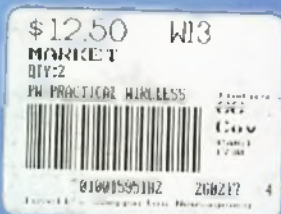


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Keylines

Don is back from the Chatham Islands and has a miscellany of topics on his mind as the year draws to a close.

I've been on the road again this month, as part of the Chatham Islands ZL7G expedition. I love to do these trips and it's always particularly fascinating to hear UK signals from the other side of the world. I hope to write up some reflections on the trip for a future issue.

CoTPW

This month our *Carrying on the Practical Way* article is by old friend of PW Phil Ciotti G3XBZ and written specifically at my request. With the recent correspondence about home construction and kits, I thought it would be useful to get back to basics in terms of how to set up a home workshop. I hope in future months we can also talk about the basic tools you might need and the sort of test equipment that could prove to be useful. None of this needs to be expensive – with prior planning you can pick up much of the necessary hardware at rallies, boot sales and so on.

With regard to furniture, Phil suggests second-hand office suppliers, which is certainly how I bought my first (very substantial) operating/constructional desk. Recently, though, my wife wanted a large work surface at waist height for cutting out and sewing curtains. The suggestion we hit upon, which is proving very successful, was to buy (in our case) a dozen Ikea coffee tables for the princely sum of £5 each and assemble them (using cheap metal brackets) as two layers of six. Not only has it given her the work surface she wanted but there's what is, in effect, a shelf below where she can store her tools and materials. It just goes to show what can be done with a little ingenuity.

Screwdriver Antenna

We also feature the first part of a constructional article for a

Screwdriver portable/mobile antenna. This is very much more of a mechanical project than an electronic one. I love the fact that, in building and improving our stations, we can be drawn to learn much more about mechanical engineering, IT and much else over and above pure radio (whatever that is nowadays because, in many cases, it certainly isn't all analogue any more). I've never owned a lathe, milling machine or floor standing drill but I've certainly learned about concrete, steel cables and much more in the course of putting up my various masts! Truly, amateur radio can lead us in many directions.

Incidentally, the article's author, **David Beard G8FMX**, tells me he was first licensed in 1970, has enjoyed *PW* for almost five decades and wanted to give something back. Thanks David!

Club Speakers

We recently (October) had news about the Lincoln Short Wave Club, which was sent to me by the Club's Activities Officer **Steve M5ZZZ**. In a later e-mail, Steve wrote, *"One of the problems I have is finding people to do talks at the Club. I am sure many other clubs have the same problem. It would be useful if either of your magazines (PW and RadioUser) could publish a request for persons willing to give talks to get in touch and then to publish a list of them and their contact details."*

If you are a speaker on the club circuit, would you be interested in having your name added to a database of speakers? Equally, if you are an aspiring speaker who thinks you could deliver an interesting talk on a radio-related topic to other hobby radio enthusiasts, then please drop me an e-mail and we can start to compile a list. Having made this request, I am equally aware, as I said

in an earlier *Keylines*, that some would-be speakers hold back because they have had unfortunate experiences in terms of their treatment when they have given club talks. However, there's no harm in asking!

Valve & Vintage

Our *Valve & Vintage* column always goes down well but I do feel there is a significant gap in the coverage, insofar as we don't have anyone to write about classic amateur radio gear (as against, for example, ex-military gear, well catered for by regular contributor **Ben Nock G4BXD**). I have in mind equipment from manufacturers such as Hammarlund, Hallicrafters, Heathkit, Collins and Drake, not to mention our own KW Electronics, Labgear and the like. If you feel you might be able to pen an occasional column on this subject, do let me know.

Elecraft KX2

I apologise that the Elecraft KX2 review doesn't appear this month. With my trip to the Chatham Islands and other recent commitments, I simply don't feel I have had time to do the rig justice. The review will appear next month.

Finally, as this issue appears in early December, all of us here at *PW* join in wishing every reader a very Merry Christmas and a Happy New Year. Without you, our readers, there would be no magazine and we value that support as we move into our 86th year of publication. I already have some great articles lined up and next month there's also the results of the *PW* 70MHz Contest to look forward to, along with Part 2 of our Screwdriver antenna project. You did get a *PW* subscription from Santa, I hope!

