Smith M0UEH**, the Schools Link Project Leader, provides us with willing and able volunteers to staff our projects and that allows us to deliver our charitable aims.

Two Sides to RCF Funding

You can help the RCF in two ways. You can donate to the charity fund to help us do more or you can seek funding for your projects that help us deliver our aims.

If you would like to give to the RCF, you can do that through the RSGB shop or via the RCF website or you can donate up to £10 by sending a text message 'RCOM25 £10' to 70070.

The Trustees are always looking for new ways to deliver our aims and if you need funding for a project that would help us do that, please do not be shy in seeking our help. Further information about the RCF can be found at:
https://commsfoundation.org

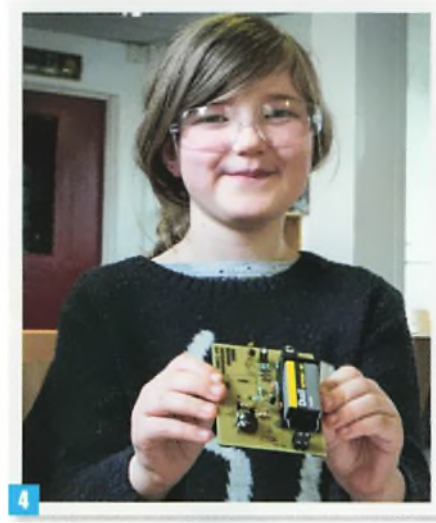

Fig. 2: Some of the Arkwright Scholars at the 2019 RCF Connect Day. Fig. 3: Three young radio builders at Sandringham School during British Science week. Fig. 4: One very proud radio builder at Bletchley Park during British Science Week.

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A Homebrew Antenna Rotator

Matthew Nassau MONJX describes how he designed and built his own antenna rotator, a true Practical Way project!

In this article, I describe my journey towards building a simple homebrew antenna rotator that may inspire you to tackle a similar need that you have or perhaps improve upon this basic idea.

You can usually find me on the HF bands, operating from a temporary wire dipole in the backyard, squeezed across the natural diagonal at roughly North-East/South-West. Starting out with SSB, over time, I have wandered into CW. Yet, the fast-pace on 40m or 20m can be a challenge as a novice.

More recently, in experiencing our Sutton and Cheam club entry in last year's *PW* 2m SSB contest, I learned more about operating 2m in SSB and about Yagis in the process. Slowly, an idea started to ferment in my mind – why not explore the local UHF bands, including CW, with their compact directional antennas – but I would need something to point them with!

Looking at commercial rotators, they comprise solid engineered gearing and rotator controls, with a commercial price to match. In the spirit of amateur radio, and my love of making things, I decided to have a go myself.

A Kernel of an Idea

Rotators comprise basically three parts:

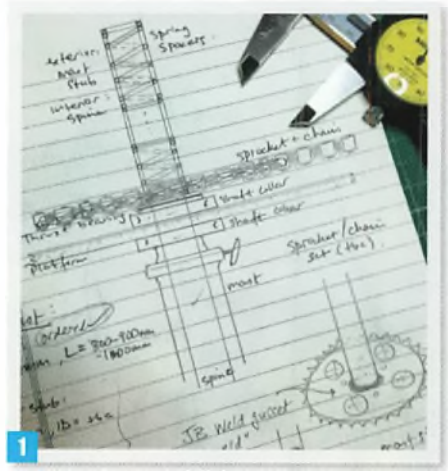
- a lower bracket to couple your mast to the rotator,
- the rotator mechanism,
- an upper mounting pole upon which to mount the antenna.

I opted for an all-in-one idea: a single pole from mast to antenna with a motor in the middle, **Fig. 1**.

Mechanicals: The Motor

Turning the antenna needs some form of gearing. Surfing the internet for ideas regarding geared drives, I happened upon car windscreen wiper motors that are based on worm gears. These offer large amounts of torque, use a 12V source (car batteries and amateur radio are a proven partnership), are cheap (~£15-20) and well-documented on the internet for wiring and electrical current needs.

I decided early on to use a chain-drive mechanism and found several online retailers offering platewheel sprockets. Looking ahead to gearing ratios to manage turning speeds (small gear on the motor, large gear on antenna stub), I opted for an 11-tooth BS 3/8in (06B) with an 8mm pilot bore, since the motor's drive shaft bolt is an M8 thread. The motor has a splined shoulder, which I mated to the gear by grinding out the platewheel pilot bore with a conical tapered tungsten carbide burr of just the right angle to match the splined shoulder and a hobby drill press. This was then secured with metal epoxy and the drive shaft nut, **Figs. 2**, **3** and **4**.



1

2

Fig. 1: Early drawing of the rotator with chain-drive. Note the lack of motor position yet! Fig. 2: Wiper motor with drive gear. Note the splined shoulder to be ground into the gear.

The Backbone and Antenna Stub

Moving onto the main body of my design, I envisioned a central tube that fits inside the top of my push-up mast. Around this 'backbone', I would mount a second, shorter tube, which would support the antenna. This 'antenna stub' would spin around the backbone tubing, moved by the motor with a chain drive.

My mast accepts 24mm tubing at the top so I started with 24mm x 900mm tubing as my 'backbone'. I accounted for approximately one third of this pole inside the mast to ensure bend strength, giving about 600mm of exposed central tubing. To ensure the outer antenna stub would remain concentric with this backbone, I introduced compression springs to take up the space uniformly between them. This offers low contact surface for minimum friction. I added some general-purpose grease for good measure. Somewhat measuring sizes and tolerances as I went, I ended up with an outer 38mm (1½in) diameter antenna stub tube, 500mm long. The assembly is topped and tailed with thrust bearings to ensure smooth, low friction turning and these are clamped snugly together to the backbone tubing with shaft collars, **Figs. 5** and **6**.

The Motor Mount

With the antenna stub and motor ready, the next exciting step was to bring them together with some form of mounting platform. I drew a 1:1 scale template to explore the motor and its centre of gravity, the gears and mounting hole positions, settling upon a logical location for the motor. Bearing in mind the mantra 'measure twice, cut once', I cut out the basic shape of the motor mounting board on a spare piece of MDF hardboard to test the idea. When I was happy, I copied the outline on a piece of scrap plywood, making use of a Forstner drill bit to create a sharp, clean backbone tubing hole to ensure a snug fit, **Figs 7** and

8. The motor mounting board was then fitted onto the backbone tubing and secured with a common pole bracket that was clamped to the tube and screwed into the motor mount board.

The Driven Gear

I chose a compromise between dimensions and gear ratio in selecting the driven-gear to be a 40-tooth BS 3/8in (06B) platewheel, for a ratio of 40:11 or 3.63:1. Given that I needed to mount this driven-gear around the 38mm diameter antenna stub tubing, I needed to cut a 38mm hole in the 5mm plate steel – no small task. I invested in a tungsten carbide hole saw with a 6mm pilot drill bit for this purpose (I am sure it will be useful again someday!). The platewheel comes with a 12mm pilot bore pre-drilled, so I needed to step down the 12mm hole to the 6mm of the pilot bit to ensure concentricity of cut. This was achieved with a drill bushing, which is a hardened steel spacer intended for the purpose of reducing one hole to another, **Fig. 9**.

After mounting the motor in situ on its plywood platform, it was a delicate task of aligning the drive-gear, driven-gear and chain in the same horizontal plane and using metal epoxy to bind the driven-gear in place onto the antenna stub, after keying the surfaces with a grinder (or rough sandpaper and elbow grease!). I found the best method of applying the epoxy was with 10ml disposable plastic syringes (no needles supplied), using only 3-4ml of epoxy. Once set, the epoxy yields a strong fillet that bonds well. The last step was to cut the drive chain to length, fit it in place and add an idler wheel to take up the slack in the chain, which is ever-present in chain drive mechanisms, **Figs. 10** and **11**.

Electricals

With the mechanics of the rotator complete, I needed to tackle the electrics required to drive the motor. Car windscreen motors are a hardy breed of DC motor, used to a hard life in all weather. Modern designs include two speeds (wipers fast or slow) and a park switch that accounts for why your wipers return to the home position even if you turn them off mid-way through a swipe across the windscreen. Having tested the motor speeds, I only needed the low-speed wire and 'ground'. Due to their design with permanent magnets, the direction in which the motor turns depends upon the polarity attached to each of these two wires.

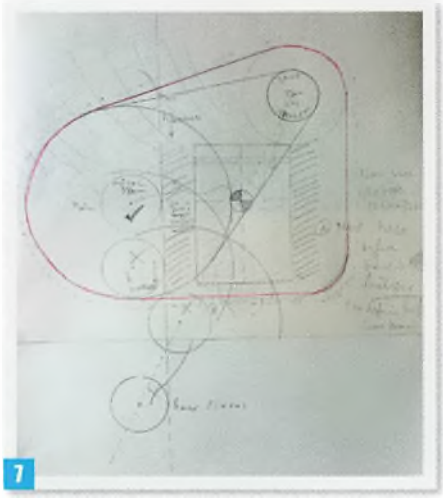
I recognised early on that I would need some form of pulse width modulation (PWM) supply in order to control the motor speed – gearing alone with the low-speed circuit at a full 12V is too fast as a rotator. Conveniently, this is a common requirement when repurposing wiper motors and a quick search on the internet located a Chinese-made complete 12V-30V DC controller, with directional rocker switch, LEDs and potentiometer to control speed, for less than £10. Fitting this into a Hammond 512 series case, drilled for switches and cabling ports (for fused 12V DC power in, PWM power out), I had almost finished the build, **Fig. 12**.

Fig. 3: Tungsten carbide burr to grind the gear to fit the splined motor shaft. Fig. 4: Drive gear fitted to motor splined shaft, secured with metal epoxy and shaft nut. Fig. 5: Backbone tube with spacer springs mounted in the mast. Note the lower thrust bearing and shaft collar. Fig. 6: The outer antenna stub is fitted, sitting between thrust bearings and shaft collars.

How Far is a Turn Too Much?

Buoyed by the thrill of transforming the sketched idea into a working rotator with controller, I envisaged using it on a sunny Field Day, where the antenna would be clearly seen. Its direction would not be in doubt and the danger of coaxial cable wrap around the mast would be avoided with due care and attention. If this is all you need, you can stop here and the rotator is finished. But I like a puzzle and wondered how to create a rotation sensor that would respond to the direction and angle of turn and alert the user via LEDs to stop when coax wrap might be a risk. A potentiometer and an Arduino Nano seemed likely tools to use here but how exactly?

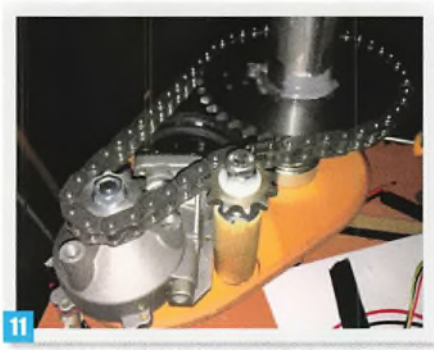
Pondering this for a week or two, I used a simple observation of the humble corkscrew. As a corkscrew turns clockwise (CW) or counter-clockwise (CCW) between clasped fingers, your fingers travel in a line upwards or downwards relative to the screw. Thus, rotational movement becomes proportional linear movement. Tentatively, I built a 'corkscrew' out of some 42mm inner diameter spring to fit loosely around the 38mm antenna stub tubing, epoxying the spring to a square metal plate mounted with high strength neodymium magnets to the

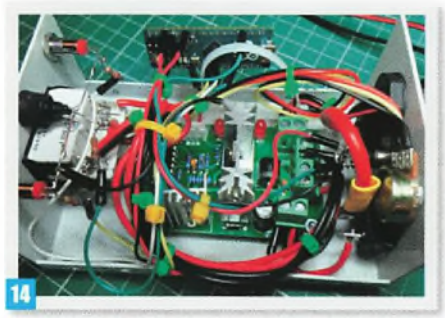


underside of the driven-gear. I chose magnets to attach this sensor as a strong, yet temporary, fixture in case the idea proved impractical. The 'finger' that touches the 'corkscrew' is a 50kΩ linear potentiometer. As the antenna stub turns, the corkscrew turns, pushing the linear potentiometer backwards or forwards, creating a changing voltage divider. A short sketch (program) written for the Arduino uses the Arduino's ability to sample an analogue voltage and convert this to a digital value between 0 and 1023 with an on-board Analogue Digital Converter (ADC). After installing the sensor and some testing, it was easy to find digital values where the rotator pointed at a reference angle of 0°, 180° CW and 180° CCW. The Arduino then triggers LEDs to turn on or off when the digital level seen from the potentiometer reaches beyond these 180° levels (red LEDs) or within a defined band of values near the 0° midpoint (green LED). I added LEDs and Arduino (powered by the same 12V supply to the PWM controller because the Arduino has an on-board 5V voltage regulator) to the control box, along with three-wire cabling from the control box to the potentiometer on the rotator. It is more complicated to describe than to build and **Figs. 13** and **14** should make clear the setup.

Next Steps

I am sure this idea is not entirely novel nor optimal but I hope it offers a demonstration of what can be achieved to fill a need for a practical tool in our hobby with a simplistic mechanical design of rudimentary car parts, tubing and the odd spring! Better rotational sensors surely exist with rotary encoders; smaller DC motors with sufficient torque would leave a more compact rotator. A constructor could take this further and identify digital values that align with each 30° of rotation, thus making low resolution relative bearings. Indeed, Arduinos offer straightforward use of LCD displays and far more information than simple LEDs. This is no doubt the tip of the iceberg in potential refinements and extensions of the core rotator idea. I hope this offers some ideas to you budding homebrewers. Why not assess what you need to further your participation in our hobby and make it yourself?





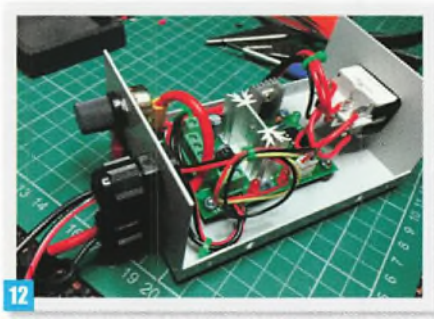


Fig. 7: A 1:1 template to find the location of motor, drive gear and mounting hole for the backbone tubing. Fig. 8: The finished motor mount, with P-clips for the motor body and Forstner-drilled hole. Fig. 9: Slow and steady, cutting the 5mm steel with cutting fluid. Note the drill bushing at the centre of the middle disc that is removed by drilling. Fig. 10: Metal epoxy, applied with a disposable syringe sets while magnets hold the arrangement in place. Fig. 11: Finished mechanical arrangement with idler wheel to take up slack in the chain. Fig. 12: PWM controller in a box, comprising a voltage regulator down to 12V and high current MOSFET for pulse control. The rocker switch flips polarity to the motor which turns clockwise or counter-clockwise. Fig. 13: Rotation sensor comprising spring epoxied to square mounting plate, held to the underside of the driven-gear with small neodymium magnets and linear potentiometer 'finger' on a bracket that sits between coils of the spring. Fig. 14: Added Arduino and LEDs to the control box for rotation sensing of direction and angular distance.

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Feature by Tom Morgan ZS1AFS/ZT1T

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Trapezing Antennas? Yeh?

Tom Morgan ZS1AFS offers a photo diary of how he managed to get a new HF Yagi onto the tower. Not a challenge most of us face in the UK but a stirring tale or derring-do!

I suppose it all started when I found a still-in-the-box TW-33 WARC antenna by Mosley, advertised at half price in a UK radio magazine. Although there's a lag in my magazines arriving, the owner had received no interest.

This happened to coincide with a visit to the UK by **Sue ZS1AFR** on business. And she was able to negotiate discount shipping. So, I was going to get a new toy for Christmas! My DiY two-element WARC band antenna had been easy to man-handle along the paths in the garden and I had been able to wiggle it around the guys up to the top of No. 2 tower. The photos, **Figs. 1** and **2**, show how easy it was to manhandle.

The main problem was that Susan's flower garden and orchard had grown around the No. 2 tower, meaning that the 'Don't disturb the garden' instruction was important! Because Susan is the ground crew it would be counterproductive to ignore the limitations.

But I'd already thought of that. I had a gin pole made for the first tower at the local engineers. The *ARRL Antenna Book* showed one but I found it was not ergonomically convenient. All of the ones I'd seen before using mine were straight. Fortunately, our next-door neighbour was a metalworker who made it into a crane. As you can see from **Fig. 3** there is a strut supporting the horizontal arm, and the bracket, through which the pole slides, clamps to a tower leg.

A Plan is Hatched

So, the plan was hatched. Because the new beam had three elements and was too big to manhandle down the paths, a new strategy was needed. I would raise the new beam up on the No. 1 tower and then trapeze it over the flower garden and the trees! Of course, I didn't have a clue how. But I was sure it could be done.

I bought a couple of double pulleys with swivels from a yacht chandler in Cape Town and we collected some DYNEEMA

Fig. 1: Lift-off was easy.

Fig. 3: Photo of Crane & Bracket.

Fig. 5: Photo showing pulley arrangement.

Fig. 2: Wiggling around the guys.

Fig. 4: Pulley Support Arm.

Fig. 6: Bridle Mark 1.

rope (6mm) from our sail maker son. I think I paid for the part of the drum he kept. He's good at business! With the other bits needed, Susan returned from the UK to South Africa.

The first job was to create a fixed point up the No.1 tower, **Fig. 4**. The tube is industrial steam pipe from a local engineering company. The plate is 6mm steel, cut and drilled by an engineer friend and painted with black waterproof paint. The U-bolts are 40mm for the tower and 50mm for the arm. In a farming town there are a number of engineering workshops servicing the farms. But don't ask for high-tech!

Fig. 5 shows the pulley attached to the pivot arm on the tower. It's important that both blocks can swivel. I had a few practices lifting the antenna.

The trapeze line is on the other side of the tower. And the thin red line is the halter line that holds the travelling block before launching. It's sensible to ensure that everything will run before the antenna reaches the point of no return

Fig. 6 shows the bridle, Mark 1, made up of two webbing straps. It's fairly clear how the antenna is attached using a bridle and shackles. When we replaced the WARC band antenna with the Shorty Forty I used a strop to stretch from the block to the top of the bridles. Hence, we could trapeze only the antenna.

Fig. 7, the trapeze block, shows the DYNEEMA strop, sewn by Sue on her ageing ELNA. When we raised the Shorty Forty (some months later) this modification also made attaching the bridle easier. So, the pulley system on No.1 tower does not leave the support arm. However, the white strop needs to be long enough to reach the connecting shackle.

It is most important to ensure that the red halter line and the white strop are facing the correct way when the antenna leaves the pulley system. This is to account for the 180° turn around the tower. Having a halter line means that I can stop at any point before letting the antenna go.

With a flat roof you have an extra, clear platform on which to build antennas. And with a vertical assembly pole alongside the tower I'm already part of the way up to the top. The old photo, **Fig. 8**, shows two antennas on the post when I was replacing the TA-36 with a TA-34XL.

Back to the Plot

The biggest consideration was turning the antenna 180° above the height of the trees on the next-door neighbour's property.

Fig. 7: Block, strop and retaining rope.

Fig. 9: 'There's a bend in my crane!'.

Fig. 10: How do I cope with the weight distribution?

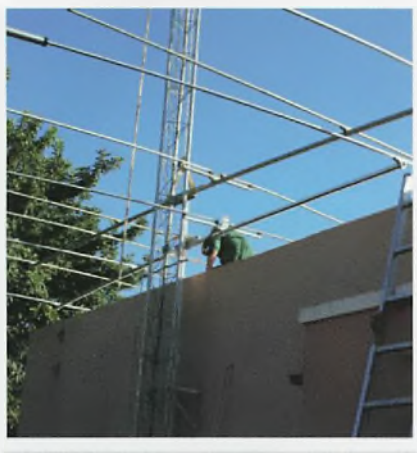

Fig. 8: Two antennas on assembly pole.

Fig. 11: On the ground we had a closer look.

He's a grumpy old man who has complained about my towers to the Municipality (they told him my towers are legal). In South Africa you can erect a mast of up to 15m without planning permission for the use of amateur radio communications. And no restriction on the number of towers! Of course, plots in ZS are a lot bigger than in the UK. Ours is over 800m².

And that 15m does not include the antenna! So, why didn't I have a quad? The management in some of our winds and the variation in temperature of over 40°C are deterrents. And I'm a great believer in 'no moving parts'. That's why we shied away from the SteppIR antennas. A replacement part could mean months of waiting. Import duties for 'non-essentials' would mean an even more expensive exercise even if the part ever arrived.

The Tricky Bit

How, then, did we get the antenna from one tower to the other? Well, the first attempt was a disaster, **Figs. 9, 10** and **11**.

There are no photos of the 'rescue operation' because it took both of us to direct the antenna past the neighbour's trees. With so much slack in the trapeze line it was an uphill battle to rein in the antenna back to the main tower! Fortunately, we had attached halter lines with bridles (that kept the boom at right-angles). We managed – without touching the garden!

I took down the bent crane and realised that the tubing was too thin to take lateral forces. Of course, this was not foreseen when it was made. The bad news was, it was the day before the Christmas holidays. They last a full month for many factory workers in South Africa. Fortunately, a guy I know runs an engineering company and he welded an extra section inside the pole, before packing up for the holidays.

For the next attempt I attached the trapeze line directly to the No. 2 tower with the intention of only using the crane to lift the beam, after I had got it to the second tower. Then we had a few days of rain. Finally, on Christmas morning, before going out to farmer friends for lunch, we lifted the beam, transferred it to the block on the trapeze line and let it go.

Like before, I put bridles on either side of the mounting plate just in case. We thought we might have to line up the beam

Fig. 12: The next attempt with fingers crossed.

Fig. 18: The antenna felt really heavy.

Fig. 13: Whee-ee!

Fig. 14: At the point of no return.

Fig. 19: Gotcha!

Fig. 15: Now comes the uphill bit.

Fig. 16: Not far now.

Fig. 20: Lowering the antenna onto the stub mast.

from the ground or from the second tower. The sequence is shown in the **Figs. 12** to **19**. (Later on, we changed things for the 40m beam. I had learned it was easier to be at the level of the antenna instead of pulling upwards.)

I had pulled the beam close enough to secure it to the tower, temporarily. The last few metres were a bit of a struggle. But I could relax and tie the crane line onto the bridle before dropping the trapeze line. Then Susan pulled the beam up using the crane, **Figs. 20** and **21**. Finally, I got my amateur radio Christmas present!

Fig. 17: It's getting more difficult.

Fig. 21: Job done! Who's for Xmas lunch?

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Submarine Telegraphy

Roger Cooke G3LDI gives a fascinating insight into the challenges faced by Morse operators in the early days of trans-oceanic telegraphy.

A very good friend of mine, **Donard de Cogan M0KRK, Fig. 1,** recently made a presentation at our club, the Norfolk ARC. Various visual means of transmitting Morse are known, some more common than others. The one used at sea, semaphore, is probably the best known but I had not come across this before. It took a while to be able to decipher anything and I thought the topic would be an interesting item for this month's column. Donard has kindly offered to set it up again at the Barford rally in July.

The intention was to show how a double key and a very sensitive galvanometer were used on transatlantic cables where the signals were both attenuated and dispersed. **William Thomson** used Fourier methods to solve the responses of cables of different lengths and with different distributed resistance and capacitance. He then developed his mirror galvanometer as a very sensitive instrument that would use a light-spot to show the voltage deflections. Naturally, I don't have a mirror galvanometer to hand, but used a Pye galvanometer from the 1960s, such as I had used in undergraduate physics labs in 1966/7. The double key was a modified pair of standard practice keys and the box contains an RC ladder network to simulate a typical cable.

Challenges to be Overcome

In the old days of telegraphy, Morse transmissions over landlines experienced both attenuation and dispersion. Their effects could be overcome by means of repeaters to revive signals before they became undecipherable. However, this was not possible on ocean telegraph cables and operators had to develop coping strategies. For example, a 50V pulse impressed at one end of an Atlantic cable would be undetectable at the other end unless you used a very sensitive galvanometer. Even so, the deflection would be spread over about four seconds and it would be almost impossible to distinguish a dot from a dash. So, an alternative approach was used where dots and dashes were of equal duration but of opposite polarity, as illustrated in **Fig. 2.** Thus, the letter 'A' would be transmitted as +50V, –50V using a double key.