Don Field
G3XTT



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We regret that due to Editorial time scales, replies to technical queries cannot be given over the telephone.

Any technical queries by e-mail are very unlikely to receive immediate attention either. So if you require help with problems relating to topics covered by *PW*, then please write to the Editorial Offices, we will do our best to help and reply by mail.

Band Optimised Log Periodic Array (BOLPA)

The first in the series of BOLPA Yagis from InnovAntennas operates on five HF amateur bands simultaneously from a single feedpoint so is ideally suited to the modern-day SDR radios such as those from Apache Labs, Flex Radio Systems and Expert Electronics where multiple band receiver slices can be used at the same time.

The BOLPA is a result of two years development and testing. **Justin Johnson G0KSC** embarked on a project to test the monoband abilities of a log periodic antenna (LPDA). It is known that an LPDA in traditional form can provide usability over a very wide range. However, the compromise is that performance in terms of gain and Front-to-Back (F/B) is generally average to poor.

The project started with Justin optimising a 3-element LPDA for the 20m band only. This produced an antenna with a very short (6ft, 1.9m) boom with just under 7dBi forward gain and almost 25dB F/B. The BOLPA came from the combination of several Monoband LPDAs on the same boom. To start with, 3 x 3ele monoband LPDAs were placed one in front of the other for 20, 15 and 10m. Performance of each was excellent and a bonus band materialised from this 9-element array; 12m was delivered for free.

Therefore, this first pass with nine elements gave 20, 15, 12 and 10m, all in a very short package but 17m was missing. Justin shifted the 20m 3-element cell back on the boom and placed a single element between the 20m cell and the 15m cell and optimised this element for lowest SWR for 17m while carefully adjusting the position of the 20 and 15m cells either side of it. The resulting BOLPA-10 covers all bands from 20 through to 10m (usable right up to 30MHz)



New Products from Nevada Radio

The Nitecore i4 can charge virtually all types of cylindrical battery with charging currents of up to 1A. It uses active current distribution technology to select the correct charge based on battery capacity. Charging voltages are selectable from 1.2, 3.7, 4.2 and 4.35V for the different types of cylindrical battery available on the market. The unit will also recover depleted IMR batteries.

The list of battery types this unit can handle is long and includes Ni-MH AA, AAA, AAAA, C and D cells plus a wide range of Li-ion/IMR/LiFePO4 types

The Nitecore i4 sells for £29.95 and is available from Nevada Radio.

Nevada Radio have also become UK distributor for the USA manufactured Myantenna End Fed wires.

The most popular version the EFHW 8010 (see photo) uses a clever design to make it resonant on 80/40/30/20/17/15/12/10m bands without the need for a tuner and handles up to 1kW. This antenna is 130ft (40m) long and uses stealth marine grade 18SWG black covered wire, with a large commercial grade balun incorporating a silver Teflon SO-239 socket.

The antenna can be used in a variety of installations, such as horizontal, vertical, inverted V, inverted L and zigzag and still perform well with reasonable SWR. Retail price is £159.95 and it is available from Nevada Radio.

www.nevadaradio.co.uk



with exceptional performance throughout.

Not only did the director for 20m provide a reflector for 17m and the first of the 15m elements provide a director for 17m, ensuring excellent results on that band, the dedicated 17m element added an additional element to the 15m cell (now totalling four close-spaced elements), which delivers over 7.5dBi on this band along with 28dB F/B. The first customer reports have confirmed SWR figures on all amateur bands of around 1:1.1 with 12m rising to 1:1.3.

<http://tinyurl.com/zgz98mx>

GPS Disciplined Reference Oscillator

SDR-Kits has selected the Precision GPS Disciplined Low-Jitter Reference Oscillator from Leo Bodnar Ltd as the recommended external frequency source for their popular DG8SAQ Vector Network Analyser but also as a universal external clock oscillator for the laboratory or the shack.

The oscillator can be programmed to two output frequencies between 450Hz up to 800MHz with a stability of better than

one part per billion within one minute after achieving lock to the high accuracy GPS satellite network.