At the receiving end a beam of light reflected off a small mirror attached to a galvanometer movement would be projected onto a screen. In the absence of a signal, the light-spot would be located at the centre of the screen. As the letter 'A' arrived, the spot would first move to the right (a dot) and then to the left (a dash). Reading the spot was a skilled task involving two staff who would take turns at the mirror. One would read while the other wrote down what had been received. The written message was then carried to the landline room and handed over for onward transmission. They were very worried that lightning strikes to overhead lines could damage the cable so the human was a form of 'opto-isolator'.

The photo, **Fig. 3,** shows a modern form of this equipment. A pair of keys have been adapted to represent the circuit in Fig. 1. When both keys are up the cable is attached to ground. If the dot key is pressed, then the positive terminal of a 9V battery is connected to an RC network inside the box, which replicates a long ocean cable. In use, the output from the network is connected to a Pye Scalamp galvanometer (wires have been omitted for clarity). In the photo the light-spot is just visible at the centre of the scale.

The situation changed in the early 1870s when the Kelvin siphon recorder was introduced on trans-Atlantic cables. Effectively, it was world's first bubble-jet printer, **Fig. 4.**

Instead of a mirror, a mechanism was used to move a capillary from left to right. One end of the capillary was immersed in an ink-well, while the other was located just above (but not touching) a moving strip of paper. This avoided any friction. Droplets of ink were 'pulled' to the paper by means of a train of high voltage pulses applied to a metal plate behind the paper.

1

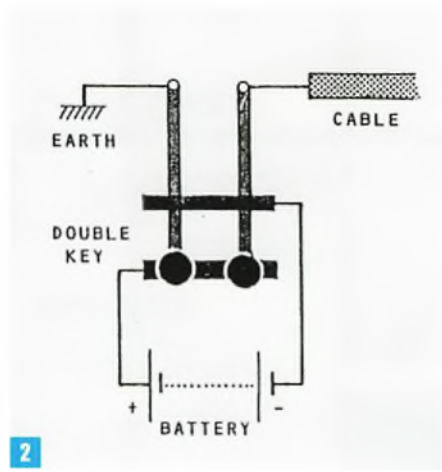

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Fig. 5 shows an output that is quite readable.

However, earth currents were a perennial problem on ocean cables due to the difference in ground potential between the two ends, separated by several thousand miles. **Fig. 6** shows an extreme case and it would be a challenge for any of us to make sense of it. And yet, that is what cable staff regularly did. Tape from the recorder was cut and gummed onto cablegram forms and it was the duty of the clerk-in-charge to write an appropriate translation above the trace before a message was forwarded to the addressee.

Further details about this and sub-

3

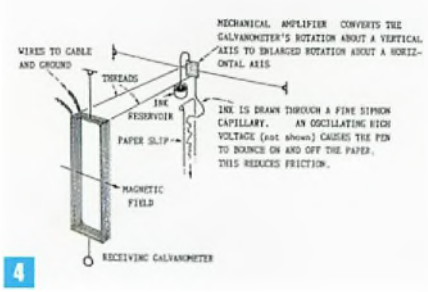

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Fig. 1: Donard de Cogan M0KRK. Fig. 2: Principle behind dual-polarity double keying. Fig. 3: Using modern gear to illustrate dual-polarity keying. Fig. 4: The Kelvin siphon recorder. Fig. 5: A readable output from a siphon recorder. Fig. 6: A corrupted output – difficult to interpret! Fig. 7: Headstone featuring Morse code.

sequent developments can be found in several books authored/edited by Donard M0KRK. These include:

They talk along the deep: a global history of the Valentia Island telegraph cables. The cover picture of this book shows operators working at a mirror galvanometer.

Thirty six years in the telegraphic service 1852 - 1888: being a brief autobiography of ***James Graves*** *MSTE.* A first-hand description of the difficulties faced by the Atlantic cable pioneers.

Autobiography of James Graves: A Personal Record. An intimate description of a career with the Electric Telegraph Company, including the time when they adopted the international Morse alphabet

These are print-on-demand books available from Amazon

In Remembrance

I recently had several e-mail exchanges with a lady called **Darda McDonagh**. Darda lives in Ireland and had recently lost her father, **Thomas Mcdonagh**. He wasn't a licensed amateur but was a radio operator. He served in the Merchant Navy over 60 years ago and passed away peacefully in a home at the great old age of 84.

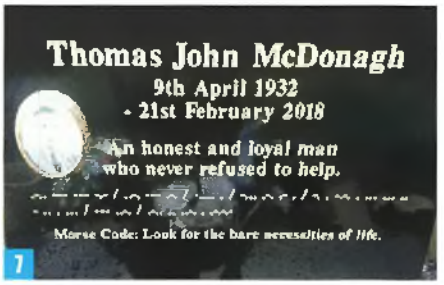
Darda and her brother wanted a passage/saying in Morse Code. They eventually chose 'Look for the bare necessities of life!' I duly translated it and they had it carved into the headstone, as you see from the picture, **Fig. 7**. It's a shame the stonemason made one small error but I feel sure it does not make much difference!

Darda and her brother were both very happy with the end result.

It reminded me of the memorial at Bletchley Park. If you haven't seen it, look for it next time you visit.

Operating in the RSGB CC Contests

The RSGB 80m Club Contests were originally set up to encourage the newer operators to gain experience in contesting.



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However, the achievement of the number one spot is what contesting is all about, and that alone for some.

Our club, Norfolk ARC, is doing pretty well and we do have several who are new to contesting who tend to stay at the QRS (low speed) part of the band. I have spent several minutes up there myself, trying to help, but have yet to work any of our locals. They have found that it is non-productive, so have been enticed into the rest of the band. In the last CW event I heard **Stew GW4J** there and called him. We had a slow leisurely exchange at about 14WPM, totally unnecessary, but at least we saw the funny side and sent 'HI' to each other on completion!

I then received this e-mail from **Bruce G4EUW**: *"Thank you for giving me a point this evening during the RSGB CC CW 80m Contest. I am very new to contesting but not to CW, having started in amateur radio at around the same time as you then having a career at sea as an operator, RN and MN, for 32 years. I read your columns in* Practical Wireless.

"The reason I am dropping you a line is that I am surprised that there are so few stations S&P (search and pounce) in the maximum 15WPM portion of the band. It was very dead tonight. Very few UK stations called me. I understood that this portion was to encourage those wishing to progress. I am not interested in high scores for myself but would like a few of the high speed/power merchants to tune up the band, drop their speed and give the slower boys a few points and encouragement.

"I am no longer able to send usable hand Morse due to a neurological problem but can put out a computer-generated signal for those who will carry on the CW craft in the future.

"So, please give some time for those nervous operators who live in hope of some QSOs to instil some confidence and encourage them to progress. It's like teaching Morse, it gives you a nice satisfying feeling!"

Please keep the input coming. 73 and May the Morse be with you. **Roger G3LDI.**

E-mail: HARRYG3LLL@gmail.com

Thinking of Opening a Shop?

Harry Leeming G3LLL reflects on the trials and tribulations of making ends meet in the electronic retail business.

It upsets me to see an enthusiast opening their own hobby related business and then a year or so later to see the 'Closing Down Sale' notices appear.

If you have a hobby in which you are very interested, the idea of making a business out of it by opening a shop may seem attractive but life on the high street is difficult. Do think very carefully before sinking your savings into a business venture. Ask yourself what the competition is like and whether other similar shops closed down lately. Make sure you regularly attend the appropriate local Camera/Art/Radio/Knitting/Walking/Computer/Fishing club, whatever, and here you should get some idea of the demand locally and a chance to meet potential customers. A local businessman is unlikely to welcome a competitor but if you attend a club in a town 20 miles away, you might even get talking to someone who runs a similar business and pick up some tips.

Ask yourself whether the profit you are likely to make will cover all your expenses or whether there is a danger that your shop will simply provide free showroom and demonstration facilities for larger discount and online cardboard box merchants. To be successful in a small business in this modern age, you have to offer something extra, preferably including a service such as repairs. Hopefully our experiences will be helpful to someone.

Holdings of Blackburn

My wife **Brenda's** family had operated a successful tape recorder and photographic business, Holdings of Blackburn Ltd, since the late 1940s. I joined in the 1960s to develop the electronic side. I was reasonably successful at developing first hi-fi and then amateur radio but in the late 1970s the shop as a whole was struggling. Hi-fi became difficult even before the internet when a national discount chain opened locally selling similar equipment, mostly without being able to offer a demonstration. I found out that customers who were interested in particular equipment would come to us to compare it against other models, using our comparator system, and then when they had made a decision, would go and purchase from the discounter. In some cases, their sales staff would actually recommend that customers come to hear the equipment they were enquiring about in our showroom before buying from them. Because national discount stores and later online retailers do not have the expense of operating a showroom, employing technical staff, or running a local service department, and buy in bulk nationally, they could of course afford to undercut us. The same thing was also happening on the photographic side of the business.

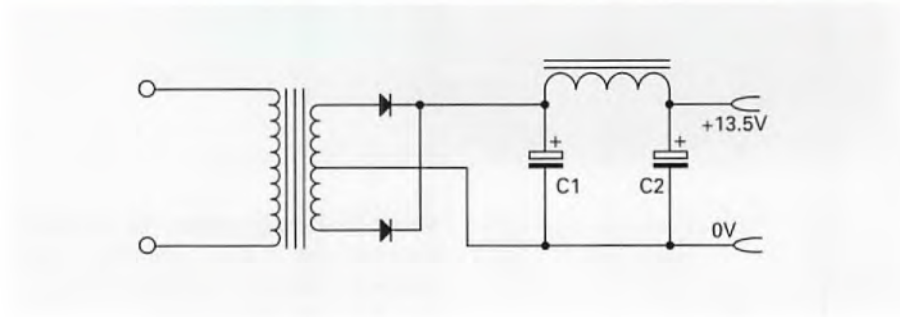

Fig. 1: Part-circuit of FT-101 PSU.

We struggled on for a few years, gradually reducing staff and expenses, but the only side of the business that seemed to be thriving was amateur radio because this was too specialised a line for the discounters.

Brenda and I wondered if, at some time in future, we would be able to open a much smaller shop on our own and take the over amateur radio side. I was in charge of the electronic side of the business so I decided to close hi-fi down and concentrate all my efforts on amateur radio. I gave lectures at various radio clubs, stopped writing for hi-fi magazines, started writing articles for amateur radio magazines, and designed a few items such as the G3LLL RF Clipper. I also took an opportunity that arose to teach the City and Guilds amateur radio course for one evening per week at the Blackburn technical college. Doing this after a day

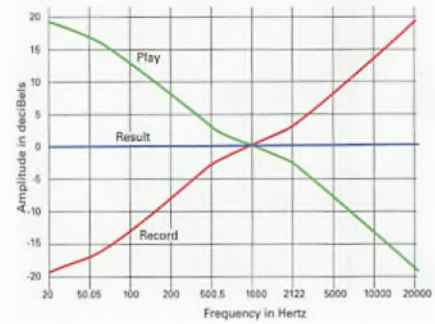

Fig. 2: RIAA response curve.

at the shop was hard work but it paid well and gave me the chance to meet many customers. All of this raised the profile of the amateur radio side of the business, without incurring the cost of large adverts. Good publicity can be the lifeblood of any business or career, while bad publicity can destroy you (unless, it seems, you happen to be running for President of the USA!).

Making a Plan

It is very easy to be dazzled by large numbers and fancy spreadsheets but Brenda likes to be in touch with reality and to keep things simple. She did some calculations and estimated what the annual expenses would be to run a small amateur radio shop on our own. She then took the total, including wages, heating, lighting, telephone, insurance, rent,

council tax and all the rest and divided it by 52. This gave us a figure for the profit we would need to make per week from sales and repairs to keep our heads above water. We eventually realised that apart from closing our eyes and sleep walking into bankruptcy, closing the existing business and operating on our own was the only way forward.

We were very worried and gathered together a collection of the magazine reviews of some of the equipment I had developed, letters of support from suppliers and some rather flattering correspondence I had had from magazine editors and similar. I then went to see the bank manager and eventually persuaded the rest of the family to agree. Brenda spotted a small shop out of the town centre available for rental, around which there was plenty of free parking. We moved in and started operating as 'Holdings Amateur Electronics' with the help of Amateur Electronics of Birmingham.

Now when money starts coming into a business, there is always the temptation to think it is yours and this is a big mistake because most of it will be owed to suppliers and other creditors. In our case we still had the debts and a bank overdraft to pay off that the Holdings town centre shop had run up previously. So, at first every penny we could spare went back into the business.

Once we got on our feet we could relax and we then operated successfully for nearly 20 years until we retired. We were very fortunate that after such a difficult time our efforts worked out, and we have often thanked our heavenly Father for watching over us.

We then moved to Heysham and I was able to carry on doing some repairs to older equipment for a few years before eventually deciding that it was time to 'pull the plug'.

Back to The Past

I thought that I had finished servicing an FT-101 but when giving it its final check over, I noticed that the background hum in the speaker and headphones was higher than normal and that on transmit the drive seemed a bit on the low side The hum was not affected by the volume control and showed up worse at low volume settings. I tried disconnecting the audio feed to the output IC but the hum was still there, hence I presumed that it was on the 13.5V line feeding all the

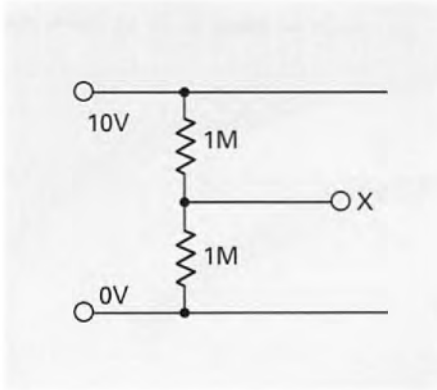

Fig. 3: Example circuit, see text.

transistors. The circuit of the relevant part of the PSU is shown in **Fig. 1** and my next move was to connect a 2200µF capacitor in parallel with C1. This reduced the hum slightly but then I noticed that the its tone seemed very deep, which the internal speaker reproduced more as a 'rattle' than a pure sound. With a PSU using full-wave rectification as per Fig. 1 any mains hum should be at 100Hz but listening to it on a larger speaker or hi-fi headphones made it clear that most of the sound was at 50Hz.

Next, I measured the voltage on the 13.5V line. It was below 12V. This made me suspect that one of the rectifier diodes was faulty, so I removed the rectifier board to check them. The cause of the trouble was then obvious because a strip of PCB feeding one of the diodes had fused. The PSU was therefore acting as a half-wave rectifier, hence the 50Hz hum. I strapped the missing part of the PCB across to restore full-wave rectification and the hum disappeared.

I have since had various rigs in with the above fault. It seems to occur when someone has tried to replace the pilot lamps, which in some FT-101s are fed from the 13.5V line, and they have managed to short-circuit the holders. If you do have to replace pilot lamps, disconnect the rig from the mains first and then, (as I said to the surgeon, who mumbled something about my groin being a very busy area, before he operated on me for a hernia) *"You'll have to be careful won't you!"*

Telling a Customer He Is Wrong

If you want them to retain their custom you have to be rather careful when you tell a customer they are wrong but years ago, when I was still selling and repairing hi-fi equipment, I had a rather amusing conversation.

One problem with hi-fi equipment is that good quality speakers soon make the slightest hum audible. This is compounded when the system is fitted with a magnetic pickup cartridge for playing the older vinyl gramophone records.

To cram around 30 minutes recording on an LP disc, it is necessary that the track is not too wide. Because of this LP records are cut according to an internationally agreed RIAA curve, see **Fig. 2**. Low frequency sounds are cut with the frequencies attenuated by 20dB and to compensate for this, most of the cheaper crystal or ceramic pickup cartridges are engineered to have the opposite response. High quality magnetic pickup cartridges, however, have a flat response so these have to be connected to the magnetic input on a hi-fi amplifier, which has RIAA correction built in. This boosts the low frequencies to compensate but, unfortunately, also boosts any low frequency hum by 20dB.

A very common cause of hum on hi-fi equipment was an earth loop and this could easily occur when a customer connected a gramophone turntable with built-in pickup arm, which had a three-core mains lead. If the screened audio lead that fed the magnetic pickup head was connected to the turntable's metal chassis and was plugged into an amplifier that was also earthed, then the turntable was earthed via the mains plug and also via the lead to amplifier. This formed a classic earth loop, which acted like one turn on a transformer, and the system suffered from a high quality 50Hz hum.

Trying to explain all this to non-technical customers could, to put it mildly, be difficult, and was the subject of many articles in hi-fi publications. I well remember struggling through the subject with a customer, only to be told that according to an article he had read in *Hi-Fi News*, I had got it wrong. I tried to tell the customer that he must have misunderstood the author but he would not have this until I said, *"Well I'm sorry if it wasn't clear but I know exactly what the author meant because I wrote the article"*. We got rid of his hum eventually!

What is the Voltage or Your Blood Pressure?

Many people suffer from 'White Coat Hypertension', which in simple English means that they are of a nervous disposition and that their blood pressure rises as soon as a doctor tries to take

Fig. 4: The classic AVO 8.

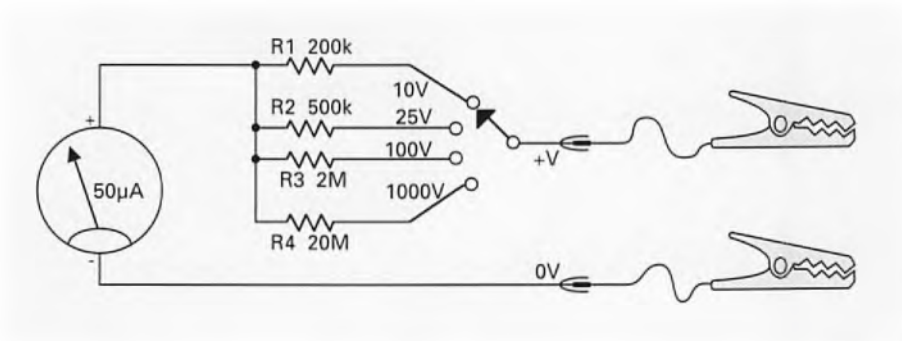

Fig. 5: Internal circuit of test meter, with alternative range resistances according to selected voltage range.

it. Even some doctors suffer this way and one sheepishly told me that his blood pressure 'goes through the roof' if a colleague tries to check it. To avoid being over-medicated, we have ended up investing £20 for our own tester and visit our doctor armed with a list of readings.

In electronics however a similar problem can happen when we try to measure voltages.

When I started in the radio and TV trade over 60 years ago, service manuals containing all the necessary information were freely available. These included not only typical voltages but sometimes stated what make and model of test meter had been used to take the readings. Surely if good quality test equipment was used, you would expect their readings to be all the same but *'It ain't necessarily so'*.

Have a look at **Fig. 3**. Now you don't have to be a mathematical genius to calculate that the voltage at point X should be 5V but what will happen if you try to measure it with the highly acclaimed AVO 8 set, **Fig. 4**, on the 10V range.

The AVO 8 has a sensitivity of 20,000 OPV (Ohms Per Volt). What does this mean? It implies that it uses a meter movement that requires 50µA (0.05mA) to register full-scale deflection. Simple maths (R in kilohms = voltage divided by current in mA: 1/0.05 = 20kΩ) shows that on a DC range as per **Fig. 5**, the total resistance of the meter movement plus the range resistor will have to equal 20kΩ for every volt in the range the meter is set at. On the 10V range, therefore, the meter will place a load of 200kΩ on any circuit you try to measure. While there will be 5V at point X when you are not trying to measure it, this will drop to less than 2V as soon as you connect the meter. If, however, you switch the AVO to the 1000V range, the load it represents will increase to 20MΩ so the reading would be almost correct, except, of course, you would hardly be able to see the movement of the pointer!

Modern digital meters are normally much higher in impendence but even then it's as well to check what loading the meter places on circuits you are measuring. This should be in the specification but you can easily double-check it yourself. If you think the input impedance is 10MΩ, for instance, measure the exact voltage of, say, a 9V battery and write down the reading. Next, measure the voltage again with an accurate 10MΩ resistor in series with the test lead. If the input impedance of the meter is 10MΩ, the meter should read exactly half of the previous reading.

If it doesn't, try a few high value resistors in series with the lead until you find one that does give you a reduction of 50%. This then is the value of the input impedance on the range you have selected and the loading it presents to any circuit you are measuring. Unlike analogue meters, your digital meter will possibly present the same input loading on all its DC voltage ranges but it's as well to check and make suitable allowance when using it for measurements.

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Antenna Analyser & Return Loss Bridge

The quest for the holy grail or check your antennas from the comfort of your armchair or shack.

The search for an affordable means of checking the electrical performance of an antenna led me to the original idea for this item. Affordable here means less, much less, than hundreds of pounds.

I tried a circuit by K6BEZ. The breadboard was assembled in minutes. 5V in, both boards lit up. Now for the op amps... I found, however, that the listed program has errors, and it didn't work. Correcting the problem required skills I do not have, so I must try another approach. I had obviously trodden in more than I could chew. [*interesting mixed metaphor Geoff – **ed**!*]

Other analysers I found are SARK100 £100, KKMoon analyser £60, QRP Guys (PCB only £10. Find your own bits). These products mostly include a power oscillator, digital frequency readout and often a graphical display of the resonant point. I got the cost down to £40, but continued to look. Now, Eureka! *"A Poor Man's antenna Analyser"*, by GM3VLB.
https://tinyurl.com/y5mv4xyz

No digital readouts, no microprocessors, no programs to download, no attached computer, no vast expense, no variable power oscillator. Reader, you already have one, it's your transmitter!

Description

This device measures SWR and resonance, that's really all we need! I combobulated mine out of my spares box, cost £0.00. It's basically, a resistive (not frequency-dependent) bridge. With a little thought we can dispense with the above complications and the price drops dramatically. It is entirely passive (Input limit 2W of RF) and can be built from a moderately well stocked junk box. I built two versions on Veroboard, without success, finger trouble on my part, no doubt, but a third on copper clad, unetched PCB material, using a variation of the 'Manhattan' construction technique (which I've dubbed 'Sheffield'!) based on Gaffer tape and 3mm copper strip, worked perfectly. This construction technique lends itself to easy alteration mid-project, which the original Manhattan, glued islands on copper clad board, does not. SWR and Z (impedance) read out directly and the resonant frequency is found empirically. There is an excellent photo of the finished unit in the GM3VLB article.

Using the Analyser

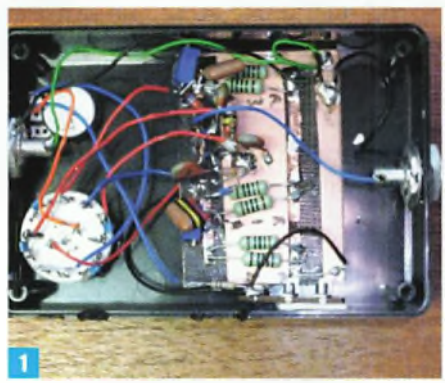
A short antenna needs inductance adding for resonance (It shows capacitive reactance) while a long antenna (Inductive reactance) needs capacity added to resonate. Abolishing digital readout, graphic display and the like means doing a little more thinking, which is not difficult. We mostly deal with resonant antennas so complex calculations are unnecessary.

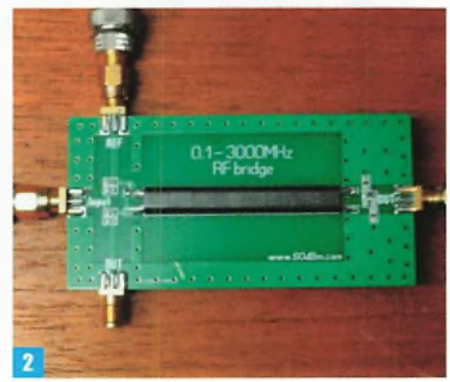
Take readings at the high and low ends of a band and see which has the lowest SWR. That's the direction towards which the resonant frequency will be found. If they are the same, the antenna is just fine or is completely non-resonant. I don't wish to think about the latter. An antenna that is 'short' at the desired frequency has capacitive reactance, so add wire or a loading coil. If it is 'long' it has inductive reactance, so shorten the elements or add capacity. The meter scale shows 50Ω impedance 'Z' at half scale; any deviation is unwelcome. SWR reads from 1:1 to infinity, so the lower the reading, the better the SWR. After calibration (see GM3VLB's notes) I connected the output to my commercial dummy load/wattmeter, which gave 1:1 SWR and a shade under 50Ω impedance., thus proving the circuit.