Light, portable and USB powered, the Precision GPSDO Reference Oscillator can be used as a reference clock for most other instruments and applications that up to now would have required a bulky and expensive rubidium clock.

The price is £125 plus VAT and shipping. <http://sdr-kits.net>

Woolly Jumpers!

Congratulations to **William Poel G8CYK**, who won himself a pre-programmed Baofeng handheld at the **Essex Repeater Group AGM** in October. The photo shows William (left) receiving the prize from **Murray Niman G6JYB**.



E-Field Probe Active and Antenna and Power Feed



As a new introductory project to surface mount assembly, hupRF is now offering the E-Field Probe Active Antenna. The project is in two parts – the probe electronics and the power feeding Bias Tee.

The E-Field Probe needs to be mounted above ground (the higher the better) and connected by coaxial cable to the Bias Tee. The Bias Tee allows DC to be fed up the coax to power the probe, while separating out the RF to be passed to the receiver. The unit requires a 13.8V DC supply – powering from a USB port is not an option.

The E-Field Probe is available as a component level kit, an Assembly kit, and there is an optional hardware kit. The component level kit contains all components and the PCB but does not have the connectors or enclosure hardware. This is all in the Hardware kit, although many users may prefer to make their own arrangements.

In the Assembly kit, all of the SMD assembly work is completed, and you just need to make the connections.

The picture shows the Bias Tee in the optional hardware enclosure, and the prototype Assembly kit version of the probe electronics. Please note that an active antenna, such as this, is a 'receive only' device.

<http://hupRF.com>

Successful 70th Anniversary



Guy GOUKN with a group of Scouts at GB2RE.

LAMCO in New Premises

PW readers may already have spotted this but, after a couple of years of searching, LAMCO have moved to a new location in Barnsley town centre only 200m away from the Barnsley Alhambra shopping centre and half a mile away from the train and bus station.



The location has quick and easy access to junction 37 on the M1 and is still within easy striking distance from the north, east, south and west with Manchester city centre only 30 miles away.

They anticipate being open for Christmas with some great new products and special winter pricing only available in store. The address is **LAMCO, 5 Doncaster Road, Barnsley, South Yorkshire, S70 1TH.**

Hernia Inter Club Challenge Quiz

The Hernia Inter Club Challenge Quiz was held on October 26th at Farnborough Community Centre. The clubs taking part were Bracknell, Basingstoke, Farnborough, Guildford, Horndean, Horsham and Wey Valley radio societies.

An enjoyable time was had by all, with 75 questions on general knowledge and amateur radio. Bracknell and Wey Valley drew with 54 questions each, a 10-question decider was initiated and Bracknell won. They now have to organise and hold the event at their meeting place next year. 45 people attended.

www.farnboroughradio.org.uk



Commonwealth Contest 2017 Prize Draws

The organisers are pleased to announce that Martin Lynch and Sons and Kent Engineers have agreed to sponsor a special prize draw for IARU Region 1 entrants to the 80th RSGB Commonwealth Contest on March 11/12th 2017.

The prize is a replica of a historically significant Morse key. Morse used the original key in his 1844 demonstration. It became the reference for key designs over many years and the design has changed little to this day. The KENT Replica is based on the original key displayed in the Smithsonian Institute and Vail's own documentation. Polished brass, steel and wood make this a real showpiece.

Further details of how the draw will be conducted and news can be found at:

<http://tinyurl.com/qzap8h>



Cray Valley Radio Society (CVRS) celebrated their 70th anniversary in style last October. In keeping with their high profile, they made almost 7,000 contacts with GB70CV, GX3RCV and GX1RCV. They also ran a number of activity periods designed to make it easier for amateurs to obtain the special 'Platinum' award plaque.

GB2RE was also active for JOTA from Severndroog Castle in the Royal Borough of Greenwich for the Severndroog Explorer Scout Unit. The Society was also active in the CQ Worldwide SSB contest as M8C.

The month began with a talk by **Smudge G3GJW** about wartime radio but the highlight was a memorable 70th anniversary party attended by 100 members, ex-members and guests. The evening featured short addresses by **Dave Lawley G4BUO** (Chairman), **Nick Henwood** (RSGB President), **Bob Treacher M0MCV** (President) and MP for Eltham, **Clive Efford**. An extensive buffet was provided, and Nick Henwood proposed a toast to the Society, while Clive Efford cut a special 16 x 14ft 70th anniversary cake complete with Cray Valley's anniversary logo.