I find I need a little more than 2W for it to work properly. Be aware that a low SWR is not, in itself, an indication of resonance or efficiency. A dummy load shows impedance of 50Ω and a 1:1 SWR, while not radiating at all!

Using this basic analyser showed that none of my three antennas is resonant, so I need to do a bit of adjustment.

For meter rescaling templates, try Googling 'Meter+scaling+templates'.





1. Analyser inside, note 'Sheffield' construction method. 2. Return Loss Bridge.

Return Loss Bridge

A true module, $7 from eBay, is a wideband Return Loss Bridge, costing £8 from the UK and covering 1-3000MHz. Search for RF Bridge 0.5-3000MHz, VNA on eBay. It will look like the photo.

It is a version of the previous device but more compact and with no adjustments. Equipped with SMA connectors, readers will need adaptors or 'pigtails' to connect to their system. Again, it is entirely passive and uses a transmitter or other signal source to calculate antenna performance. Ideally, a source with tracking generator is required, but is not essential. A white noise generator or your transmitter, set to less than 1W, is fed in and the output taken to an SD receiver. I used my FUNcube Dongle Pro+. Set a known frequency and level datum, call this 0dB. Then switch on and check how much the signal changes. Look up the details in a table such as in:
https://tinyurl.com/yyuj4xyq

This gives the return loss conversion (download the PDF datasheet). There are many other such pages on the web.

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Create Your Own Printed Circuit Boards

Clive Mott G4ODM explains how to go about creating your own PCBs.

Back in the day when transistors came to light and replaced thermionic valves, smaller construction techniques evolved. The original Bush Transistor radio, **Figs. 1** and **2**, was built with all components soldered onto bits of tag board, and transistor bodies supported in rubber grommets in a sheet of aluminium. But not for long. This was a labour-intensive process and the Japanese had not even thought about copying anything like this yet. So Printed Circuit Boards (PCBs) came about. This being a sheet of insulating material with a copper foil 'printed' on top to join up lots of components that were fitted through holes drilled into the PCB. Often the insulating material then was Formica but seldom was the copper printed onto this. Copper was first laminated onto the surface of the plastic sheet and then a chemical process called etching used to remove the unwanted copper. To stop the wanted copper from being dissolved during the etching process, the top of the copper was also given a coat of Photo Resist. Originally this Photo Resist was a spirit-based chemical, applied by slowly withdrawing the laminated board from a bath of the liquid resist to leave a thin uniform layer on the board surface. UV light was shone onto the board to harden the dried resist through a photo negative of the actual PCB artwork. Processing then involved nasty phenol-based chemicals to remove the unhardened resist before etching with acid.

This method was soon overtaken by a water-based Photo-Positive system, which was much friendlier. That method worked the other way around. Artworks were traditionally drawn in black for maximum contrast and originally mostly twice full-size. Black Indian ink on translucent film to start with. French chalk would stop one artwork from sticking to another when stored and pulling off the ink. The artwork was then photographed and the image projected with UV light onto the Photo-Positive resist-coated PCB to soften the resist required to be removed with the later water-based systems. The board was then washed in developer to remove the exposed resist. Then washed in an acid to remove the now exposed copper. That's how it was. After Indian ink came Tape and Pad where pre-shaped adhesive backed pads and various thicknesses of tape replaced all the ink. The design of the component layout and shape of the track work was still an art form. Film with light green lines 0.1in apart was the base film for this.

Fig. 1: The original Bush transistor receiver.

Today we use a computer to enter the components and the connectivity. The computer will generate a layout to suit your dimensions and design the artwork for you. But the detail you have to enter needs to be precise and complete or this will not work.

It's interesting to note that even today the thickness of the copper foil is quoted in ounces. And nearly all electronic components are on an imperial grid, tenths of an inch. IC lead pitches are 0.1in pitch and most small ICs have the rows 0.6in apart.

Bring on my DIY Electronic Tape and Pad system.

My favourite drawing package is today part of Microsoft Office Professional and is called Visio Technical. Like most such programs, its use is limited only by the imagination of the user. I have built up my own PCB page and set units to inches, the SNAP function to a small decimal of an inch and the GRID to 0.1 inch. What you need first is a library of the components you wish to put on the PCB. ICs, transistors, resistors, capacitors, relays, terminals and so on. This library is added to as new boards are designed, **Fig. 3.**

All my artworks are drawn full size, 1:1 and as viewed from the component side of the PCB. The reason for this will become clearer later. It suits me to have both components and track work together and when I think it's complete, I take several copies and from one remove the track work while from another I remove the components, **Figs. 4**, **5** and **6**. These happen to be the PCB artwork for an active attenuator, **Fig. 7**. Make yet another copy into a drilling drawing showing the hole sizes, **Fig. 8.** Others may wish to play with the LAYERS

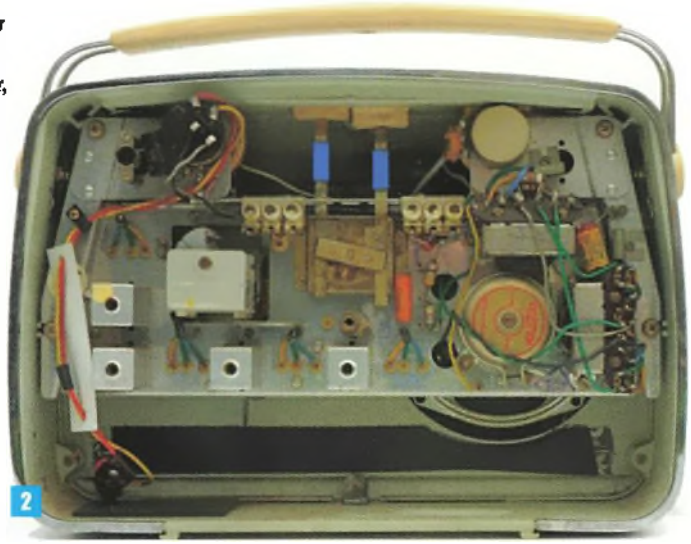


Fig. 2: Interior view of the Bush receiver, showing the construction method.

facility in Visio to do this. Having checked your artwork several copies of the track work can be laid out alongside if more than one PCB is required, **Fig. 9**. I then print at best resolution of the printer onto clear coated film designed for making overhead projector slides – HP Premium Transparency Film inkjet 0.13 mm thick. The track work comes out jet black.

It is best if you draw the circuit diagram first using Visio. Annotate every pin of every part. That way you will know when you have fully tracked a PCB layout. If you want text on your copper, then you will need to draw yourself a set of letters and figures and mirror these so they come out correctly when viewed from the copper side. Just flipping ordinary text in Visio does not mirror the text!

Exposing the Board to UV

I have a DIY UV light box, **Figs. 10** and **11**. This part is carried out in a dim location (garage), well away from bright sunlight. The board is laid down on a flat surface resisted copper side up and the printed film laid over it with the ink side of the film directly against the board. Then a thick heavy bit of plate glass is laid over the top to compress the film to the board. This way the thickness of the film is immaterial because the ink is directly applied to the PCB resist. The UV light box is then lowered over the top and the board exposed for about ten minutes. Modern pre-coated PVB laminate has this time down to two and half minutes.

Developing the Resist

After exposure the board is washed in a tray of warm developer. This stuff is clear when first made up by dissolving the powder in water. **Fig. 16**. After a few uses it looks like lager but still works. When it looks like Guinness it's time to make up some more. Lay the pre-filled plastic developing tank in a sink of hot water first to warm up the developer within. Now, with the tray out of the sink manually wash the developer backwards and forwards over the board and you will see the image of the track work slowly appear. The exposed resist will progressively fall away. A gentle rub with a soft finger has been known to help! I did consider pre-warming the developer in its plastic bottle in the microwave oven for a few seconds but concluded that senior management of the culinary department might take a dim view of this.

The Chemical Bits

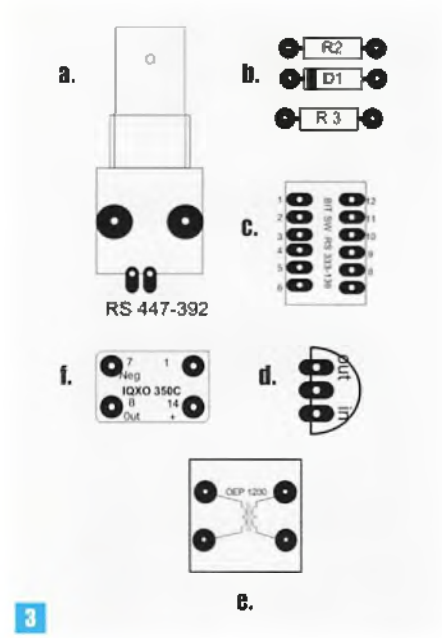
All the chemicals and dishes you need today you can get from RS Components. (Radiospares) as well as other sources. Alternatively use old engine oil plastic cans cut sideways to make your own dishes.

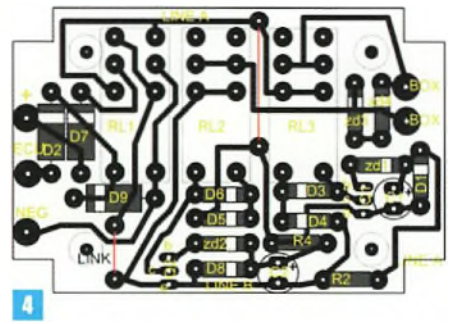
Use Pre-Coated positive photo resisted board, which comes with a peel-off light-proof plastic sheet to protect the photo-resist.

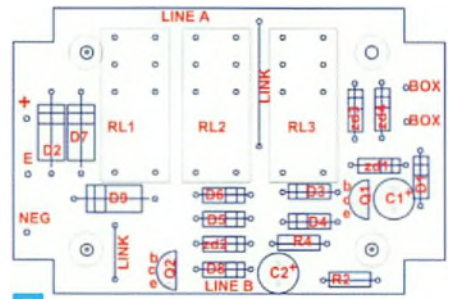
I use inherited Pre-coated AutoPos coated fibreglass (GRP) PCB material from Circuitape. (defunct) Date coded Use by August 1991. It still works today, **Fig. 21**!

Nowadays try RS components 159-6057 for single-side positive photo resisted copper clad board 160 x 100mm. For double-sided board then RS 159-6108. Lots of sizes on the RS website.

All of the chemical stages can be carried out in trays. Some need to be warm and others such as the etching process more than a bit warm, close to hot. I did once make myself a 'Dish Rocker' using an old wiper motor connected to a variable power supply to control its speed. If you get the







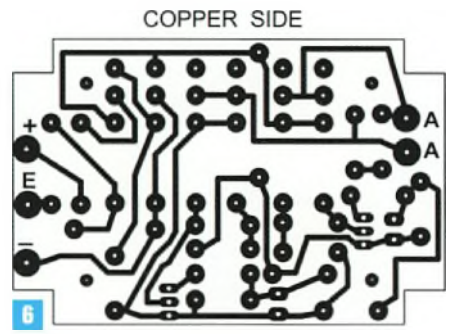
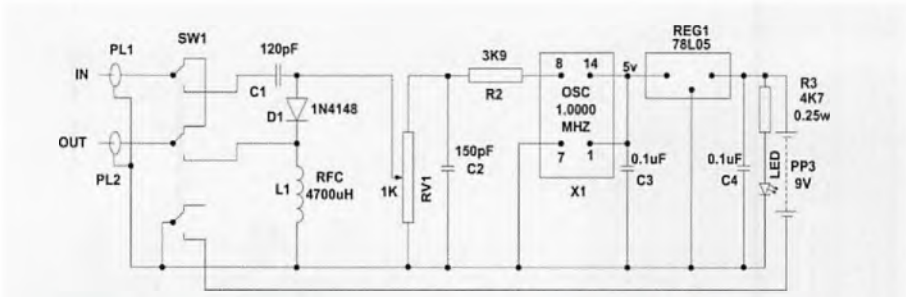


Fig. 3: Examples of VISIO generated component shapes. (a) BNC connector (b) Passive components (c) IC socket (d) Transistor (e) Transformer (f) Crystal oscillator. Fig. 4 Trackwork – all layers together. Fig. 5: Component layout Fig. 6: Trackwork.



PARTS LIST	Comp Ref.	R.S.
Connector BNC 90 deg shielded	PLL 1	546-5137
Connector BNC 90 deg shielded	PLL 2	546-5137
Potentiometer 1Ko Cermet 90 deg	VR1	410-176
Switch 4PCO latching 90 deg	SW1	333-748
Button round black	BUT1	333-631
Knob	KN2	498-659
Oscillator 1 MHZ	X1	316-6686
Inductor 4.7 mH	L1	191-0784
Capacitor 0.1	C3	264-4876
Capacitor 0.1	C4	264-4876
Capacitor 120pF 1 off	C1	167-0868
Capacitor 150pf 1 off	C2	167-0874
Resistor 3K9 1/4 watt	R2	131-328
Resistor 4k7 1.4 watt	R3	131-334
LED	LED1	223-1492
Diode 1N4148	D1	436-7341
Voltage regulator 78L05	REG1	177-5317
Box	BOX1	225-170
Battery connector - PP3	Bat 1	489-021
PCB	PCB	Q5ATT

OSCILLATOR BLOCK ALTERNATIVE RS 478-5749 EPSON.

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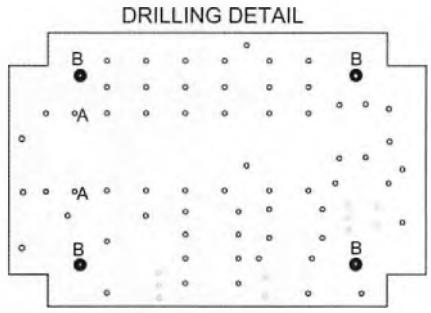

All holes 1.0 mm except
A 1.3
B 3.0

8

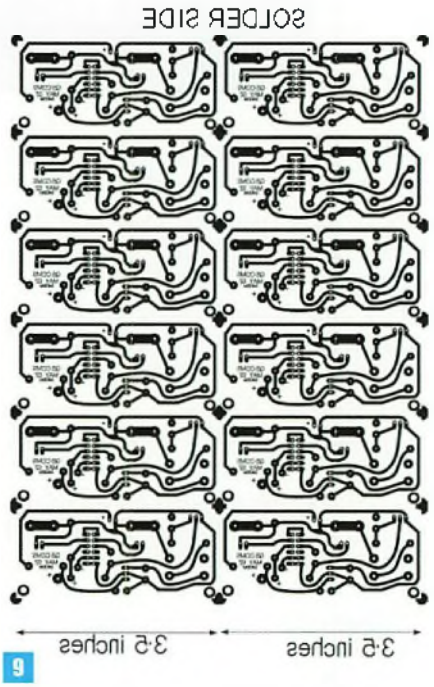

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Fig. 7: Circuit diagram for example project. Fig. 8: Drilling detail. Fig. 9: Many copies of trackwork for multiple boards.

speed right, a wave travels back and forth across the board in a developing dish for the etching process.

Etching

Today I have a vertical plastic narrow tank with a superheated fish tank heater and aerator pipe built into the bottom. It's a 'Bubble Etch' tank. A fish tank aerator pump blows air into the pipe in the bottom of the tank and comes out of a row of very small drilled holes, **Fig 12**.

The knack here is to put the air pump ON before you pour the etchant into the tank. And at the end drain out the etchant before you turn off the air pump. If not, the air pipes fill with etchant. The air pump is positioned well above the etchant tank. The etchant of choice for most is Ferric Chloride, **Fig. 22**, although professionals use more aggressive acids such as hydrochloric to save time. Check the board periodically to monitor etching progress. **Fig. 13**.

So now you have a sheet of laminate with your copper artwork on its surface. Next is to remove the remaining resist from the copper track work; you cannot solder through this. A fibreglass scrubbing block is a simple way to achieve this. There are chemicals you can use to dissolve the resist but I have never bothered with them. Once the copper is bright then a thin coating of Flux Varnish to protect it, **Fig. 14**. Today available in spray cans, **Fig. 23**.

Drilling

Now cut out the board(s) to size, **Fig. 15**, and drill all the holes required, **Fig. 20**. Ideally you have a small fixed miniature high speed pillar drill. A Dremel in the Dremel Workstation perhaps? The drills you need are solid carbide. They do not bend! They are available from RS but are expensive. Most holes will be either 0.8mm or 1.0mm to suit component leads. Ordinary high-speed steel drills go blunt very quickly when drilling fibreglass PCBs. Then drill the larger holes, **Fig. 17**.

Double-Sided PCBs?

Double-sided PCBs are possible and you start with a laminate with resisted copper on both sides. You assemble an envelope or tube from the two printed films. Ink sides inside and taped together on two or three sides so that the two artworks are correctly located to each other. Then the double-side resisted board with a couple of holes drilled near the edge is slid into the envelope and also taped in position. Expose one side, then turn over and expose the other. Remove the board and pass a cable tie through the pre drilled holes to stop the board lying flat and scratching the resist. Then develop turning frequently to monitor both sides. Again, a soft finger can be very useful to aid stubborn resist.

Board Assembly

Board assembly is next, **Fig. 18**. Fit small parts first. Then add the larger components, **Fig. 19**.

Resources

Pre coated PCB GRP Laminate: Today try RS components 159-6057 for single side positive photo resisted copper clad board 160mm X 100mm.. For double-sided board then RS 159-6108. Lots of sizes on the RS website.

Universal Developer: RS 690-849 Sodium Metasilicate Auto-Positive Developer.

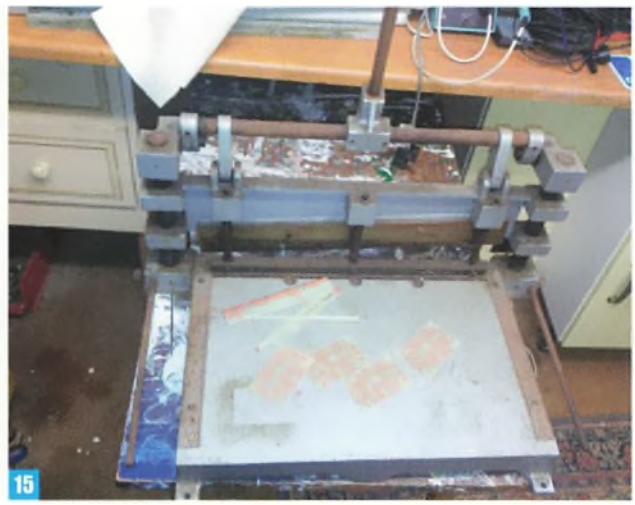
Etchant: Ferric Chloride Hexahydrate. RS 551-277 (2kg) or 551-283 (5x2kg)

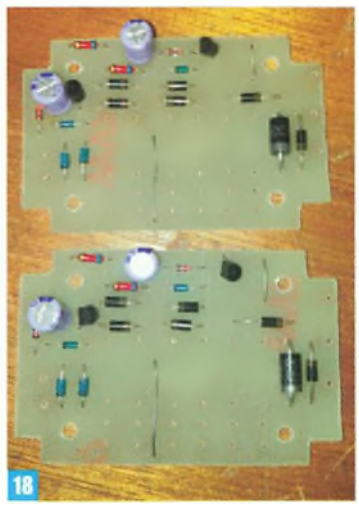
Flux Varnish. Multicore P.C. 52 Multicore protective coating. Today try Lotlac SK10: https://tinyurl.com/y454xqwa

Printer film. HP Premium Transparency Film inkjet 0.13 mm thick from: www.printware.co.uk **Tel 0330 058 6364**

UV Light box. I made my own using UV tubes inside an aluminium case. You can purchase these in a variety of sizes. Look at 300-001, Single Sided 229 x 159mm UV Exposure Unit with 2 x 8W Tubes, 420 x 175 x 90mm. RS Stock No. 555-279.

Drill: Dremel from Amazon or elsewhere: https://tinyurl.com/y2ccbe3r





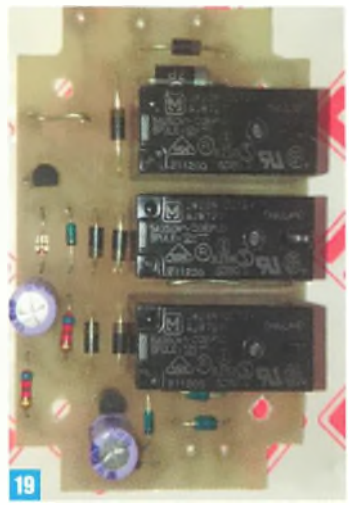


Fig. 10: UV Light box. Fig. 11: UV light box ON. Fig. 12: Etching bubble tank. Fig. 13: Regular board inspections to check progress of etching. Fig. 14: Electrolube original flux varnish. Fig. 15: Crop boards to size. Fig. 16: PCB drilling machine with solid carbide drills. Fig. 17: Conventional pillar drill and HSS drills for bigger holes. Fig. 18: Assemble small components first. Fig. 19: Fit larger components to board later. Fig. 20: Universal developer for aqueous system. Fig. 21: Pre-coated PCB material. Fig. 22: Ferric Chloride granules from RS Components. Fig. 23: Modern spray on flux varnish.

E-mail: longworthtim@gmail.com • Twitter: g4vxe

The Baofeng T1, 70cm FM fun for around £17

A cheap 70cm handheld, some early Es on 6m and more satellite news. Tim Kirby G4VXE's monthly round-up of the VHF and UHF bands.

On Twitter recently, I saw some tweets from Phil M0KPH. Phil had ordered one of the Baofeng BF-T1 transceivers. These are absolutely tiny rigs, which will easily fit in the palm of your hand and have an integral antenna that is around a centimetre tall. I'd seen the rigs on eBay and imagined that they would probably mostly be used for PMR446 or similar very short-range applications so had rather ignored them. Phil mentioned to me a video on the 'Ringway Manchester' You Tube channel where **Lewis M3HHY** programs up the rig, takes it up to a hilltop and tries it out. Watching all that made me wonder what I could do with one. I headed over to Amazon and found that I could order one for around £13 or for £17, including a programming cable. I opted for the latter because 'regular' Baofeng programming cables won't work. You'll need to program the rig up because when it arrives, all the frequencies that are programmed in are illegal to use here in the UK.

The rig arrived. I needed to charge it up before I used it (just like old times!) and then had to program it up with some 70cm frequencies. The rig is charged using a USB cable rather than requiring a mains charger. Because the programming lead uses a 'fake' Prolific chip, I found that the drivers that I had on my laptop would not work with the lead. Fortunately, I found a very useful article (see link below), which explains how to get around this, by backdating the drivers. This meant that, as I found, the T1 programming lead based on a fake Prolific chip worked, as did the lead for the Yaesu FT-2DE, which uses a genuine Prolific chip.
https://tinyurl.com/y5nruab7

With that sorted, I thought I'd use the CHIRP software to program the channels but found that didn't work as well as I'd hoped – I kept getting failures to read the rig while part way through a download. However, there's some Baofeng software that is specifically designed for the T1:
https://tinyurl.com/yy524fg6

This worked perfectly and I was quickly able to program up a few repeater and simplex frequencies, including setting repeater offsets, CTCSS tones and so on.

With such a small antenna, I wasn't sure what I'd be able to hear but even with the rig indoors, I could hear the GB3UK repeater on the Cotswolds, some 40 miles away, and the GB3TD repeater around 15 miles away. Trying to access the repeaters was unsuccessful, which didn't surprise me, with 1W to such a small antenna. However, walking around Cheltenham, I found that I could access both GB3UK and the GB3GH repeater without any problems. In fact, from a good spot in the village here in Oxfordshire, I was able to have a scratchy contact with **Ken G3LVP** through GB3UK. Unfortunately, the GB3UK repeater is no more, with the group having lost the site, but on my next visit to Cheltenham I had an excellent contact with **Graham G8XRS** through the GB3GH repeater some 5 miles away from where I was.

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Fig. 1: The tiny Baofeng BF-T1 transceiver. Good fun on 70cm for minimal outlay!

Incidentally, it's possible to program the T1 with 2m frequencies. However, with the size of the antenna, I don't think it's likely to work very well. So, it's probably best to consider the rig as 70cm only. The rig's design resembles the Hytera PD365 digital radio very closely. The Baofeng, of course, is an analogue-only radio – despite saying 'Digital Portable Radio' on the case.

If you have a 70cm analogue repeater or two around you, or want to try some simplex contacts over a fairly short distance, or perhaps you want to take the rig out for a walk on the hills and see what you can hear, then this rig is a lot of fun for a very minimal price. Thank you to Phil M0KPH for the inspiration to try the T1 out. If you try one, it would be good to know what you manage to do with it.

100 Years of Bentley Motors

Regular correspondent **Pete Walker G4RRM** writes that GB100BM celebrating 100 years of Bentley Motors will be active on the VHF bands on FM, SSB and FT8 from the north-west during July. Pete's currently working on a commemorative QSL showing some of the cars produced over the years. I'm sure lots of people will be keen to work the station and get that card.

The 6m Band

John Wood G3YQC (Hereford) says things on 50MHz (6m) have been a bit livelier

this month as stations test the band. John says that he has worked several EI and GI stations along with GU8FBO. On March 24th he heard EA1NL and EA1TF but they were too weak for him to work. On April 6th, John saw F4VPC, IZ0AEG, GI4SNA and EA5UB being worked by UK stations but they weren't quite strong enough for him to work.

At **G4VXE** I started to pay more attention to the band from early April and found a good number of like-minded souls from around the UK doing the same, which resulted in some good contacts around the country. I was pleased to work ON8DM (JO10) on April 11th and then my first Es contacts of the season on April 13th with OH5O (KP30) and OH0Z (JP90) in a brief opening around lunchtime. All contacts made on FT8 using 100W to a vertical antenna.,

The 2m Band

Don Roomes G0RQL (Holsworthy) is very active on 2m FT8 and says that he has just had to replace his 10-element Jaybeam Yagi after 36 years! Don currently has a 6-element up, which works well. Don's signals have a nice habit of peaking up on aircraft scatter or tropo here in Oxfordshire. Don is also planning to try FT8 on 432MHz.

On March 22nd, **Keith Watkins G8IXN** (Redruth) noted the GB3GD repeater on Snaefell in the Isle of Man coming in well in addition to the more usual repeaters from Eire – obviously a nice path up and across the Irish Sea. Keith is very active on 2m FT8 using both vertical and horizontal polarisations and can switch between them for best results. On March 29th, Keith couldn't sleep so put on his Band II FM radio and found that stations from West Wales were very strong. On DAB, the RTE multiplex from Eire was a huge signal. Taking the hint to get up and get to the rig, Keith found that the Northern Irish beacons were very strong, with GB3GD and many Irish repeaters on both 2m and 70cm being audible. No sign of GB3VHF so it was clearly ducting across the Irish Sea.

Here at G4VXE there have been plenty of contacts on the band with the highlights being EA1MX (IN73), EA2XR (IN83) and F4HIK (JN06) on March 16th, F4CHB (JO00), ON4IQ (JO20), F8PRC (IN99) and F4HJO (JN09) on March 20th as well as many very welcome contacts around the UK. All contacts on FT8 using 50W to a vertical antenna.

The 70cm Band

It was good to hear from **Nick Bennett 2E0FGQ** (Shepton Mallet) who has been enjoying FT8 activity on the VHF/UHF bands, particularly 2m but is now spending time looking for contacts on 432MHz.

Bob Copeland G4PDF (Market Rasen) e-mailed after we worked on 70cm FT8 on March 24th, saying that it was his first 70cm FT8 contact. Bob is always an excellent signal on 2m FT8 so I was a little surprised to find that he is using around 65W to a W-2000 antenna on 2m rather than a beam. He uses around 30W to the same antenna on 70cm. Our 70cm contact seemed to be completed by aircraft scatter, with periods of silence followed by a minute or two of signal. I checked my ADS-B receiver for planes in the area and sure enough there were some aircraft on the mid-point of the path, just as we completed. Another great example of how, if you're not able to put up a beam, a vertical can produce some great results.

Alan Bowker M0AGJ (Doncaster) is waiting for a new IC-9700 but we worked on 70cm FT8 when Alan was using around 20W from an FT-857 to a Diamond X7000 vertical antenna. Alan's also very active on 2m FT8 with a good signal.

The 23cm Band

Steve Macdonald G4AQB (Bolton) writes, *"I have been using an SG Labs transverter on 23cm for almost two years and I am so impressed with it. I drive it with my Yaesu FT-857D set to 5W. It's amazing what can be done with just 2W on 23cm. SG Labs have now brought out a 25W linear amplifier and preamp to go with the transverter. I am thinking about buying one; they are about 150 Euros.*

"Over the last few months a group of us in the Manchester area have been running a net on 23cm, initially on SSB, but then we changed over to FM because we can all hear each other without any problems. The net is on 1297.500MHz starting about 8.00pm on Wednesdays. One of the things we talked about was the possibility of trying FT8 on 23cm. Unfortunately, there is only me at the moment with FT8 on the band. It would be interesting to see how FT8 performs on this band". It's particularly good to know about the Wednesday net, Steve.

Satellites

Jef Van Raepenbusch ON8NT (Aalter) reported two schools contacts from the International Space Station. The first was

Fig. 2: Paul M0EYT talking about the new QO-100 satellite at the Flight Refuelling Amateur Radio Society.

on March 5th with a school in Spain and the second on March 20th with a school in Canada (the telebridge was in operation because an ISS pass over Canada would not be audible in Belgium). Unfortunately, Jef's FT-736 is now only useable on FM, which has stopped some of his satellite and other activity.

Kevin Hewitt ZB2GI has been active on AO-91 and AO-92. Through AO-91, he worked OH5LK (KP20), EA8CYZ (IL18), IU1LBM (JN43), 7X3WPL (JM13), 2E1EBX (JO02), EA1GAR (IN52) and through AO-92, EA1BYC (IN70), EA1VM (IN70) and ED5CIA (IM98). Kev also spent some time listening for the JY1SAT telemetry on 145.840MHz and was able to decode it using the JY1 Dashboard software. Operating as **M0GTD** from Chatham in Kent, Kev monitored the ISS signals for SSTV on April 1st and 2nd. Kev used a Baofeng UV-5R+ and a homebrew two-element Yagi and received two full images and one partial image.

PW columnist **Ben Nock G4BXD** writes, *"I have now got equipped to operate through the new geostationary satellite with great results. I'm running an FT-817ND to an SG Labs 13cm transverter with the SG Labs 20W amplifier, running at about 8W, to a simple PCB Yagi feeding a 1.1m dish. I was using the webSDR from Cornwall but the new Octagon LNB seems stable enough to listen direct.*

"I have already contacted the four edges of the footprint, Brazil, South Africa, Thailand and Norway, so I'm now looking for the real DX! It is fairly easy to get operational on this new satellite and a lot easier to work through than the low earth satellites. There's no sweeping the sky with beams to track orbits and so on. My dish

and 40-element Yagi are mounted only about 3ft off the ground".

As ever **Patrick Stoddard WD9EWK** (Phoenix) has been very busy in support of AMSAT and promoting satellite operation. Patrick writes, *"One day before the March 30th hamfest in Tucson, I made a day-trip to two rarely-heard grid boundaries in the neighbouring state of New Mexico. I started on the DM52/DM62 grid boundary, near the transcontinental I10 freeway outside the city of Deming. I worked a bunch of SSB passes, three FM passes (an AO-92 pass, followed by two AO-91 passes), and one FalconSat-3 pass to put these two grids into many logs. After lunch, I drove south of Deming to the DM61/DM62 boundary, a place I visited last year. About 15 miles north of the USA/Mexico border, and a mile or so south of a US Customs aerostat (tethered blimp) base, I worked a few SSB passes, and two SO-50 passes approaching sunset. After the last SO-50 pass, I drove back to Tucson for the night, and to be closer to the site of the hamfest the next day.*

"On April 5th to 8th, I took a trip to east Texas and Louisiana. I wanted to visit ***Hector W5CBF*** *(also CO6CBF) and his wife, who now live in southwestern Louisiana after they emigrated from Cuba a few years ago. A flight to Houston, followed by a 150-mile drive, and I was at Hector's house. We worked an SO-50 pass a few minutes after I arrived, standing in Hector's driveway. The next day (April 6th), we took a drive towards the Gulf of Mexico coast and the rarely-heard grid EL39. From there, we worked a pair of SO-50 passes next to a lake just north of the Gulf of Mexico. We worked other passes from his driveway, in grid EM30, during the weekend. When we weren't on the radio, Hector and his wife showed me around their part of Louisiana, a state I hadn't been to in over 40 years.*

"On the way back to Houston for my flight home on April 8th, I made a quick stop at the Johnson Space Center's amateur radio club W5RRR. I met ***John Maca AB5SS****, who opened the shack and showed off the operating positions – four HF positions with different radios (FlexRadio, Kenwood, Icom and Yaesu), along with a Kenwood TS-2000 for satellite operating. As W5RRR, I worked a couple of SSB satellite passes, along with an AO-91 pass. Since I don't normally use a station with computer control, it was fun to work from W5RRR with software moving the antenna array and adjusting the TS-2000's frequencies at the same time. John also took me to a nearby restaurant for lunch, before driving to the airport for my flight home.*

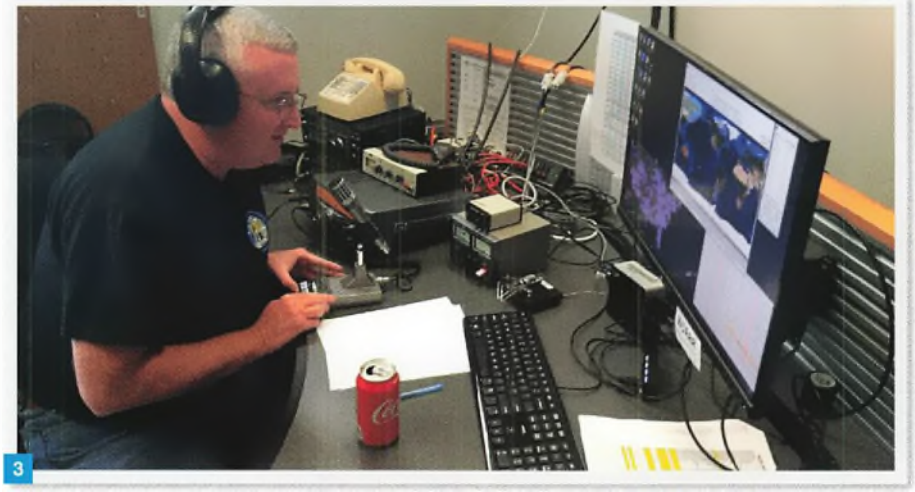
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Fig. 3: Patrick WD9EWK operating from W5RRR at the Johnston Space Center.
Fig. 4: A screenshot of the JY1 Dashboard software with signals received by Kevin ZB2GI.

"As I am writing this (April 11th), the latest ARISS SSTV transmissions for a worldwide audience are now in progress. I copied two complete pictures during the first SSTV pass here in Arizona and look forward to seeing more pictures over the next three days.

"In addition to all of my operating, world traveller ***Gabe AL6D*** *(also VE6NJH and other callsigns) has been traveling around Alaska recently. One of his trips last month took him to Adak, in the western part of the Aleutian Islands near the International Date Line in grid AO11. Gabe worked FM and SSB passes from out there and I was able to make a contact with him via AO-7. Grid AO11 is the westernmost location I have worked via satellite from Arizona. Gabe has his own plane and is now looking to fly to other places around Alaska and western Canada. He travels with his radio gear and will activate more grids in that part of the world. As of a couple of days ago, Gabe reported via his @AL6D_Alaska Twitter feed that he has activated 417 grids in 32 DXCC entities. That's impressive!"*

John G3YQC says he's receiving television signals well from QO-100 and has seen pictures from many European countries. John says he's building a Portsdown transmitter and hopes to be using that by the summer.

Graham Jones G3VKV (Cheltenham) writes, *"I have finally got the transmit side going for the QO-100 satellite. It produces about 7W at the dish, which is a 60cm prime focus with a circular patch feed that I originally used in 2002 for the AO 40 satellite downlink. The transmitter is a kit-built 2.3GHz DB6NT transverter re-aligned for 2.4GHz. (one coil needed changing), The crystal has been removed and replaced with a Leo Bodnar mini-GPS signal source. The receiver is an SSB Electronics (very old) 10GHz downconverter, revamped with a new 10MHz referenced local oscillator and a very low noise preamp. The waveguide input is from an Andrew 60cm dish. My SSB source is an Elecraft K3 + internal 144MHz transverter and the receiver is an Airspy R2 SDR. My third contact on the satellite was* ***Kob HS0AJ*** *located in Bangkok, Thailand, I'm very impressed so far. I won't be deserting the LEO satellites though!"*

E-mail Difficulties!

Many apologies to readers who may have been trying to get in touch using my **g4vxe.com** e-mail address. That is no longer operational – I won't bore you with all the details but please use the gmail address at the top of the column for now.

Thanks to everyone who has been in touch this month – it's very much appreciated. Please keep it coming. See you next month.

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Batteries

Joe Chester MW1MWD relates the lessons he has learned regarding batteries for portable operation.

I have received a number of e-mails, commenting on what one correspondent called *"my adventures"*! **One of the main questions these e-mails ask is about the batteries I'm using for portable operations.** I'm not an expert and it took a bit of research to sort this out. Here is what I found.

The Challenge

Of course, you know why power for portable operations is a problem. My friend M certainly does, and he's constantly nagging me about it. Most 100W radios need 13.8V to operate at full power. It's easy in the shack, where a good power supply does the trick. But it's a bit more difficult out portable. Many club Field Day operations bring along a generator. This has its own problems, including the need for a smooth sinewave output and the dangers of petrol or diesel handling. The obvious solution, the battery in the car, is not really a runner – you can end up with a battery that won't start the car! Carrying a spare car battery in the boot didn't work either (I tried it). The problem is the way the battery voltage falls as I'm transmitting. In the case of car batteries, as soon as energy is drawn from them, the voltage quickly drops below 12V and the radio stops working. There is, of course, the extremely expensive solution of buying and re-equipping a Land Rover (or equivalent) specifically as a broadcast radio platform, with a specially designed DC electrical system. More sensible, is probably to find a different kind of battery.

Battery Basics

What did the electron say to the proton? *You put me in a spin.* Old joke, but for many radio amateurs, thinking about battery technology has the same effect! Since the Italian named **Volta** first put acid-soaked paper between two metal plates way back in 1800, battery operation has changed little. Today, it's still two pieces of metal between some sort of acidic stuff. You can do this yourself, with two nails and a lemon, but you won't get much juice (pun intended!) out of it. The classic lead acid battery is just lead plates in a bath of sulphuric acid. The problems are immediately obvious – for a start, don't spill the acid.

Today's battery experts have become smarter and now use more reactive metals to increase energy density – in other words to get more power out. Lithium is the popular metal these days. Some really clever acidic gel compounds are used instead of liquid acid. By this means batteries have been designed with new characteristics to meet various demands. For example, a key requirement for ocean-going yachts is that when the yacht turns over in a gale, the acid doesn't spill. The AGM battery was designed for this application – basically a glass mat is impregnated with the acidic electrolyte, so there is no liquid to spill. Today, the precise components used have changed but the principle is the same.

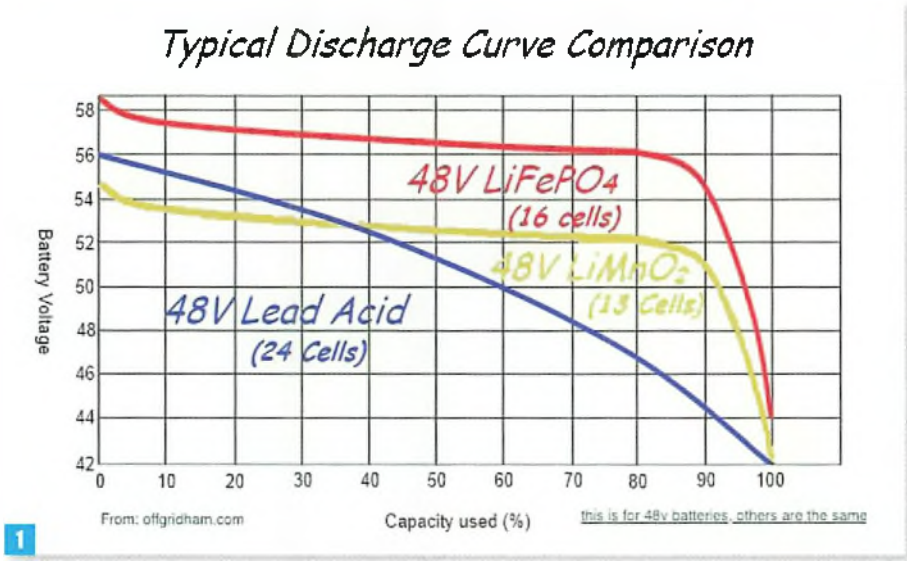

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Fig. 1: Discharge characteristics of LiFePO4 batteries. Fig. 2: The Zippy batteries bought by the author.

Requirements

This brings us to the requirements of amateur radio and specifically portable work. The KX3 is low powered, compared with my IC-706 – 150mA on receive instead of 2A, and 2A on transmit instead of 20A. Basically, I think I need a set of everlasting AA batteries, weighing almost nothing and costing even less. Dream on! I also need a slow discharge rate and one that manages to hold the voltage high as long as possible. This is essential if I am to operate for more than a few minutes at a time.

Possible Solutions

As I said at the beginning, I'm not really an expert on this stuff so I decided to see what others are using. I found a set of battery tests done in the USA by **Howie WA4PSA** of ProAudio Engineering, which looked interesting (all of these tests are on their website, plus much more). The batteries he tested were only on the market in the USA but they used different kinds of battery technologies. For example, he said in an e-mail that when they tested alkaline cells, such as Duracells, they quickly dropped in voltage. This makes them unsuitable for high-current use. Thus, they are useless in a portable operation. Which is why my AA dream won't work well!

The answer, and this is also Howie's recommendation as well as that of several others I spoke with, came down to something called Lithium Ferrous Phosphate, LiFePO4. These are used extensively for radio-controlled models. They are also used by many SOTA operators such as **Jim M0JCQ**. They are relatively small and lightweight, and although not cheap, they are certainly affordable. They are also much less prone to spontaneous combustion than pure Lithium batteries. As **Fig. 1**

shows, they also hold their voltage high, even as the battery discharges (shown for 48V battery packs but the principle is the same for the ones of interest to radio amateurs), which solves the problem for radios that need as close to 13.8V as possible to maintain output power.

In principle, a Lithium Ion battery with something like 5000mAh, or a few hundred watt-hours should last all day. I ordered a pair of these, brand name Zippy, **Fig. 2**, from a company called Hobby King, who deliver in the UK. One is 8400mAh, the other 4200mAh. For the technically minded, these are 4S2P 30C batteries. These codes mean that they contain two packs of four cells. Each cell delivers 3.3V, which means the battery delivers 4 x 3.3V, or 13.2V. The other key number is the maximum discharge rate, which is the C number multiplied by the battery capacity, divided by 10. So, the 8400mAh (or 8.4Ahr) battery can deliver up to 25A if this is required. Please don't ask me how the manufacturers of these batteries came up with these strange codes. But they do provide the key information we need to select the right battery for the task in hand – running a portable radio station. The batteries came with weird terminals but a company called Flying Tech, based in Stratford-on-Avon, supplied pigtails with the correct X-type connections for the batteries (Thanks **William**!). I added Powerpole connectors to these pigtails for connection to the radio.

2

Charging

It's very important to understand that these batteries cannot be charged with a 'conventional' battery charger. Because they are packs of smaller cells, each of these cells needs separate charging and the cells need charging at the same rate. This is called 'balanced' charging so I also ordered the proper charger for these exotic batteries. And in case you are wondering, the whole lot – two batteries, charger, pigtails – came to less than the price of a decent car battery. Finally, and this is the crucial thing about these batteries, the discharge curve is different from that of a car battery. Where the car battery voltage declines sharply as the battery is use, the LiFePO4 batteries maintain their voltage until they are nearly fully discharged.

I'm still working on the problem of recharging these batteries when I'm away from home. Their charger also needs 13.5V to charge the batteries properly. So, I can't simple plug it into the car. I could take the power supply from home and charge in the hotel overnight. I suspect that this will have to serve for now. But what I really want to sort out is how to use solar panels for charging. So far, I've got into a tangle about solar battery regulators so it's not sorted yet. But when it is, I plan to deploy solar panels and plug them into one battery while using the other. This way, I have a spare ready to go when one runs out. I've read of operators who manage to plug the solar panel into the battery in use, to delay the discharge rate of that battery while operating, but that's something that also needs further research before I try it.

For now, I use my LiFePO4 batteries for my portable operations. I have read online of radio operators who have carried these batteries either as hand luggage or in their check-in airline baggage with no problems. In several cases, they attracted no interest from security screening staff. So, in a small lightweight package, I now have a pair of batteries (one is a backup) that will run my KX3 for hours. And I don't have to carry a car battery around with me when I go travelling. I can even imagine doing some more exotic travelling at some time in the future, with my entire portable radio setup in a rucksack (apart from the stand-alone mast for the Buddipole). I rang M with the news that I had sorted the battery issue. He had just returned from an expedition to some exotic island. *"It would have been nice to know about these before I went out"*, he moaned. Well he knows now!

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VSWR

Tony Jones G7ETW repairs an aged VSWR meter and takes the opportunity to explain the whys and wherefores of their design.

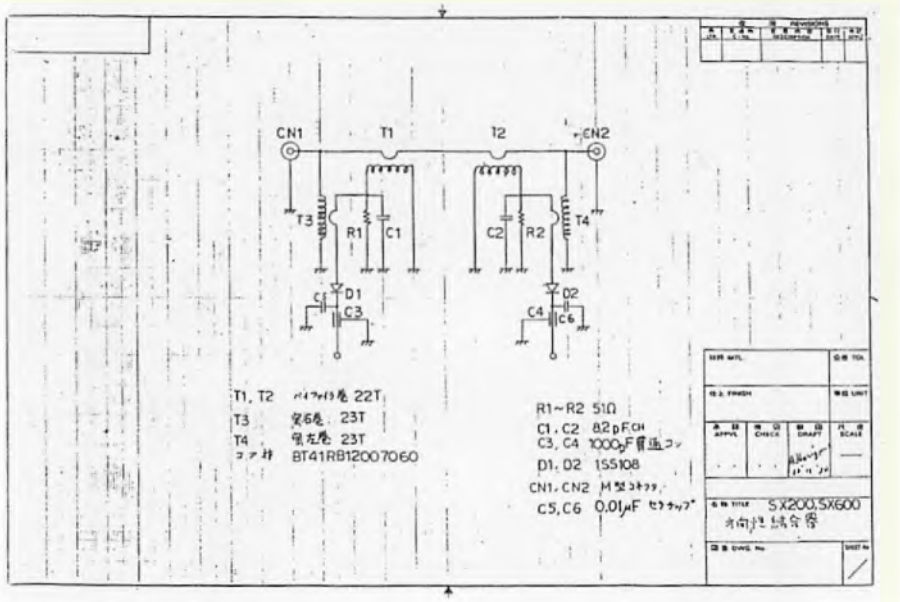

Fig. 1: Circuit diagram of sensor 1.

This article is about a Diamond SX-600 VSWR meter which Robert, one of Harrow club's newish 2E0s, brought along to be checked one shack open day.

The SX-600, **Fig. 2**, is an amateur radio 'standard'. I bought one 30 years ago, and I still have it. I prefer an analyser nowadays for tuning antennas but this old friend still gets used from time to time for testing transmitters.

The SX-600 is a single-needle VSWR meter with frequency coverage from 1.8 to 160MHz (Sensor 1) and 140 to 525MHz (Sensor 2). It has two three-position switches that work together, one marked 'PWR', 'CAL' and 'SWR', the other marked 'OFF', FWD', and 'REF'. Dual-needle meters are undoubtedly simpler but these have their advantages, see sidebar.

Finding the Fault

Robert's SX-600 was bought for VHF use. Recently he'd tried it on HF and found it didn't work. Warning bells rang at this point. *"Were you testing on SSB?"* I asked. Robert laughed, and assured me he'd switched to FM for his tests.

Assuming Robert was right, I was 95% sure I knew what was wrong. But I've wasted a lot of time on that 5% before so I got a radio out and a deliberately 'bad' dummy load we use for teaching. With 145MHz going into Sensor 2 we saw a plausibly high VSWR but Sensor 1 gave no reading. I tried again using 7 and 18MHz and got the same result. On VHF and below, the meter did not work.

I tried some power readings. On FWD, both sensors were fine. On REF, Sensor 2 showed about half the power coming back, as expected. But Sensor 1 detected no power. One of its diodes had 'gone' – an easy fix!

Preparation for the Repair

When fixing anything I need information – at the very least, a circuit diagram. I checked my SX-600's manual, and there wasn't one. I looked online – no luck. So, late on a Saturday evening, I e-mailed Diamond in Japan.

When I woke up, I'd had a reply. Diamond had no service documentation in English, **Mr Hiromi Shioya** apologeti-

Single-needle VSWR meter basics

At the heart of a VSWR meter is a bi-directional power sensor circuit called a bridge. This derives two DC voltages from RF in the transmission line (one for forward power, one for reflected).

In the SX-600 circuit, D1, say, rectifies the forward RF voltage. (C1 is just smoothing.) When CAL is selected, this voltage is converted by a variable resistor into a current, which drives a micro-ammeter to maximum deflection (a few hundred microamps).

When SWR is selected, the voltage derived from D2 is converted by the same variable resistor into a lower current. This is displayed on the microammeter, which is calibrated to show VSWR.

For those who like maths, VSWR = (1 plus Voltage Reflection Fraction) divided by (1 minus Voltage Reflection Fraction)

Imagine a transmitter being used with a not very good antenna.

On Switch 1, the user selects PWR.

On Switch 2, the user selects FWD and sees 100W going out.

The user selects REF and sees 25W coming back. (The correct power range would need to be chosen – there is another switch for this. On an SX-600, that would be 200W in both cases.)

25W out of 100W is 25% or one quarter – this is the RF power reflected as a fraction.

Power is proportional to voltage squared, so the voltage reflection fraction is the square root of one quarter (i.e. one half).

So VSWR = (1 plus a half) divided by (1 minus a half)

Which is (three halves) divided by (one half), which is 3.

To see this as a VSWR

On Switch 2, the user selects OFF.

On Switch 1, the user selects CAL and sets the meter to maximum deflection using the variable potentiometer control.

On Switch 1 selects SWR and sees the needle point to 3.

Fig. 2: The SX-600 – still found in many shacks.

cally told me, but attached were some circuit diagrams (**Fig. 1** shows the one for Sensor 1). Now that's what I call incredible service.

I took the cover off, see photo **Fig. 3**. The sensors are the screened boxes; Sensor S1 is on the left. I removed that and discovered the bridge circuit was built on copper-clad board with the diodes easily accessible.

Both diodes were tested in situ. One was fine but the other was an open circuit in both directions. When I tried to unsolder it, the diode crumbled into glassy dust, confirming my diagnosis and hinting at some serious past trauma.

Doing the Work

As Fig. 2 shows, Sensor 1 has two 1SS108 Schottky diodes – not a common component. I found an American online supplier but he charges $2.93 each (minimum order value $20). With shipping quoted at $106, I didn't pursue that.

I needed a substitute diode. **Table 1** shows the key specifications for 1SS108, 1SS106, BAT43 and BAT41 Schottky diodes. The 1SS106 is cheap and plentiful but has a maximum reverse bias voltage of 10V, which rules it out for a 200W meter. The BAT43 diode is eminently suitable but I didn't have any. A friend offered some similar BAT41 diodes so that is what I used.

I fitted a BAT41 (see **Fig. 4** – against the diode's blue body, '41' is just readable). Success! The meter now measured reflected power and displayed a VSWR but all readings were down compared to my SX-600, which was disconcerting, see **Table 2**. Was Robert's meter wrong? Or was mine? This was a classic case of the Two-Meter Problem (see second Sidebar).

Since neither meter was in calibration all bets were off and I should have stopped there. But there was one thing more I could try.

Making a Better Job of It

Ideally diodes in a bridge circuit should be matched but Sensor 1 now had different devices. To give Robert's meter the best chance I replaced the remaining 1SS108.

The Two-Meter Problem

An engineer takes a reading on old and trusted meter. Another meter becomes available, and he (it's my story; it's a man) takes a check reading on that. If the readings agree, or are pretty close, all is well. But what if they differ, perhaps a lot? Our engineer's whole philosophy, his reality even, is threatened.

Two solutions present themselves – he can get a third meter (this way madness lies) or jump up and down on the second meter until it's in pieces and keep the faith with the original!

The photo, **Fig. 5**, shows the finished job with two BAT41s. Testing again, I saw a very tiny difference – certainly not worth the effort of changing a perfectly good diode.

But was Robert's SX-600 going to be useable? Some final, more realistic tests were needed. I made up a 2:1 dummy load from two 50Ω ones and tried again. See Table 2 again for results.

Both meters under-read. Mine was closer but that was 10% out! I reminded myself that these meters were old and never had been laboratory precision instruments. In addition, my 25Ω dummy load was somewhat Heath-Robinson so expecting to see exactly 2:1 was a tad optimistic!

I had done all I could. I gave Robert his SX-600 back, making it clear that an indicated 1.5:1 VSWR was really 2:1.

Conclusions

This was a simple fault. The repair cost nothing except a little time. Next time something packs up, don't just bin it (or put it on eBay, as the previous owner did!). Do some Googling and you'll probably find it's fixable. What do you have to lose?

And please, when buying second-hand, especially if the equipment is described as fully working, do some testing immediately on taking delivery. If you need help or additional equipment, then don't be shy – ask another amateur! If something is wrong, the kit can go back and a refund obtained.

If you want to dig more deeply into how a VSWR meter works and the maths behind it, it's worth trying to get hold of the May 2012 issue of the RSGB's *RadCom* in which **Reg Irish G4LUF** covers the subject very well.

Why stick with a Schottky? A Schottky diode has a turn-on voltage of about 300mV, comparable to a germanium diode. This is much less than the 650mV silicon diodes need. Germanium diodes are essentially obsolete (and expensive) and a silicon one would have really hurt the SX-600's sensitivity and accuracy.

Fig. 3: SX-600 with cover removed.

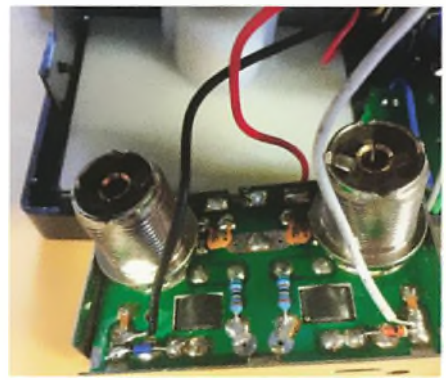

Fig. 4: Board after fitting of one BAT41.

Fig. 5: Board with two new diodes fitted.

	Max Reverse Voltage (V)	Repetitive Forward Current (mA)	Junction Temp (°C)
1SS106	10	30	125
1SS108	30	15	125
BAT41	100	350	125
BAT43	30	500	125

Table 1: Specifications of possible Schottky Diodes

	FWD Power (W)	REF power (W)	VSWR
My original	5	0.450	1.8
Repaired	4	0.350	1.5

Table 2: Final readings as seen on both SX-600 Meters using my FT-817, Sensor 1, 145MHz FM and a 2:1 load.

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Exhibition Stations

Colin Redwood G6MXL looks at demonstration, or exhibition, stations, making use of extensive notes from his friend Alan Walker G4UWS who has run numerous such stations over the last decade.

Why operate demonstration/ exhibition stations? There are two main reasons. Firstly, it's a very effective way of making the general public aware of amateur radio. It seems to me there is less a lack of interest in our hobby than a lack of awareness of it. Visitors to demonstration stations often comment on a former relative listening or being involved and offer remarks such as *"I didn't know it still went on!"* Secondly, it's enjoyable to operate from attractive or unusual locations.

Visibility

The first objective is to be seen, which requires going out to meet the public. While an individual operating portable is fine, the operator is likely to be preoccupied with operating and not able or willing to give visitors enough attention, and that's vital for raising public interest.

Attracting Visitors

It is far more effective to make fewer radio contacts and talk with visitors than make many contacts as potential visitors walk past. I've found that a club station with a mix of operators and explainers works well. The operators spend most of their time operating while explainers bring the visitors in and explain what is going on. It's worth considering who does what. Personality can be an important point. A 'bringer inner' has to be comfortable spotting someone at a distance, strolling out to meet them, and gently inviting/ coaxing them in to take a closer look. Visitors don't come in of their own accord and don't like to intrude on what is going on.

Chatting to a visitor may be limited to a brief mention of amateur radio before the visitor moves on. Some visitors may show some interest and willingness to discover more. Explain what is happening and what can be done, hand out a leaflet, talk at length and invite them to a club meeting. Either way the visitor is now aware of the hobby. At this stage there is a need to sense when to release the visitor. Too much 'sales' talk can irritate and do harm. Never blind a visitor with science or jargon.

Outside Display Materials

There is another way of catching the attention of passers-by: display material. My local club has a few 60 x 120cm

Fig. 1: A-boards provide a simple way of presenting some basic information about amateur radio to attract visitors to find out more. Fig. 2: Feather banners take up little space and make a club's presence very visible.

'A' boards, **Fig. 1.** They are made of hardboard with stiffeners simply linked at the top so the boards can fold over and protect each other in storage. Each face has colourful brief notes about an aspect of amateur radio. The passer-by stops to see what it's about and the club's 'bringer-in' approaches as they look up. With careful placing, the boards can act like a funnel, leading visitors towards what is going on. The club also has a pair of 5m-high 'feather' banners, **Fig. 2,** announcing who we are. These are made of rip-stop nylon (available from sail and hot air balloon makers and sometimes other suppliers) and mounted on fibreglass roach poles.

Operators & Equipment

Careful placing also applies to operators and rigs. If the thing most obvious to an approaching visitor is a row of backs and

balding heads, they're not impressed. The same applies to the backs of rigs and fronts of stern operators. There is no universal solution. It has to be a question of looking from the way visitors approach. One way is to have the operating table side-on to visitors so they at least see the operator's profile. Most necks can manage a 90° turn to smile.

A variation on this, so the visitor sees a face, is for the operator also to be side-on to the rig. You may wish to show visitors your log to demonstrate where you've reached. Try to keep the wiring tidy, **Fig. 3**. A rat's nest of wires behind the rig looks dauntingly complex to the uninitiated. For the operator, headphones are helpful but not ones that necessitate lip reading of questions. Another point, which I hope will not offend anyone: visitors noticing one of our members actively taking part while wearing dark glasses and with his white stick clearly visible makes a point about the hobby more effectively than words.

Fig. 3: Tidy wiring creates a good impression with visitors. (Photo: Tex Swann G1TEX)

Lighting

From a distance, especially on a sunny day, a bottle green gazebo with three sides in place can look gloomy and uninviting. Weather permitting, don't bother with the sides, and generous general overhead lighting makes the station more inviting. I've not tried them yet but I suspect LED security lights might be better than others. Having said that, on one occasion a host provided the most magnificent white tent my club has ever used. Even with three sides having to remain in place it remained so bright inside that no extra lighting was needed.

Club Members

The most important thing is an ample supply of club members to answer questions, explain, discuss and simply converse. Bear in mind that club members and visitors all take up space – a congested gazebo can drive people away. It may be helpful to move outside, perhaps to show the antenna, or use a larger gazebo!

Exhibition Materials

You'll need visible things to discuss. Pictures, charts and posters offer a better background than the station itself. At one station a satellite tracking antenna was a great hit. At another, examples of home construction raised significant interest: various QRP rigs, a crystal set, a Morse key made from two paper clips. Ideally something could be under construction at the time but this needs careful planning because components are easily dropped and impossible to find in grass. I've also known a tool to vanish when staffing was limited. Another way could be showing both completed and partially constructed projects. For children, something to take away would be helpful. My club is considering developing a few kits saleable for a pound or two; perhaps a continuity tester or a Morse oscillator – something simple but useful.

If your club is RSGB Affiliated, RSGB HQ can normally provide leaflets that explain amateur radio (and your Affiliated status means that you automatically have third-party insurance in place too).

Children

Some claim computer-savvy children will be bored by Morse. Not so! A code with which to communicate 'in secret' goes down really well. My club's most senior member does a little item where children (and some parents) use a crib sheet to receive his name in Morse and send theirs, **Fig. 4**. They leave with a certificate, **Fig. 5**, and a memory that may come back in as much as 30 years' time. These events need to be considered long-term investments in the future of our hobby.

Children in their teens are likely to be sufficiently informed and have enough understanding to grasp what amateur radio is about. If they have a taste for making or fiddling with things, it can be a link to them. Very few may develop enough immediate interest to come to club meetings. What matters is that they have an awareness implanted for a lifetime. All of them will become more concerned with exams, college/uni/apprenticeship, courting and starting a family but as their children grow they will have time for that recollection to re-emerge (especially if they see another demonstration station). This is where the long-term investment matures. Who knows, a young visitor may be an amateur's future neighbour, for example, whose support may be sought for a planning application for an antenna.

Choosing a Venue and Site Visits

I am thinking mainly of a station in a tent or gazebo outdoors. Where do you put the demonstration/exhibition station? This raises questions such as:

- Where will you enjoy it being?
- Where is it convenient?
- Where will people see the station?
- Where will you be permitted to put it?
- Where is suitable?
- Can we afford to put it there?

You should always check a site before booking. My club booked an expensive and prestigious location of historic radio interest for use with a special event

callsign. We had used the venue about 30 years earlier. Unlike the previous time, we were not permitted to put a G5RV antenna on the roof. As a concession we were allowed to put a 40m groundplane antenna with only two radials at ground level, tucked against a retaining wall. When we tried to operate, we realised we had overlooked a couple of adjacent conference rooms, with huge plasma monitor screens that caused S9+30dB QRM on all bands!

Risk Assessments

No matter how many exhibition stations you've run, you should carry out an individual risk assessment for each event. It might be based on a previous event but things can and do change. It might simply be seasonal weather risks (cold, wind, sun), which may not have been relevant on a previous occasion. You may be using different sources of power, different antennas or accommodation. Many hosts will want to see your risk assessment and insurance document before allowing you to proceed. Have a look at the July 2016 *What Next* column, which covered risk assessments.

Cost

Public parks may seem free but if you have advertised the station or put up a single 'Radio Society' sign or any display material, it becomes an 'event', which cash-strapped councils may wish to charge for. On the other hand, if you are booked in as part of the 'Friends of the Park' fete or similar, you should be safe. But then bear in mind it is their annual fund-raising event.

Choosing Locations

Convenience of access applies to both you and visitors. The cost of long-term car parking may be significant. If you can find the right one, a rural or viewpoint car park can itself be a remarkably successful site. Hikers putting their boots on in the next bay are hardly able to ignore you. Some car parks may be better in propagation terms but the lack of toilets and refreshments means there are fewer visitors. Indoor sites may be more comfortable but need another very strong attraction to bring visitors in. Beware QRN and audio QRM, especially music. Alas, experiences of open days at the club QTH, no matter how well publicised, tend not to bring in many visitors.

'I've always fancied operating from...' is a good starting point in selecting sites. Landowners wishing to interest tourists may be quite welcoming. Just ask. It's a matter of 'Nothing ventured nothing gained'. If you like being there, visitors will see it in your faces and it will encourage their interest. Always liaise with the host at every stage. A misunderstanding can ruin a generous welcome. Always adhere scrupulously to whatever conditions are imposed, even if they seem excessively strict. The host has good reason and will not want to restrict unless necessary. Previous experience may come into it.

Fig. 4: Children love sending their names in Morse. (Photo: Alan Walker G4UWS) Fig. 5: Morse Certificate.

Hosts

One final point on public relations is the relationship with hosts. Some hosts are very generous in terms of their own convenience and/or costs and a letter of thanks and token of gratitude are most important. Apart from not leaving litter, you need to be considerate about the event to maintain good relations. My local club was scheduled to operate at a heritage railway station on their busiest weekend of the year.

The Saturday went well, the end of a long hot spell. The forecast for Sunday was torrential rain and strong winds. We chose to cancel our Sunday operation so that the railways passengers could make full use of the limited space in the waiting room during the inclement weather. We judged this the best approach to maintaining our good relationship with both the railway and their passengers.

Conclusions

For many readers this may have sounded like teaching Grandmother to suck eggs. For others I hope it will have pointed out that amateur radio has merely fallen out of most of the population's sight. Grand schemes for introducing young people to the hobby need to be backed up by many outwardly insignificant demonstration/exhibition stations making it visible to all generations and providing long-term investment. A plumber's best advertisement is word of mouth, amateur radio's may be Monday morning comments about what was seen over the weekend.

Finally, I must record my thanks to **Alan Walker G4UWS** for producing his excellent notes on which this article is based.

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The Personal Digital Node for Yaesu Fusion users

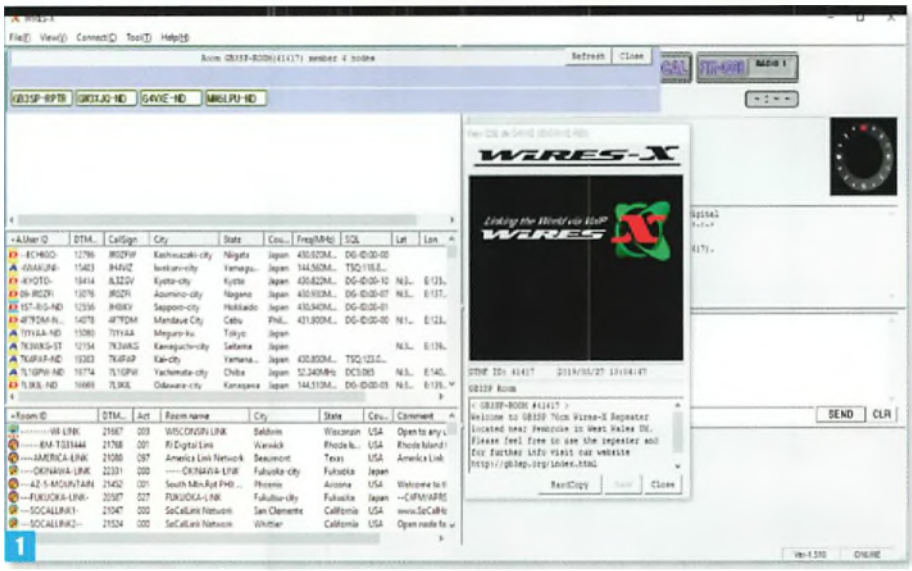
Tim Kirby G4VXE has an update on Yaesu Fusion developments, as a supplement to his earlier Fusion features.

Last summer when I was talking to Peter GW4VRO, he told me about a development being planned by Yaesu, which would enable owners of various Fusion-equipped radios to operate with an internet-connected PC as a Wires-X node. Previously, as you may remember, setting up a Wires-X node required an HRI-200 controller, an internet-connected PC running the Wires-X software and a node radio (which could be analogue or digital) as well as a radio to access the system. Although a great system, it required a fair investment. Much as I enjoy the various Fusion networks, I found that I could access most of the really active ones through a hotspot and didn't want to go to the trouble of establishing an HRI-200 based node.

Of course, as my friends at Yaesu would be keen to tell you, that did mean that I didn't have the opportunity to explore and exploit the Wires-X network in depth. I couldn't connect to the various Wires-X nodes and rooms, which were not otherwise connected to other networks. So, when I heard about the possibility of running a Wires-X node without the HRI-200 box, I was keen to see how it worked.

New Firmware

A few weeks ago, a new release of firmware for the FT-2DE handheld was made available, which supported the Personal Digital Node capability. In addition, you need an internet-connected PC running Windows 8 or later and the Wires-X software (1.5 or greater) as well as the SCU-39 connection kit. The SCU-39 connection kit contains an SCU-19 connection cable, which is all you need for connecting to digital Wires-X rooms, but also an adapter and a set of audio leads that interface your rig to your PC soundcard for analogue or mixed-mode Wires-X rooms. The price of the connection kit was nearly £70, which as I reflected, was most of the way to paying for an HRI-200 interface! However, if you already have the SCU-19 connection cable, then you can use this to get going and connect to digital-only rooms.



1. Screenshot of the Wires-X software running with the FTM-400XDE, connected to the GB3SP repeater in Pembrokeshire.

The first thing to do was to get the FT-2DE updated to the correct level of firmware. In fact, this consists of three separate upgrades, the Main upgrade, the Sub upgrade and the DSP upgrade. The upgrades are not difficult; however, you do need to stick exactly to the instructions. Fortunately, there are both good written instructions to be found, along with the firmware updates (make sure you get the right one because there is different firmware for the USA and Export models), on the Yaesu USA site. You can also find an excellent 'how-to' video on the Yaesu USA Official YouTube channel.

Once you have upgraded the firmware and have at least an SCU-19 cable, you are ready to get set up. You'll need to install the SCU-19 USB driver (also to be found on the Yaesu.com website) and the Wires-X software, which can be found under the HRI-200 section on the Yaesu website.

As you install the Wires-X software, if you have not already registered a node with an HRI-200, you will need to register for the Wires-X system. This involves completing a simple form, including the serial number of your FT-2DE, and sending the details to Yaesu. The registration process can take up to three days, although the turnaround was less than 24 hours when I registered mine.

With the updated firmware applied to the FT-2DE it has two new modes – Personal Digital Node (PDN), which is used to connect to digital-only nodes, and HRI mode, which is used to connect to mixed analogue and digital nodes.

Getting Started

If you are in PDN mode and you try to connect to a Wires-X room, which can contain both analogue and digital stations,

2. & 3. The FTM400XDE supports two new modes, Direct mode where no RF is transmitted and the rig acts as a speaker mike and Access Point mode (second photo), where the rig acts as a local hotspot allowing you to connect to it using a C4FM enabled handheld close by.

you will receive an error. So, my first test was to connect to the Yaesu PDN digital-only node, which worked fine. I wanted to try connecting to the GB3SP room, for which I needed to put the FT-2DE into HRI mode (power the rig on, holding the 'X' and 'Back' keys down), because Wires-X assumes that the GB3SP room can contain both analogue and digital stations although in practice it can only accept digital stations. For the purposes of the quick test, you can just use the SCU-19 cable connected from the Data socket on the FT-2DE to a USB port on your computer. Bear in mind, though, that if you connect to a WIRES-X room like America Link that carries both analogue and digital traffic, you should connect up the sound card cables, which will allow analogue stations to hear you.

With the Personal Digital Node functionality, you can use the rig as a speaker/microphone, in which case you are not transmitting any RF. This is known as Direct Mode. Alternatively, you can use the rig as an Access Point, which makes it a mini-gateway, and use another C4FM-equipped rig to transmit and receive to your Access Point. This would be the option if, for example, you wanted to go out in the garden or close by. Do note your licence conditions if you plan to run the gateway unattended. Switching between Direct and Access Point mode is achieved by hitting the A/B button.

With all this connected up, I was able to have a QSO in the GB3SP Room, including the GB3SP repeater in Pembroke Dock, with Peter GW4VRO and **Martin GW3XJQ**. There was a bit of finger trouble on my side because I had a jack plug in the speaker on the FT-2DE, which muted the audio. Once that was sorted out, I didn't look back.

Another interesting test was connecting to the Wires-X node of **Richard GW1JFV**. This was different because Richard runs an analogue Wires-X node, using an HRI-200 interface connected to a Yaesu FT-817 for the node radio, and he accesses the node using a cheap Baofeng FM handheld. I was excited to find that we could communicate between digital and analogue modes, although unlike digital modes, a bit of fiddling with audio levels was required at my end.

PDN Functionality for the FTM-100DE and FTM-400(X)DE

Shortly after I finished testing the FT-2DE and Personal Digital Node, Yaesu announced firmware upgrades for the FTM-100DE and FTM-400(X)DE models, allowing them to exploit the Personal Digital Node functionality too. As I own an FTM-400XDE, I grabbed the firmware updates from the Yaesu site, held my breath and followed the instructions carefully! To my delight there were no problems. With both the FTM-100 and FTM-400(X)DE models, you can use the data cable that comes with the rig to connect to digital nodes. If you want to be able to connect to analogue nodes and rooms as well, then you will need to obtain the connection kits with all the leads. You'll also need to make sure that you are upgraded to the latest version of the Wires-X software (currently 1.51), which supports the FTM-100 and 400 models.

The firmware upgrades for the two rigs offer the same options as the FT-2DE that I described earlier; PDN and HRI modes and within those, a choice of Direct and Access Point modes. The document that I have listed in the resources gives more details on how to use each function on the different rigs.

Conclusions

I am delighted with the Personal Digital Node functionality. It means that I can use the full Wires-X network and connect directly to other Wires-X nodes around the globe. There are some limitations. With the PDN functionality, you don't have your own Wires-X room, just a node. Neither can you use a transmission mode other than narrow voice, the wide voice and data modes being unavailable. If you want to do these things, or establish a more permanent node, then you will still need an HRI-200 interface. This all makes sense because the PDN was envisaged as a way of connecting to the Wires-X network when you are away from home but I think in practice, many people will use it to put a toe in the Wires-X 'water' and see if they want to go for a full node, using an HRI-200.

Within this article, I've tried to give an idea of the capabilities of the Personal Digital Node and what you need to do to set up and use it. However, for a full flavour, do look at the excellent document that I've listed in the resources.

If you have an FT-2, FTM-100 or FTM-400 I hope you will enjoy taking advantage of these new features offered by Yaesu.

Resources

- Wires-X Portable Digital Node Function Instruction Manual
  https://tinyurl.com/y4hm274p
- Updating the FT-2DE firmware (official Yaesu USA video)
  https://youtu.be/iiyUZsG0cSQ
- Using the FT-2DE Personal Digital Node functions (official Yaesu USA video)
  https://youtu.be/Wx2aRzI2nbQ

Rallies

Send all your rally info to Georg Wiessala at: wiessala@hotmail.com

Plan your visits with our wide-ranging list of forthcoming events. Warners (RadioUser & Practical Wireless) will be attending events marked with an asterisk (*). Club secretaries/ event organisers: Please send full and accurate details of your events, affiliations and clubs as early as possible if you would like to be mentioned here: wiessala@hotmail.com

May 5th (Sunday)
THORPE CAMP HAMFEST
The Thorpe Camp Hamfest is open for traders who camp over to set up from 29th April. More information:
Sylvia or Ant
Tel: 0795 665 4481

May 6th (Bank Holiday Monday)
DARTMOOR RADIO CLUB RALLY
The 35th Dartmoor Radio Club Rally is taking place at the Butchers Hall, Pannier Market, Tavistock. Entrance to the rally will be from the square, and doors open at 10am. Admission is £2. There will be traders, a bring-and-buy, and an RSGB bookstall. Refreshments will be available.
Roger 2E0RPH
Tel: 07854 088 882
2e0rph@gmail.com

May 11th (Saturday)
CDXC CONVENTION
CDXC (the UK DX Foundation) is changing the format of its social programme this year and merging the Annual Dinner and Summer Social into a single event, a min - Convention. This will be held at the Link Hotel in Loughborough. The AGM (voting limited to members but all welcome to attend) will take place at 11:30, while the afternoon programme of talks (one of them by PW's editor G3XTT) and evening dinner will be open to all comers (£7.50 for day visitors and £37.50 to include dinner).
sec@cdxc.org.uk
http://cdxc.org.uk

May 12th (Sunday)
LOUGH ERNE RALLY
The Lough Erne ARC will host the Lough Erne Rally in the SHARE Centre, Lisnaskea, Co. Fermanagh, BT92 0EQ. Doors are open at 1130, free parking, bar, café, cooked lunch, free tables for trade, special interest, shack clearance etc. RSGB sales stall. All in hall pay same door fee £5.00 or €5.00. The raffle is included in the door entry price. Bring-and-buy is free. SHARE is disability-friendly. Traditional strong attendance from Northern Ireland and the Republic.
erneradiorally@gmail.com
www.learc.eu

May 12th (Sunday)
NATIONAL VINTAGE COMMUNICATIONS FAIR (NVCF)
This event is organised by the British Vintage Wireless Society (BVWS) at the Warwickshire Exhibition Centre, CV31 1XN.
https://www.bvws.org.uk
www.nvcf.org.uk

May 17th to 19th (Friday to Sunday)
DAYTON HAMVENTION
Greene County Fairgrounds and Expo Center, Dayton, Ohio, USA.
https://hamvention.org

May 19th (Sunday)
DUNSTABLE DOWNS RADIO CLUB CAR BOOT SALE
The Dunstable Downs Radio Club (DDRC) is holding its Annual National Amateur Radio Car Boot Sale at the usual venue, Stockwood Park in Luton on Sunday 19th May 2019. This is the 36thconsecutive year that this event has been run. All the usual facilities will be there. Further details:
www.ddrcbootsale.org

May 25th (Saturday)
READING DX MEETING
The Reading International Radio Group will be meeting in Room 3 at Reading International Solidarity Centre (RISC), 35-39 London Street, Reading RG1 4PS. The meeting will take place from 2.30 to 5pm and is an opportunity for those interested in listening to broadcast stations from around the work on the short wave, medium wave and FM bands to get together. More details:
barraclough.mike@gmail.com
www.bdxc.org.uk/diary.html

May 26th (Sunday)
DURHAM DISTRICT ARS RADIO RALLY
The rally is at the Bowburn Community Association, Durham Road, Bowburn, Co. Durham DH6 5AT. The doors open 10.10am to 2.30pm, with disabled visitors gaining access at 10am. Admittance is £2. There will be traders, a bring-and-buy, as well as RSGB bookstall and Special Interest Groups. Catering and a licensed bar on site.
Michael Wright G7TWX
Tel: 07826 924 1192
g7twx@mickwright.f9.co.uk

June 2nd (Sunday)
SPALDING & DISTRICT ARS (SDARS) RALLY
Organised by the Spalding & District ARS (SDARS), this long-established rally takes place at the Holbeach Community Sports Academy, PE127PR (event will be signposted from the A17). Entrance is £3 per person. Inside trader tables cost £10 (pre-booked and paid, £8). The outside traders are always a popular aspect of this rally. With the new venue, we have plenty of space to accommodate visitors; outside pitch free of charge, £3 per person applies. Disabled access to the hall, catering and car parking available.
Graham G8NWC
Tel: 07754 619 701
rally-secretary@sdars.org.uk
https://tinyurl.com/y2za5gwe

June 9th (Sunday)
EAST SUFFOLK WIRELESS REVIVAL (Ipswich Radio Rally)
The rally will be at the Kirton Recreation Ground, Back Road, Kirton IP10 0PW (just off the A14). Doors are open at 9.30am, and the entry fee for visitors is £2. The venue has free car parking. Trade tables cost from £10. There will be trade stands, a car boot sale, a bring-and-buy, special interests groups, GB4SWR HF station, and an RSGB bookstall. Catering available on site.
Kevin G8MXV
Tel: 07710 046 846
www.eswr.org.uk

June 9th (Sunday)
SNADARC JUNCTION 28 RADIO RALLY
The Junction 28 Radio Rally will be held at the Alfreton Leisure Centre, Alfreton, Derbyshire. Doors are open at 10.15am (traders' setup is from 7.30am). The event is run by South Normanton and Alfreton and District ARC (SNADARC). There will be full disabled facilities, a bar selling alcoholic drinks, hot and cold beverages, and a selection of cobs on the day. Hot food is also available in the on-site café. Free parking on the day.
Anya Lawrence 2E0BQS
Tel: 01773 535 117
adylawri@btinternet.com

June 15th (Saturday)
ROCHDALE & DISTRICT ARS SUMMER RALLY
The RADARS Rally takes place at St Vincent de Paul's, Caldershaw Road, off Edenfield Road (A680), Norden, Rochdale OL12 7QR. Proceeds from this rally ensure the continued operation of the DMR repeater GB7MR. Doors are open to the public at 10.15am, with disabled visitors gaining access 15 minutes earlier. Admission is £2.50, with those under 12 years free. £5 per pitch (for traders with own tables) or £10 for a pitch, with a table provided. Refreshments available, including bacon and sausage butties.
Robert Lynch M0NVQ
Tel: 07778 113 333.
m0nvq@outlook.com
https://g0rac.co.uk

June 16th (Sunday)
GMDX SCOTTISH RADIO RALLY
https://tinyurl.com/y9eknee3

June 16th (Sunday)
WEST OF ENGLAND RADIO RALLY
The 16th West of England Radio Rally will take place at the Cheese & Grain venue, Market Yard, Bridge Street, Frome, Somerset BA11 1BE. Doors are open from 10am to 2pm. Inside & outside trade stands, an RSGB bookstall, café, disabled access/ facilities, and car parking.
Shaun G8VPG
Tel: 01225 873 098
rallymanager@westrally.org.uk
www.westrally.org.uk

June 21st to 23rd (Friday to Sunday)
HAMRADIO FRIEDRICHSHAFEN
The 44th Amateur Radio Exhibition will take place in Friedrichshafen, Germany.
https://tinyurl.com/yc9jls2o

June 22nd (Saturday)
BANGOR & DISTRICT ARS RALLY
The Bangor and District ARS Rally will be held at The Hub, Hamilton Road, Bangor. Doors open at 10am.
Tel: 02890 422 762
samanumi11@gmail.com

June 23rd (Sunday)
NEWBURY RADIO RALLY AND BOOT SALE
The Newbury Rally will take place at the Newbury Showground. A talk-in station will be on S22 (V44). Free car parking. Traders can access at 8am and visitors at 9am. Admissions will be £2.50. Car boot sale pitches are £12.50. A huge radio, electronics & computing boot sale area and a demonstration marquee with a display of amateur radio on-the-air. Catering available.
Phill G6EES
Tel: 07771 504 738
NewburyRally@nadars.org.uk
www.nadars.org.uk

July 6th (Saturday)
STOCKPORT ARS RALLY
The Stockport ARS rally will take place at Walthew House, 112 Shaw Heath, Stockport, Cheshire SK2 6SQ. Doors are open from 9.30am to 4pm, with disabled visitors gaining access at 9.15am. Admittance is £2. There will be trade stands, special interest groups and an RSGB Bookstall. Catering is available on site.
Nigel Roscoe G0RXA
Tel: 07506 904422
info@g8srs.co.uk

E-mail: leeg4ejb@outlook.com

Keeping Busy!

Lee Aldridge G4EJB reflects on the global exchange of ideas, first time portable, his first superhet (for many years) and getting ready for a constructional evening.

I was thinking back about how, many years ago, we stayed in touch with other amateurs apart from 'on the air'. The answer was probably by phone or meeting up. This time around, I have found e-mail has played a similar role (however old-hat that may sound to some now) but it's been the exchange of ideas, circuits and advice from fellow amateurs around the globe that makes it different from all those years ago. Let alone the digital revolution within the hobby, which I've not even got near – patience, I will. Meanwhile back in my basic analogue world.....

A Portable Excursion

I alluded to going portable a while back and quite honestly a lot of my little radios were built with that in mind but it needed a date for a walk with some old friends in the Peak District to get me focused and ready to go. The plan was the 40m Pixie and a W3EDP antenna. What could go wrong?

Well, life gets in the way and I didn't have the time needed. So, I hurriedly put together my 20m Howes receiver and OXO transmitter, a little speaker fitted inside an old spray lid, my microswitch Morse key and a quickly built 20m half-wave dipole, all thrown in a box along with the walking gear, **Fig. 1** – close!

I knew it was too much to take up on the hills but hoped I could at least set it up at the wonderful place we found to stay. So, it was portable in the garden with an incredible view across to Hollins Cross and Mam Tor.

I had given a copy of *Practical Wireless* to my friends to read about my exploits and they were good humoured enough to go along with my demonstration. I didn't make any contacts but they could hear 20m activity and I was impressed by the questions asked by one of my friends – he had obviously read the article. You never know, that could have sown a seed for the future.

Fig. 1: 20m portable kit in box.

Club Rally

Recently we had our club rally and even though I wasn't 100%, it was great to help out and to meet up with old and new friends. As I mentioned before, it's the time that others give (and over many years), hopefully towards a pleasurable experience for the rest of us, that I will always remember.

Back to the Shed

Back in the shed, my first superhet (this time round), a *PW* 40m *Daventry* receiver designed by **Chris Howes G4KQH** in the mid-nineties, **Fig. 2**, burst back into life and was delightfully functioning even though just clamped up on the bench. I first tried variable capacitor tuning then decided on varicap tuning. This worked amazingly well although coverage was only about 150kHz on 40m with a 9V swing on a BB204 varicap diode. I discovered the receiver had a fault in the IF stages but considering it probably hadn't functioned for 20 years, it was great to have it going again. Following on from that, I refurbished the A5 linking module and now I am rebuilding the matching *PW Rugby* transmitter. I am getting close to that first SSB/CW transceiver.

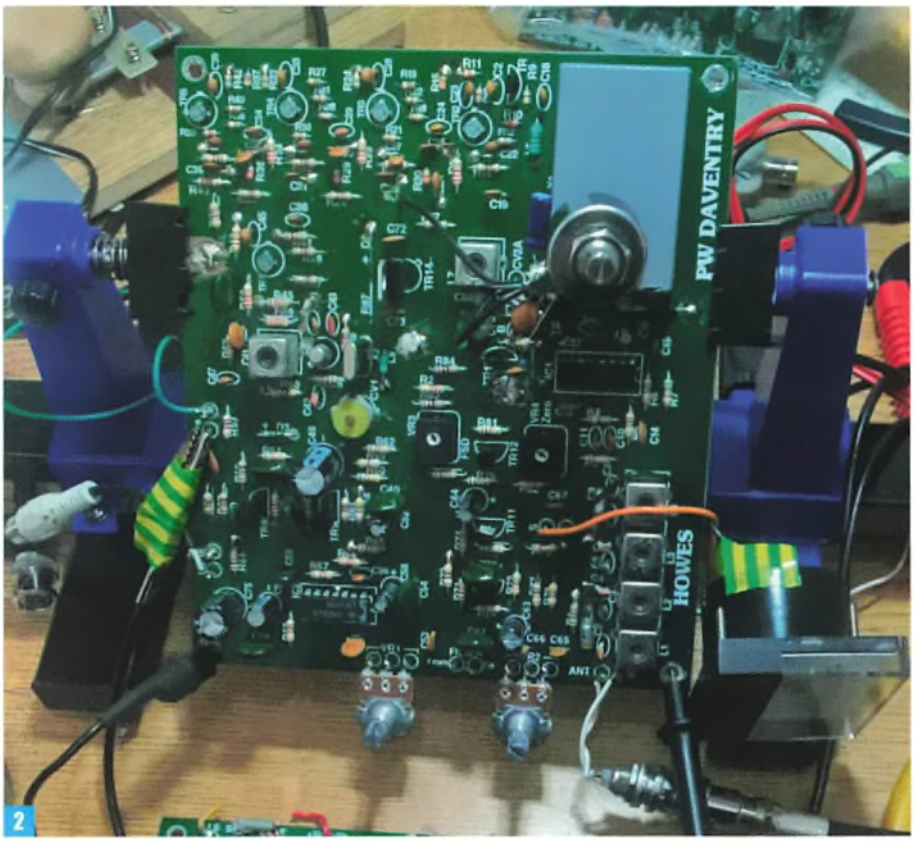
Constructional Projects

A while back, I thought I'd damaged my one and only 12V power supply for my equipment and projects. To move away from this precarious position, I have finally put together a variable power supply based on the LM317T IC and an old transformer with 12V AC output, providing in excess of 15V DC once rectified by a full-wave bridge and smoothed. The variable supply provides between 2.5V and 14V. The LM317T has a decent heatsink fitted so hopefully it will provide up to 1.5A if required. There are numerous circuits online and a good one in **Philip Lawson G4FCL's** *Test Equipment for the Radio Amateur*.

The 40m CWAZ lowpass filter has been built. I had to use some of my cheap ceramic capacitors to make up some of the values with the use of my component tester. A number of these capacitors were a long way from their stated values. I will replace them with some better-quality capacitors shortly because I don't believe I can rely on them for long. The filter has been checked in its present form with my RF probe/RMS voltmeter for loss and the SWR bridge for match.

I hope to further test the filter in the coming weeks with the help of a friend who has real (professional) test equipment. I'll keep you informed of our findings. Now I feel a little more confident to use my 40m Pixie and 40m OXO transmitter. This will spur me on to add semi-break-in keying to the 40m transmitter/receiver because the manual receive/transmit has been less than a success. (Just don't ask who put the switch in an awkward position on the front panel – see photo, **Fig. 3**).

Fig. 2: Working PW 40m Daventry receiver.
Fig. 3: Foresight and planning department failure with my 40m transmitter/receiver.



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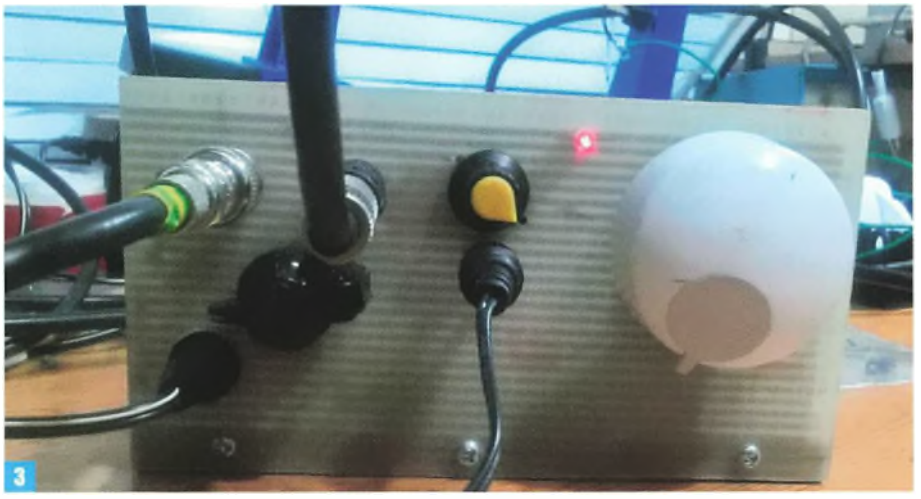
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Club Evening

With all this construction taking place in the G4EJB shed, I thought it might be fun to inflict a constructional evening on my local club. They readily accepted the idea and I have been busy preparing the small kit of parts and instructions. My hope is that it encourages more of us to give basic construction a go and even finish up with something of use – a 9V regulator built using simple Manhattan-style construction. Then there's the skill set that goes with successful construction – too long to list on this page. It's going to be an interesting evening to see how far we get and what we all take away from the event.

Antennas Too!

On the antenna front, I've been waiting for some trees to be felled from next door's garden before putting my CFR dipole back up with new coax (again, the coax cable has been inverted at its termination to prevent water ingress).

Meanwhile the W3EDP long wire has been raised a little. I have noted it performs almost as well as the 40m inverted-V during the day but the extra height of the inverted-V makes a noticeable difference at night. It would be interesting to encourage the W3EDP antenna even higher but the CFR dipole must go back up first.

Next month, a further donation of boards and kits that is a game-changer for the G4EJB station. Talk about keeping me out of mischief?

• E-mail: teleniuslowe@gmail.com

A Busy Month!

HF specialist Steve Telenius-Lowe PJ4DX has a very full postbag this month.

We have a full column with input from six countries on three continents, so I'm grateful to *PW* Editor Don G3XTT for allocating an extra page for *HF Highlights* this month. Despite somewhat lacklustre propagation conditions on HF, the bands came alive in March and April thanks to several multi-operator DXpeditions and a Spanish special event station award scheme.

March DX

First came 7P8LB, a Norwegian operation from Lesotho. As a primarily SSB operator, I appreciated their CW operators signing their callsign and sending 'up' after every (or very nearly every) QSO, making it clear who they were and that they were operating split. The result was well-disciplined pile-ups with no deliberate QRM, at least not at the times I was listening.

The Norwegians were followed by the Russian Robinson Club's XR0ZRC operation from (appropriately enough) Robinson Crusoe Island in the Juan Fernandez group off Chile, IOTA SA-005. My highlight was a QSO on 160m CW.

Next came an Israeli group led by **Dov 4Z4DX**, **Fig. 1**, operating from Ghana as 9G2DX and although I didn't work them on 160m I did manage a QSO on 80m. Hot on their heels was the Italian DX Team who, as mentioned in April's *HF Highlights*, were active from Uganda as 5X3C (and 5X3E when using FT8) and who I also worked on 80m.

A mainly Irish group supported by several other European operators, including **Jamie M0SDV**, made just over 50,000 QSOs as 5V7EI from Togo. Once again my highlight was a QSO on 80m CW.

Add into the mix a single-operator effort by **Nigel G3TXF** as 3B8XF from Mauritius and you can see the bands were quite lively during the period under review: for a couple of days all six DXpeditions were active simultaneously!

Although HF propagation was nothing to write home about, propagation on the low bands was sometimes pretty good. That was particularly the case on March 11th: at dusk I worked VK6APZ in Western Australia on 80m SSB via long path, a distance of around 21,700km. That same evening I worked OX3XR (Greenland) on 80m CW and also heard **James 9V1YC** (Singapore), **Fig. 2**. James didn't hear my calls but being an old friend he kindly responded to an e-mail request for a 'sked' (pre-arranged contact), which we completed successfully the following evening, although his signal was well down on that of the previous day. When I worked VK6APZ his signal peaked to an incredible 58 for a short period during the evening greyline, whereas at the same time on the 12th he was being spotted on the *DX Cluster* yet I couldn't even tell he was there. These two examples illustrate just how variable conditions can be from one day to the next.

Fig. 1: Well-known Israeli operator Dov Gavish 4Z4DX.

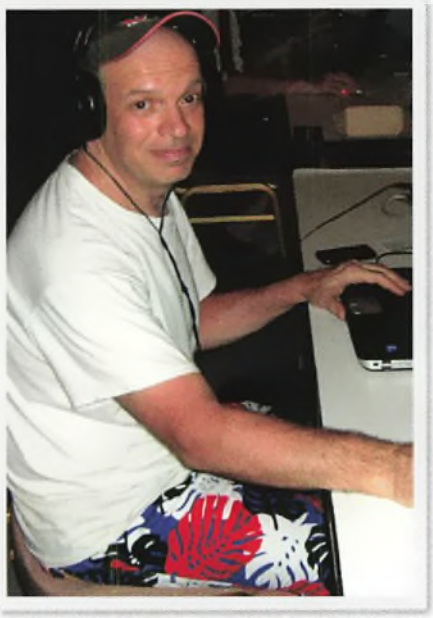

Fig. 2: James 9V1YC in typically relaxed operating mode.

Fig. 3: QSL from the 1990 3Y5X Bouvet DXpedition (credit: Tony Usher G4HZW).

Bouvet Island

The remote Norwegian sub-Antarctic island of Bouvet, **Fig. 3**, is the second-rarest DXCC entity, after only North Korea. It's rare for a reason: back in January 2018 the 3Y0Z DXpedition had to be cancelled after its ship developed engine problems *en route* to the island. This March, following several months of preparations in Cape Town, another group led by **Dom Grzyb 3Z9DX** left for Bouvet aboard the *Atlantic Tuna*. However, running into a major cyclone when only 75 nautical miles from the island, the captain made the decision to return to South Africa. Although the ship was damaged by the storm, fortunately all aboard were uninjured and the 3Y0I team promise they will make another attempt to activate Bouvet at a date yet to be decided.

WPX Contest

The CQ WPX SSB contest took place on March 30th and 31st and almost everyone agreed that conditions on the higher bands were the worst they had been since the previous solar minimum. The 10m band never really opened at all and 15m was little better, so almost everyone was crowded into 20m and below. Nevertheless, there was some DX about and I was pleased to

Fig. 4: View from the balcony at J88PI, looking towards Europe.

work *HFH* regulars **Reg G0OOF** and **Owen G0PHY** on 20m. Once again, propagation was better on the lower bands and on this occasion 40m was particularly good. My best DX during the contest were 40m QSOs with the **'Japanese DXer Club' KH2KY** on Guam, VK4KW in Queensland, YB3DY on Java and YC9ATS on Lembongan, a small island between Bali and Lombok.

...And in April

April started with an operation by a German group led by **Sigi DL7DF**, who has been mounting DXpeditions to rare and semi-rare locations since 1993. Active as C5DL from the Gambia, this was primarily a CW DXpedition but with SSB activity mainly looked after by YL operator **Annette DL6SAK**. While Gambia is not particularly rare, unlike in March they were almost the only show in town and I enjoyed chasing them from band to band. Here in Bonaire C5DL had great signals on 160m and 80m, and I was able to work them on all bands from 160m to 15m (including 60m) on CW, as well as on 20, 17 and 15m SSB.

www.dl7df.de

Those chasing special event stations were not left out either. The Spanish IARU member society, URE, is celebrating its 70th anniversary and 14 stations using the AM70 prefix are currently on the air until June 9th. There is an award scheme and details are available at:

https://70aniversario.ure.es

Readers' News

Once again we welcome another new contributor to this column: **Brian Price GW4DVB**, who wrote to inform readers that he will be operating as J88PI from Palm Island, **Fig. 4**, (IOTA NA-025) in St Vincent and the Grenadines from May 6th to 15th. He says, *"I will again be operating a small 'vacation DXpedition' in May... To get to Palm Island you fly to Barbados, take a 55-minute flight to Union Island, then a 10-minute motorboat to reach this private 135-acre hideaway... With coral reefs on three sides, crystal clear waters and stunning beaches, Palm Island is small enough to walk around, yet large enough to find a deserted cove to hang up an antenna, relax and work the world."* Brian will be using 100W to a 10m vertical antenna and will be active on 40 to 10m SSB, FT8 and SSTV. If you work him and would like a QSL, he asks you to QSL direct only, details are at:

www.g4dvb.co.uk

It was good to hear from **Martin Burch VK4CG** again after a long time, due to his being busy with work. Martin is a keen bush-walker and comments that Summits On The Air activity *"is getting popular over here but... has to be planned properly due to the vastness and with due regard to transporting gear and access... Over here in Queensland it is very photogenic but you need to have due regard to snakes, spiders, ravines, creeks plus careful consideration to time, distance and direction."*

David Smith M0OSA/M has been giving his Komunika HF-PRO-1 mobile antenna a test and by all accounts it's working well. David wrote that he *"worked 36 DXCC in about five hours on 20m during the CQ WPX contest. No ATNOs but I did manage to get two new band-slots on 20m: 9K2HN (Kuwait) and P40L (Aruba). Other highlights included UA9MA and RM9I (Asiatic Russia), P33W (Cyprus), CN3A and CN4P (Morocco) and Z66Y (Kosovo)."* Sorry I missed you David!

Reg Williams G0OOF wrote *"Beginning of the month was the ARRL SSB Contest. Good for me to collect more counties but no new states. Propagation was pretty good on 20m with North America workable from midday through to late evening on both days. 15m was poor and I did not venture to the lower HF bands. It was good*

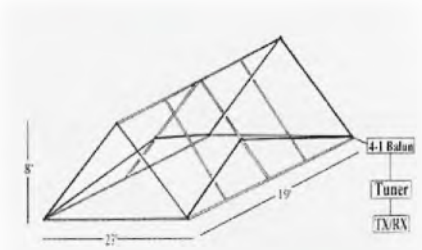

Fig. 5: GW0VSW's 'Crown' wire loop antenna.

to work two expeditions during the month on SSB: Uganda and Togo. Most of the month was taken up operating on FT8, mainly on 30m, which was interesting to work. I was pleased to work a number of JA stations during a short greyline opening around 0800... Later in the month came the CQ WPX contest with just a few contacts made on 20m and 80m from 2100 to 2300 on the second day. There has been some very windy weather during the month and I took my Buttemut antenna down three times, though as I have mentioned before it will withstand wind speeds up to 80MPH. The third time of taking it down I found an easier way by standing on a pair of steps and unbolting the top two-thirds section of the antenna. This is light and easy enough to remove, leaving the bottom section of the antenna with the coils attached in situ, along with the coaxial feedline and guy ropes. Saved a lot of work and time."

It was good to hear from my predecessor as *HFH* columnist, **Carl Mason GW0VSW**. He said *"For the most part band conditions have been very poor. The WPX contest brought out a load of stations for a time and I did copy a few Stateside calls, 9L and PY, though not strong."* He added, *"I found that my full-size inverted G5RV works well but at times my indoor 'Crown' wire loop has the edge and can be considerably quieter."* There's no substitute for a good outdoor antenna but if you must use an indoor one, something

Fig. 6: The Chinese-made Xiegu G90 SDR transceiver, a new acquisition in the GW0VSW shack.

like Carl's loop, **Fig. 5**, may fit the bill. He says it is 106ft of wire with a 4:1 balun at one end; 5ft of coax feeds the transceiver or ATU. Carl bought a new Xiegu G90 SDR transceiver, **Fig. 6**, and comments: *"The G90 is very good on SSB and the filters work well. The CW side definitely needs more work because the filter is, in my opinion, too narrow at 400Hz. The engineer is looking into this."*

Etienne Vrebos ON8DN/OS8D says he has some problems with the electricity supply at his home, with the main and secondary RCD earth leakage switches tripping frequently. Asking for advice he was told *"my system is too sensitive (but provides great protection!) and even the smallest incident will cut power."* Etienne wonders if this over-sensitivity might be caused by the fact that he has numerous 1.5m-long ground rods in his garden to provide as good an earth as possible for his antennas: *"perhaps some readers could give an idea how to handle many (or too many?) copper ground rods,"* he asks. [See *Hints and Hazards* by **Harry Leeming G3LLL** on page 49 of the April *PW* – PJ4DX.]

Terry Martin M0CLH said *"It was good to get another ATNO in XR0ZRC (they seem to be few and far between now) together with some other decent DX... I wasn't going to bother chasing the Spanish special event stations to celebrate 70 years of the URE but, after just a few, the addiction took over. It was nice to catch a few islands with VE7ACN travelling around some of the Canadian ones. All in all, a better period – let us hope it continues."*

Tony Usher G4HZW reported that he has *"Lots of ornithological activity at this time of the year but I managed to get on the air most days. 40m continues to provide some good DX contacts. 10m is generally poor but signs of life at the end of this period with Sporadic E openings to EA and F-layer (?) to South America, VP8LP opening the path as usual!"* Tony commented that the Spanish 70th anniversary stations are generating plenty of activity and that there's still time to get the appropriate number of contacts for the awards when this issue of *PW* is published.

Victor Brand G3JNB found HF propagation *"appalling"* in early March until he *"chanced upon CX2AQ calling CQ on an otherwise totally silent band. From Montevideo, **Ron** responded first call and was a surprisingly good signal on the 17m vertical."* Later, on 30m, KG4AS (Guantanamo Bay) was worked second call. Also on 30m, Victor worked Nigel 3B8XF, who was getting ready for the RSGB Commonwealth Contest. *"Conditions on 20 and 40m remained good for the contest with VK5WIA (the Australian national society) and V51YJ Namibia logged, as well as **Don C56DF** and Nigel and strong VEs"*, he wrote. On 17m CW, Victor worked the Russian Robinson team operating XR0ZRC from Robinson Crusoe Island: *"at 7591 miles with about 65W to a fishing rod antenna, tickled pink I went off to mention this to XYL Audrey – who seemed*

Fig. 7: Gibraltar Insight magazine reported on the Gibraltar Amateur Radio Society being awarded the RAFARS G2LR Trophy.

strangely unimpressed!" Still on 17m, 5V7EI was audible on CW but not responding to Victor's calls. Later, when he plugged in the microphone and called on SSB, they came back second call! Next day, a 20m CW QSO was logged without any such drama. A week of 'dry days' followed and out came the Heathkit HW8 for some EU QRP contacts at 1W output. *"I opened up the rig and sprayed switch cleaner on the antenna changeover relay and other points to remarkably good effect. That missing 17m CW QSO with Togo was made second call at dusk on the 25th but my initial response to their call was a disaster because I was sending on the wrong key!"*

Martin Evans GW4TPG has spent little time operating because he has been busy decorating both his living and dining rooms while also taking an Oxford University history course. He still found time to work several of the DXpeditions and some new band/mode slots.

As reported in the March *HFH*, the Gibraltar Amateur Radio Society was awarded the RAFARS G2LR Trophy for their contribution to the RAF 100th anniversary celebrations last July, when GARS members operated as ZB2RAF. This generated some good publicity for amateur radio in Gibraltar because the award was featured in *Gibraltar Insight* magazine, **Fig. 7**, as well as the *Gibraltar Chronicle*. Thanks to **Kevin Hewitt ZB2GI** for sending in the magazine clipping. Kevin has once again been active as ZB2GI/P from the Top of the Rock and this month also operated from across the border in Spain as EA7/M0GTD.

"With the ARRL DX phone contest at the beginning of the month, the CQ WPX phone contest at the end of March and DXpeditions to Togo and Uganda, there were plenty of stations to work during the month" is how **Owen Williams G0PHY** started his report. *"K3LR is a well-known contest station with an extensive antenna farm and as the contest exchange in the ARRL DX contest includes the power you are using, I set myself a challenge to see how low I could go. I managed to work K3LR with an indicated 20W. I turned the power down to an indicated 10W and managed contacts with W3LPL and VY2ZM (Prince Edward Island). These three contacts were on 14MHz. The Irish DXpedition to Togo (5V7EI) was worked on both 14 and 18MHz as was the Italian DXpedition to Uganda (5X3C)... Other notable contacts were 9K9A (Kuwait) and A52ZB (Bhutan). A52ZB was* ***Franz DJ9ZB***, **Fig. 8**, *and as he was not on Club Log the QSL was requested by 'snail mail'. I was delighted to receive his card after 18 days.*

Fig. 8: Veteran DXpeditioner Franz Langner DJ9ZB (left) with columnist Steve PJ4DX at the German DX Foundation stand at Friedrichshafen in June last year.

I thought conditions were not too bad for the CQ WPX contest with openings to Asia, Africa, the Caribbean and North and South America. Contacts were made into RC0, 9K, ZS, FG, PJ4, P4, W7, LU, CE and PY."

Band Reports

Martin VK4CG used 100W to a quarter-wave end-fed sloper on 40m SSB: K1KI, K3LR, K5TR, K7RL, K0RF, N6WM.

Reg G0OOF used 30m FT8: A41ZZ, CE3JRI, CO6HLP, HI8DLH, HK6JCF, JA1OGM, N6HC, OD5ZZ, PP5AB, RV9DC, TF2MSN, VK2CA, XP3A. 20m SSB: 5V7EI, AA3B, CB1H, LU5FB, P40L, PJ4DX, ZP5AA. 17m SSB: 5X3C.

Carl GW0VSW used QRP to work, on 40m SSB: LX1FF. 40m CW: 3Z100K, C56DF. 30m CW: HB0/SQ9IAU. 20m SSB: CR3DX, CT3HF, EB8HA, P33A, R160NN. 20m CW: C56DF, CN8KD, TA4LYL, VE9CB.

Etienne ON8DN / OS8D reports 40m SSB: OH0V. 20m SSB: 3DA0TM, 4L0A, 5V7EI, 5X3C, 6W/IV3FSG, 9G2DX, 9V1YC, AT3A, C5DL, D4Z, DU3/F4EBK, EP2LMA, J52EC, JA8NFV, JW6VDA, NP2P, PJ4DX, PZ5RA, S79KW, VY0AA, YB2DX, ZP5DA. 17m SSB: 5V7EI, 5X3C.

Terry M0CLH offered 40m SSB: AM70A. 40m CW: AM70A. 40m PSK63: AM70E. 40m FT8: 4O7TC, AM70URE/6 + 7 others, DF13MUC. 30m CW: AM70D. 30m FT8: AM70A plus others, II0IDR. 20m SSB: AM70C + others, LZ117ML, VA7XW/VE1. 20m CW: 5V7EI, 5X3C, AM70P + others, VE7ACN/CK9, VE7ACN/VE1. 20m FT8: HR5/F2JD, JW6VDA. 17m SSB: AM70C. 17m CW: AM70D, VE7ACN/VE1, XR0ZRC. 17m RTTY: AM70R. 17m FT8: 5T5PA, AM70URE, FG8OJ, OD5ZZ. 15m SSB: AM70I. 15m CW: AM70D, C5DL. 15m FT8: AM570CH.

Tony Usher G4HZW used FT8 to work, on 40m: CN2MA, HK2AQ, OD5KU, RI1ANL, S01WS, VK2BD, VK4COF, ZL3NB, ZL4CJF. 10m FT8: VP8LP + Europeans.

Martin GW4TPG worked, on 30m CW: 5V7EI. 30m FT8: 5V7EI, CN2MA, VU2WJ. 20m CW: 5X2B, 5V7EI, C56DF, RI1ANL, XV9YM. 20m FT8: VP8LP. 17m CW: 5V7EI, DU3LA, XR0ZRC. 17m FT8: 5T5PA, CP6UA, HS0ZIV, KG4SC, XR0ZRC. 15m CW: 5V7EI, 5X3C. 15m FT8: 4Z4DX.

Kevin ZB2GI operated /P from the Top of the Rock on 20m SSB: E77VN, K2TRD. From home on 17m FT8: AK4QR, CO3JR, KB0PPQ, LU2CHP, NS4F, NY8K, PY7KG. 15m FT8: LU1DA, PU1JSV, PY5HOT, SU9JG, UR5KBW, ZS6JES. Kevin also operated from Spain as EA7/M0GTD on 20m SSB: GB1SPD (St Patrick's Day), K2TRD.

Owen G0PHY offers 40m SSB: 9K9A, A52ZB, EF9Z, VE2BWL, VY2TT. 20m SSB: 5V7EI, 5X3C, 9K9A, CE3CT, D4C, FG4KH, HZ1HZ, K7RL, LU5FB, P44W, PJ4DX, PJ4K, PR4T, RC0A, TI7W, ZR2A. 17m SSB: 5V7EI, 5X3C.

Signing Off

Thanks to the editor for finding an extra page this month. Thanks also to all the contributors: please send all input for this column to teleniuslowe@gmail.com by the 11th of each month. For the August issue the deadline is June 11th. Photographs of your station or activity would be particularly welcome. 73, Steve PJ4DX.

• E-mail: jewell@btinternet.com

23cm, The Next Band Up? (Part 2)

Sam Jewell G4DDK continues his introduction to the 23cm band, discussing equipment and antennas.

Part 1 of this article may have given the impression that 23cm is only used for working DX. This is not true and there are many voice repeaters, TV repeaters, beacons and data repeaters on the band.

The TV repeaters include both traditional Wideband FM and digital types. The width of the band means that it is practical to have wideband FM TV transmit and receive within the band. The same is true for digital ATV. To accommodate the wideband signals, TV repeater outputs use the part of the band between 1300MHz and 1325MHz, with inputs towards the bottom of the 23cm allocation. Simplex operation is centred around 1255MHz.

Before the widespread adoption of digital satellite TV, when FM based satellite broadcast TV dominated, it was possible to buy one of several suitable FM ATV receivers. Since the widespread adoption of digital satellite TV (Sky, Freesat) in the UK, it has become very much harder to find analogue FM set-top boxes. Most set-top boxes, when used for amateur radio, benefitted from the use of a low noise masthead preamplifier.

There were several FM TV transmitters available in the past, often using modules originally designed for short range video surveillance links. To these radio amateur TV enthusiasts added power amplifiers using a variety of amplifier modules or complete, ready-built amplifiers. Using a good antenna and 10 to 50W of RF output, it was possible to view and access FM ATV repeaters up to between 30 and 50km away. During a lift in conditions it was possible to access TV repeaters (or work simplex) over more than 100km.

Although, from my QTH in Suffolk, most of the wideband FM ATV activity seems to have disappeared, there may still be pockets of FM ATV activity around the UK. In the last few years 5.7GHz FPV (First Person Video) equipment has become available at low cost and this has tended to replace much of the 23cm analogue TV activity.

Many of the FM mobile and handheld transceivers listed below have been used to access 23cm FM voice repeaters. Even the well-sited voice repeaters never seemed to get a great deal of use and many have been taken out of service. Perhaps because of this, there have been few 23cm FM-only transceivers available for several years.

Simplex operation, using 23cm FM, has tended to be very short range but works well in built-up areas due to reflected signals penetrating localities that signals on the lower bands fail to reach. For many years WA5VJB and myself used a pair of Yaesu FT-911 handheld transceivers to keep in touch around the halls and into the flea market area of the Dayton Hamvention. For this, 23cm worked extremely well. We also used commercial 2.4GHz spread spectrum transceivers on one occasion, but 23cm FM was, surprisingly, far more effective in that situation.

D-STAR DD (digital data) transceivers and repeaters also use 23cm. Again, these have not been so popular, although the introduction of the new Icom IC-9700 may soon change this situation.

Fig. 1: The new IC-9700.

Transceivers

Currently the only 23cm equipped multimode (AM, AM, SSB and CW + digital capable) transceiver from the 'big three' (Icom, Kenwood and Yaesu) is the Icom IC-9100. The IC-9700, **Fig. 1**, includes 23cm and is eagerly awaited as I write this. It may be available in the UK by the time this appears in print. There are currently no mobile or handheld 23cm FM transceivers available from Icom.

Kenwood no longer manufacture a multimode transceiver with 23cm capability. The TS2000X, **Fig. 2**, was the popular multiband transceiver available with a 23cm option. There are still several TS2000X available from dealers, if you search carefully. Kenwood no longer list a handheld or mobile 23cm transceiver, either FM-only or multimode.

Yaesu does not list a current transceiver for 23cm.

What is disappointing is that all these companies have previously made transceivers that were exclusively 23cm or incorporated 23cm as one of the bands covered.

The good news is that there are still many used transceivers to be found by careful searching on dealers used lists, on one of the popular on-line sales sites or from private sales. Ones to look out for are the:

• Kenwood: TS-2000X, TS-790 with UT-10 module, TM-741 (FM), TM-541 (FM), TH-59 (FM).
• Icom: IC-910X, IC-970, IC-1271, IC-1275, IC-1200 (FM), IC-1210 (FM), IC-901 (FM), IC-T81.
• Yaesu: FT-736R with 23cm module, FT-2312R (FM), FT-911 (FM).
• Alinco: DJ-G7 (FM handheld).

The SDR on 23cm

SDR (Software Defined Radio) is an exciting area of development, particularly for 23cm and above. SDR single-chip transceiver development boards are already capable of operation beyond the 5.7GHz amateur band.

The traditional transceiver, up to and including 23cm, has been based on the superheterodyne (superhet) architecture. That is a mixer and local oscillator down to a low frequency intermediate frequency (IF) amplifier and demodulator. This architecture relies on the use of a narrow filter (usually a crystal filter) following the first mixer in order to protect the following stages from strong adjacent signals that could cause one of several serious impairments to reception of a wanted signal. The use of narrowband crystal filters and a lack of very wide DSP-based IF has constrained operation to narrowband modes such as CW and SSB.

The use of SDR technology, with suitable software, will allow the development of new voice and data weak signal modes employing much higher bandwidths having as good, if not better, weak signal performance as the current weak signal modes but with much less susceptibility to interference of various sorts.

Currently, SDR based transceivers (and receive only) are being used as an alternative to conventional transceivers but that will change. A few digital TV uses have already emerged based on the Analogue Devices ADALM Pluto and Line Microsystems LIMESDR development boards among others.

Transverters

As an alternative to a transceiver with 23cm capability, your HF or preferably 144MHz transceiver, can be used with a transverter. Colloquially, the transceiver used with the transverter is known as the 'IF' radio.

A transverter is two frequency converters in one unit, with a common local oscillator. One frequency converter receives signals on the 23cm band while the other converter generates the 23cm transmit signal. The difference, apart from the direction of signal flow, is that the receive converter needs to have a low noise figure (it needs to be sensitive) in order to take advantage of the low noise at 23cm. The transmit converter converts the IF signal to 23cm where it is filtered to remove unwanted products from the frequency conversion. The wanted signal is then amplified up to, typically, 10 or 20W output. Often a higher power amplifier will be added to the transverter output to reach a power output of 100W or more.

Fig. 2: The Kenwood TS-2000X was a popular route to 23cm operation for many years.

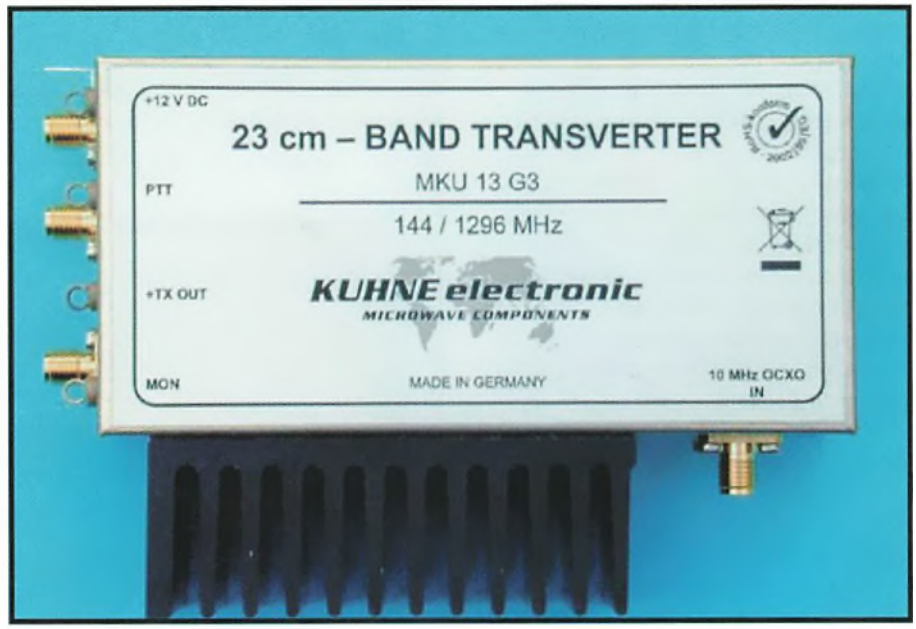

Fig. 3: Kuhne electronic 23cm transverter

Transverters for 23cm are currently available from German company Kuhne Electronics GmbH in either kit or built form, **Fig. 3**. Down East Microwave Inc. of the USA also manufactures a 23cm band transverter. Australian Minikits list several transverter kits. One of the most popular 23cm transverters is manufactured by SG Labs in Bulgaria. **Paul Wade W1GHZ** has designed a nice no-tune transverter and PCB boards for this are available from Paul.

All these transverters will produce an excellent transmit signal on the band, with very sensitive receivers.

If more transmit power is required, then an add-on power amplifier is needed. In the last few years very high power 23cm amplifiers, using RF MOS transistor technology, has become available. By combining several of these solid-state power amplifiers (SSPA, **Fig. 4**), output power in excess of 1kW is now possible if your pockets are deep enough. Most enthusiasts opt for power levels of around 100W to maybe 200W.

Amplifier modules are available from Kuhne Electronic GmbH, PE1RKI, WA6PQL and SM4DHN as well as the Gemini 23 from The DX Shop, **Fig. 5**. There are, of course, several build-it-yourself designs, including a very good design from

DF9IC.

More than any other, lower frequency, amateur band, a low-noise masthead preamplifier is very desirable. If your antenna to transceiver separation is no more than about 10m, and the coaxial cable is a good quality, low-loss type, then a masthead preamplifier may not be necessary. In general, a low-noise preamplifier, situated as close to the antenna feedpoint as possible will improve the sensitivity of a 23cm band system. It should be possible to see a small but noticeable increase in the background noise when the antenna is pointed at a nearby building, tree or even a fence, compared with pointing towards a largely open area such as the sky or distant horizon. If the noise does not increase in level, then the system may not be as sensitive as it could be. A word of warning here. With the proliferation of mobile radio masts, digital TV transmitters and a host of other radio frequency generating equipment, it is becoming increasingly important to add a 23cm bandpass filter either ahead of the preamplifier, if it is not too lossy, or maybe, sometimes, between the preamplifier and the transceiver. Each situation is different.

The MVV1296VOX masthead preamplifier, manufactured by SHF-Electronik, is a complete unit with coax switching and able to handle 180W. This preamp is available in the UK from The DX Shop.

A search on the internet will reveal several unswitched preamplifier designs for those who are happy to supply their own coaxial relay switching. Care needs to be taken when selecting a suitable coaxial relay for use with a preamplifier. Not only must the relay be capable of carrying the required RF power, but it must also have enough isolation between transmit and receive so that excessive levels of transmit power do not reach the preamplifier and destroy it. Many common, coaxial relays are not suitable for 23cm use. Choose carefully.

No discussion of preamplifiers would be complete without mentioning the need for a sequencer. This, basically, is a circuit that sequences the switching of power and the antenna so that no high-power RF is applied to the antenna until the preamplifier is switched away from the antenna and therefore cannot be damaged by the presence of the transmit signal. It should also prevent the antenna coaxial relay having to switch the transmit signal until its contacts have finally settled in the correct position. Failure to do this, known as 'hot switching', will inevitably lead to burned relay contacts and possibly a destroyed preamplifier.

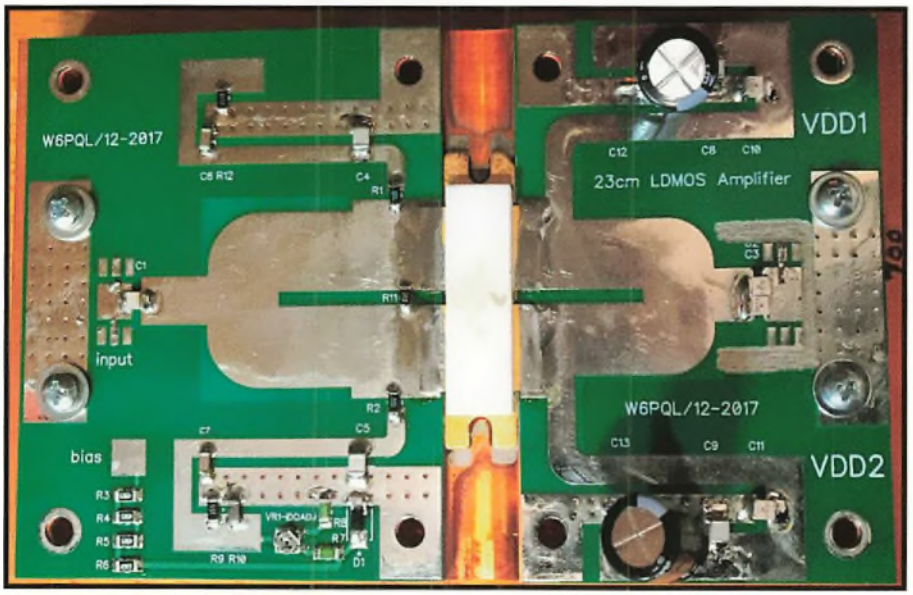

Fig. 4: Solid-state PA module for 23cm.

Fig. 5: Gemini 23 200W amplifier from The DX Shop.

Antennas

The antenna is possibly the most important part of an effective 23cm band station. For short range, of maybe 30km, a vertical 'white stick' antenna, mounted as high as possible will be enough. Often these antennas will cover more than one band. The Comet GP-98 Tri-Band Antenna is a typical example of such an antenna.

For longer distances a high-gain, horizontally-polarised, single Yagi is essential and a group of such Yagis will be even better. Dish reflector antennas are sometimes used for terrestrial operation but more commonly for EME. To be effective the dish needs to be at least 2.3m in diameter (ten wavelengths), although narrower dish reflectors are sometimes used when a larger one is not possible.

Until a few years ago the French made Tonna Yagis were commonly used. They were relatively cheap and worked well. Father and son, **Marc** and **Frank Tonna**, developed a range of Yagis before the advent of computer antenna modelling. Sadly, both have now passed away. The Tonna range of antennas may no longer be made. Some UK dealers are still listing a few Tonna antennas. It may be worth asking in case a dealer still has stock.

The Tonna 23-element, 23cm band 'Parrot Perch' Yagi was a firm favourite, especially in a box (stacked and bayed) of four antennas. 35 and 55 element Yagis were also available.

German company Wimo produce three 23cm band Yagis. The 28-element is end mount while the 44-element and a much

longer 67-element Yagi are both conventional centre boom mounted. These are available from The DX Shop in the UK.

Antennas-Amplifiers produce a whole range of 23cm band Yagis and it is worth looking at their web page for details of what is available:
https://tinyurl.com/y355vzhz

M2 antennas in the USA offer a 22, 35 and 49-element Yagi for the band:
https://tinyurl.com/ycl9sshe

Sadly, a trawl of UK companies offering a 23cm band Yagis drew a complete blank, although I know that several were available in the recent past.

It's also possible to make your own Yagi for the band. Possibly the G3JVL quad-loop yagi is the best known design and details of how to build one can be found in several older copies of the *RSGB Microwave Manuals* as well as in the ARRL *UHF/Microwave Experimenters Manual*.

Parts to build your own more conventional 23cm band Yagi can be obtained from a number of UK sources, including Antenna parts of Colchester and from Wave Antennas as well as from several other sources. Links to both appear below:
http://aerial-parts.co.uk
https://tinyurl.com/y6pfqcdw

A few words about coaxial cable. Use the best quality, low loss coaxial cable you can afford. The loss in coaxial cable can be the difference between successful contacts and no contact on these frequencies. Depending on the length of cable run, aim to use cable of at least 10mm diameter, such as Ecoflex 10 or Ultraflex10. Better still, use an even larger diameter cable if your cable run is more than about 25m. Ecoflex 15 and Ultraflex 13 are some of the largest diameter coaxial cables available that are readily available from amateur radio dealers such as Nevada, Martin Lynch and Sons and The DX Shop.

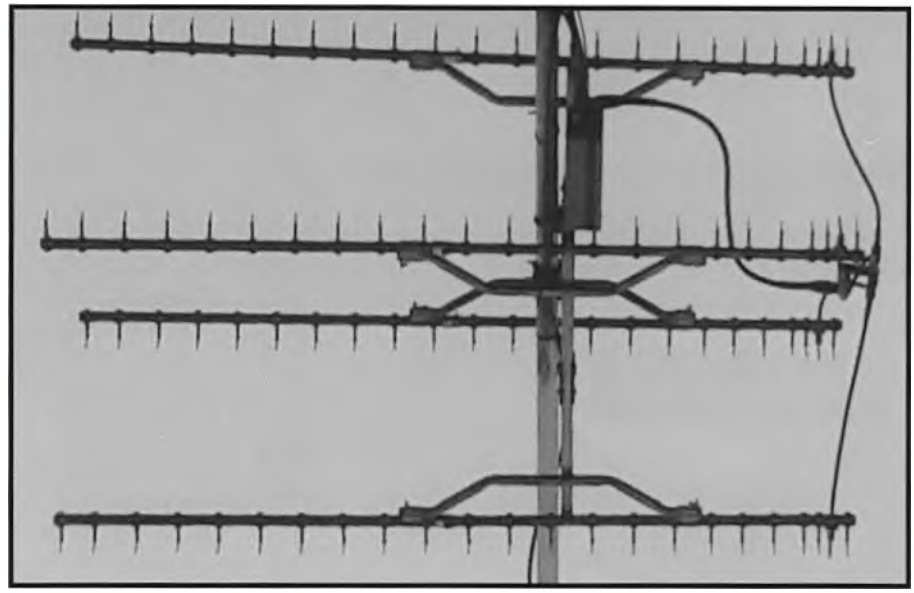

Fig 6 "A 'box' of four 23cm Yagis from Tonna

The purists will probably prefer to use professional cables such as Cellflex ½in or 7/8in or Andrew Corporation LDF4-50 or LDF5-50. Because of the cost of these cables it is usually better to seek out surplus lengths, which can often be found at radio rallies or purchased from other radio amateurs with cable to spare.

Coaxial cable requires the use of coaxial connectors. Mostly, this requires the use of type 'N' connectors, although for low signal level stages and up to about 50W of RF power, SMA connectors have the advantage of being quite small, cheap and available from most larger component suppliers. 23cm is no place for 'UHF' type connectors, despite the name!

Next Time

If what you have read so far has whetted your appetite to get going on the band, then join me for a further instalment in the July issue when I will cover what you need to do to become active on 23cm, offer some solutions to problems that may occur and discuss what you can expect to work.

Letters

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In the Footsteps of Marconi and ATUs

Dear Don,

Not only does **Joe MW1MWD** (*Footsteps of Marconi*) doubt the early exploits of **Mr Marconi**, he seems to forget that at that time radio had only just been discovered and no one knew how to make it work efficiently. MW1MWD bemoans that Marconi used very primitive equipment. That was because no equipment for radio existed. So that is why Marconi in his transatlantic experiments did not use a receiver with an RF stage, crystal filters or an AF amplifier to run his headphones. No one had invented them so he used the known technology of the day. As for spark transmission, it is estimated that spark transmitters only put 10% of their power out to the antenna. In the case of the Titanic and its 5kW (input) transmitter, the output would have been about 500W on the distress frequency in the MF band.

In the 1970s when I was at sea the usual Marconi Transmitter on MF only put out about 100W. Later and newer transmitters would put out 250W, less than the spark transmitter of the Titanic. And at night the MF signal on 500kHz can reach up to 3000 miles. For the early days of radio remember the early days of flight and how that progressed. Marconi was doing much the same with radio, making an unknown technology work.

On another subject, when I became an amateur, my first ATU was a KW107. This ATU is still with me after all these years and is one I keep going back to even though I have had many ATUs pass through my hands over the years. It sometimes matched an antenna another ATU would struggle with. I wondered why so from manuals compiled a list of some ATUs an amateur might meet at one time or another.

The internal ATU of my FTdx3000 covers 16 to 150Ω. A half-wave dipole on 7MHz would have an impedance of about 72Ω but if you use the same dipole on 21MHz (third harmonic), the feed impedance is about 96Ω. So internal ATUs are, it would seem, only for dipoles or verticals and not suitable for long wires. However, as we are talking about external ATUs:

Kenwood AT200 will match impedances of 10 to 500Ω.

Kenwood AT230 will match impedances of 10 to 500Ω.

Yaesu FC-700 will match impedances of 10 to 250Ω.

Yaesu FC-707 will match impedances of 10 to 250Ω.

Yaesu FC-107 will match a 50Ω feeder with impedances from 10 to 250Ω and a 75Ω feeder with impedances from 18 to 300Ω.

Yaesu FC-902 will match a 50Ω feeder with impedances from 10 to 250Ω and a 75Ω feeder with impedances from 18-300Ω.

The KW107 will match 80 to 40m bands with impedances of 30 to 1000Ω and the 20/15/10m bands with impedances of 30 to 2500Ω.

The SEM Transmatch will match an impedance 15 to 5,000Ω.

So, from these few figures I can see why my KW107 (as well as the SEM ATU) can tune my long wire when some other ATUs might not.

Ross Bradshaw G4DTD
Roche, Cornwall

***(Editor's comment:** Thanks Ross, though I think Joe Chester is perfectly well aware of all this. Which, indeed, is why he is wondering (as many others have) whether, for example, those early Marconi tests really did achieve the results claimed. I doubt Joe would disagree that Marconi (and his team) made great strides in understanding what radio (wireless!) was capable of. But, as I said in my April* Keylines, *Marconi was unwittingly making life ever more difficult for himself by erecting larger and larger antennas because these were resonant at lower and lower – and hence less effective – frequencies.*

As far as your comments about ATUs are concerned, I do wonder how some manufacturers get away with referring to their internal devices as ATUs. As you suggest, they cope only with (typically) 3:1 (150Ω, reactive) SWR. My Elecraft K3, in contrast, can tune up to 10:1 SWR with its internal tuner. And what the tuner sees is the impedance at the shack end, which can be very different to that at the antenna feedpoint, particularly when the antenna is non-resonant, in which case the impedance transformation depends on the feeder length. ***Peter Chadwick G3RZP*** *covered the subject well in his article in the October 2018 issue of* PW. *Look out too for a feature next month on link-coupled tuners by* ***Steve Ireland VK6VZ****. And as a final comment, tuners need to be selected not just on the impedances they can handle but also the power levels. Highly reactive impedances can lead to very high voltages in the ATU, even at modest power levels, which is why good high-power tuners employ vacuum variable capacitors.*

Finally, thanks for your long-term support for and contributions to both PW *and* RadioUser, *which is why I am happy to make yours this month's 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***.

Excellent Service

Dear Don,

I have just joined *PW* through the subscription service. I received my first free copy two weeks ago, through the special offer. I have given it a good read, cover to cover. My verdict – excellent!

I see you have a *Letters* section. I would like to add to that myself. On Friday March 8th I drove down to Barnsley to buy some rigs, power supplies, SWR meter and antennas. I had never had anything to do with LAMCO before. In the course of an hour I bought what I wanted. I found **Simon** (Sales) and **Lee** (Owner) very helpful and easy to deal with and the prices are excellent. LAMCO are only a small company but they carry a vast stock. They had everything I wanted. I came away very satisfied.

Richard Callaghan G6UXC
Scarborough

***(Editor's comment:** Many thanks Richard, it's always good to hear about this sort of service from our advertisers. The UK is well served with amateur radio dealers (in many countries, the only option is to import from elsewhere) and all seem to provide good service. Indeed,*

this may well be because we are well served – any that failed to do so would soon be out of business! We plan to run an In Focus *feature on Moonraker next month but hopefully before too long we can run one on LAMCO too.)*

Invalidating Warranties

Dear Don,
You are quite correct in your comment about invalidating warranties (see *Letters*, May, regarding wide-banding radios for 5MHz operation). Icom will not cover damage to PA stages on radios that have been wide band modified, even by an authorised dealer! With the exception perhaps of 60m, why does a radio amateur need to be able to transmit outside the traditional amateur bands? I would be interested in any comments from your readers. Surly a commercial rig would be a better choice for those who have an alternative licence and legal access to out-of-amateur-band frequencies?

The other issue seems to be the use of amateur HF rigs on the 11m CB band. In most cases these sets would not meet the specific regulations for the CB band.

Wally Sawyer G7FHN
Reading

VMARS Event

Dear Don,
Many thanks for making my e-mail the Star Letter (April) – honour indeed.

You may be interested to hear that I'm participating in a VMARS event commemorating the 75th anniversary of D-day. I'll be operating a vintage portable station using WW2 gear from the back of my 1942 Bedford MWD truck from Pegasus Bridge in Normandy.

Other members of VMARS will be operational from Gold Beach. Any other radio amateurs in the area are also invited to join in on the usual frequency of 3.615MHz AM. We'll be working back to stations in the UK and are hoping to work *HMS Belfast* whose role was lead ship in Bombardment team E off Gold and Juno on the day itself.

I believe *HMS Belfast* will have the special event callsign GB75DDAY.

More detail on VMARS activities can be found here: https://tinyurl.com/y63x4e6g

David Coles M0IDF
Loughton

Hearing Aids

Dear Don,
I've just read the letter from **Jim Shewan G3UZB** regarding hearing aids (*Letters*, May). I've had two for over 20 years, I used headphones over them for a while but found it got very uncomfortable so I now take the aids out and use the type of headphones that fit into the ear. Doing this, there have been no problems for receiving or transmitting. I hope this helps Jim and possibly others.

Mac McPheat G4OEC
Bridgwater, Somerset

It Makes you Think

Dear Don,
Having been a radio amateur for over 50 years now, I have always known how small our pale blue dot is (a quote from the great **Carl Sagan**). We set up the gear, throw a wire over a tree and away we go talking with folk all over the world. But recently I had this smallness highlighted in a way I had not thought of before.

Getting the gear ready to operate through the new geostationary satellite, I wanted to calculate the elevation angle for the beam. To do the trigonometry, I needed the earth's diameter. I discovered, though apparently known by others for many years, that it is a mere 12,742km. The satellite is sitting at 36,000km from the earth. With this information and simple maths, I got my required angle.

But it slowly dawned on me, the whole of what we know, what we experience, see, do and will ever travel to, the far reaches of the Gobi desert, the vast Pacific ocean, the wastes of Outer Mongolia and even Surbiton High St are all contained in a small ball that's only, only 12,742km across.

Contemplate that when next trying to get into the local repeater.

Bernard Nock G4BXD
Kidderminster

***(Editor's comment:** So true Bernard. It's all relative (as **Einstein** might have said …). I am fascinated by cosmology and gradually reading through a large collection of books on the subject that I inherited from my father. It's only a little over a century ago that humans discovered that even though we appear to inhabit an insignificant planet on the fringes of the vast Milky Way, that's only part of the story. Our galaxy is, in its own way, just as insignificant relative to the billions of galaxies that have now been discovered. But I wonder how many inhabitants of other planets have amateur radio and a monthly copy of* PW *to read!)*

Some Handy Tips from G4PVB

Dear Don,
Here at Verulam ARC we use the GB3VH repeater. My little handheld 70cm transceiver would only access it if I stood near a window. So, to enhance performance I made a quarter-wave groundplane antenna mounted to the interior apex of the loft. Being installed in the loft it avoids weather and has lasted for years. My element lengths are: Driven element = 16.5cm, four groundplane elements = 17.5 cm each. Feeder RG58C/U. A big thank you to HAMUNIVERSE.COM for the attached reworked diagram, construction details and formulas via the link below. I soldered the driven element to the centre of the SO239 and used bent crimp terminals with spiky shakeproof washers to bolt the ground plane radials secure. The spiky shakeproof washers I found to be essential otherwise it's near impossible to secure the radials without brazing or welding equipment that I don't have.

tinyurl.com/gpaerial

While on the subject of antennas, here's a handy online dipole antenna calculator that displays feet, inches and metric:

tinyurl.com/y7jr

Old Ringo Starr joke when the Beatles were turning on their amplifiers: *"Who's buzzing?" "Not me, I came by taxi."* Read up on the subject of shielding via:

tinyurl.com/nutsvoltsshielding

The penultimate step to refurbishing a redundant PC power supply unit into 13·8V 20A amateur radio use is to put it in a dishwasher. I kid you not – see the link below. **Volker SM5ZBS** takes us gently by the hand and guides us through all the issues and pitfalls. Quote: *"The best way to uncharge all capacitors is by letting the power supply sit unconnected for a few days. The modification is at your own risk".* It's quite a journey but I don't think the XYL will be impressed! Incidentally, his Electronic Stuff Homemade workbench looks to be the domain of a professional. Also, check out his 300 technical pages... (German).

http://tinyurl.com/ycc2y4w4

Bob Houlston G4PVB
St Albans

Classified Adverts

DISCLAIMER Some of the products offered for sale in advertisements in this magazine may have been obtained from abroad or from unauthorised sources. Practical Wireless advises readers contemplating mail order to enquire whether the products are suitable for use in the UK and have full after-sales back-up available. The publishers of Practical Wireless wish to point out that it is the responsibility of readers to ascertain the legality or otherwise of items offered for sale by advertisers in this magazine.

Antennas

G4TPH MAGLOOPS Remote tune and manual tune models. 40m through 10m. 100 Watts, SSB. See PW review on website. Details at www.g4lph.com

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REPAIRS TO RECEIVERS, TRANSMITTERS ETC. New/old. valve/transistor. Call 07903 023437 for details. Web: www.kent-rigs.co.uk

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TOP QUALITY PLL LNBs for Es'Hail2 / QO-100 satellite, 25 Mhz xtal. Latest Version 3 super stable RTL-SDR USB Stick with 1ppm TCXO. Now with HF mode, software activated bias tee, longer SMA, clock and GPIO pads. Also Thumbnet N3. pigtails, connectors, adapters and many more useful items. Buy direct from our web shop at **technofix.uk** or **www.technofix.co.uk**

CTCSS ENCODER AND DECODER KITS. DTMF kits and modules. Pic development kits. **https://cstech.co.uk**

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VINTAGE FIREWORK COLLECTOR – do not light the blue touch paper and burn British Heritage, private collector will pay cash and collect from anywhere, licensed explosive storage. Call Tony on 07956 506300

While prices of goods shown in advertisements are correct at the time of going to press, readers are advised to check both prices and availability of goods with the advertiser before ordering from non-current issues of the magazine.

Valves

VALVES AND ALLIED COMPONENTS IN STOCK Ring for free list. Valves/ books/ magazines wanted. Geoff Davies (Radio). Tel: 01788 574774.

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The prepaid rate for classified advertisements is 42 pence per word (minimum 12 words), box number 70p extra. Semi-display setting £13.90 per single column centimetre (minimum 3cm). Please add 20% VAT to the total. All cheques, postal orders, etc., to be made payable to Warners Group Publications. Advertisements, together with remittance, should be sent to the **Practical Wireless Classified Adverts, Warners Group Publications, West Street, Bourne, Lincs PE10 9PH.**

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Bargain Basement adverts cost £5.00 per advert

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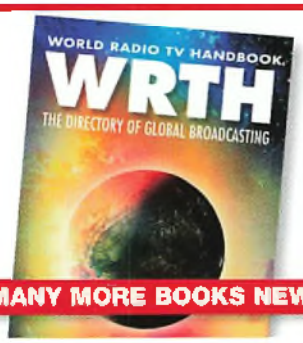

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ADVERTISERS' INDEX

Coming next month

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

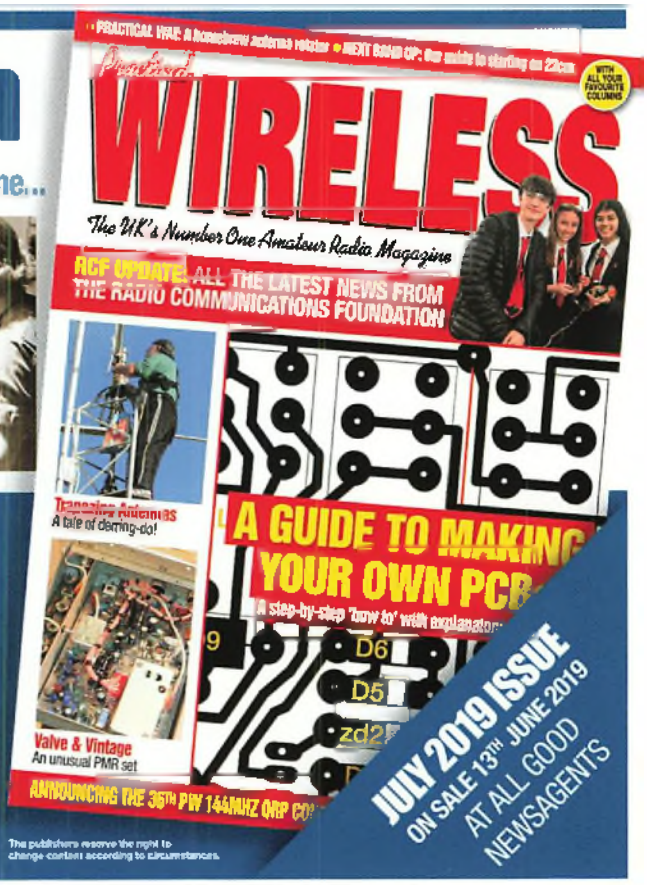
REVIEWS
July PW will feature three reviews – the SOTABEAMS WOLFWAVE audio processor, the HP-1 headphones from bhi (which we will also be offering as a competition prize) and the Moonraker YG27-35 2m/70cm Yagi.

BUILDING A UBITX HF QRP 'GO-BOX', PART 1
Daimon Tilley G4USI describes his experience of building the popular uBitx HF transceiver.

VALVE & VINTAGE
Dr Bruce Taylor HB9ANY relates how a radio spy almost doomed Britain.

THE MAGIC OF THE LCT TUNER
Steve Ireland VK6VZ/G3ZZD explains how to build a traditional Link Coupled Tuner, which can drastically reduce the electrical/electronic noise picked up by a dipole antenna.

There are all your other regular columns too, including What Next, Making Waves, HF Highlights, Doing it by Design, World of VHF, Data Modes, Starting Over and Carrying on the Practical Way.



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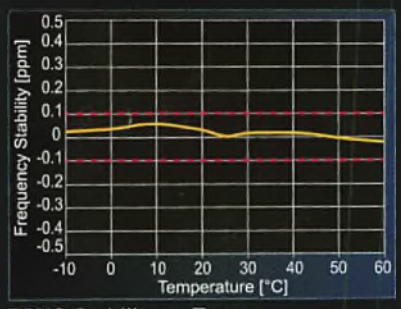

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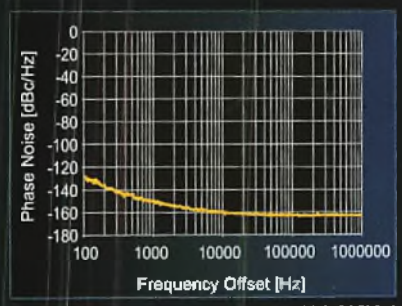

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