Bob M0MCV has written the Society's history from 1946-2016 *The Cray Valley Years* and **Chris G0FDZ** has gathered together over 65GB of memorabilia. Further details are at:

www.cvrs.org

Essex Nets Flourish



Dorothy MOLMR
(Essex YL Net host).

Essex has seen three new nets take to the air within a month. Thurrock Acorns ARC has launched a monthly SSTV net, Selim M0XTA has started a Wednesday 4m Essex Net and David M1ECC has launched a weekly 2m discussion of the state of the amateur radio hobby.

The county is already well served with nets, including the Essex CW Club's regular on-air meetups and Essex Ham's Young Ladies Net. Close to a dozen local clubs and groups run nets, most popular of which is Essex Ham's Monday Night Net, which has attracted over 130 amateurs this year and sees an average attendance of 18. The three new nets are already proving popular, showing there is demand for more on-air activity.

For a list of all of the nets in the Essex area, go to:

www.sxham.uk/nets

WSPRlite

Testing HF antennas is a tricky thing to do. Simple on-air tests are seldom conclusive and often just plain confusing. SOTabeams has come up with a new way to test antennas and locations and to monitor propagation using the WSPR system.

The SOTabeams system consists of two parts: WSPRlite, a WSPR beacon, and DXplorer, a data analysis website. WSPRlite sends a test transmission that is received by hundreds of stations across the world. DXplorer is a web-based system that gathers these reports and presents them in a whole new way, allowing the user to check the DX performance of their antenna system. However, the real breakthrough is the ability to compare systems in real time and all over the world. DXplorer does this in a simple and intuitive way, enabling you to see what difference changes to your antenna system really make to its DX performance.

More information on WSPRlite and DXplorer is available at:

www.sotabeams.co.uk/wsprlite

Fog on the Tyne Rally

The Angel club held their seventh Fog on the Tyne Rally on Saturday September 17th with bacon butties and a cup of tea or coffee as well as bring and buy, a junk stall, an RSGB bookstand and many traders. There was also enrolment for Foundation, Intermediate and Advanced Examination courses and a Morse class. A good time was had by all and the RSGB was out in force. The former Regional Manager, Nigel Ferguson G0BPK, and the newest DRM, Tony Bonney M0RHJ, met up with the Rally Organiser, Nancy Bone G7UUR, also a DRM. The Club held its Christmas meal on November 12th while, two days later, two candidates Paul Bentley and Stefan Paulovic (pictured, with practical assessor Zoltan Derzsi M0MBA/HA5DZS and Nancy Bone G7UUR) successfully passed their Intermediate examinations.



Vintage Radio Weekend



Vintage radio enthusiasts are invited to participate in an on-air Vintage Radio Weekend on December 17/18th. This activity is open to everyone who has a classic transmitter or receiver or who is interested in owning one. Activities can be on any band and mode, and at any time. All participants may download a free self-service VRW Award Certificate from the website below, where there is additional information.

www.phoenixarc.org.uk

SE London/Kent Foundation, Intermediate and Full Licence Courses 2017

Cray Valley RS, a member of the South East Tutors (SET) group of clubs (website below) is running a Foundation licence course held over two consecutive Saturdays starting on February 4th 2017 in Eltham, London SE9. This course opens the 2017 SET training programme and is followed by fully taught Intermediate and Full licence courses plus additional Foundation course(s) later in the year. For further February course details please contact Kevin M0KSJ at courses@cvrs.org <http://goo.gl/AEV5GN>

Radio Caroline Special Event Station

In August, a team from the Martello Tower Group boarded the *MV Ross Revenge*, home of Radio Caroline, to run a special event station. In total, the station made almost 2500 contacts over the four-day activation.

The GB5RC operators were joined by the team from TX Factor, the amateur radio TV show, and a behind-the-scenes look at Radio Caroline's transmitter room, radio studios and the deck feature in episode 13. In this episode, Tony Horsman G0MBA and Keith Malon G6NHU explain about the background of the radio ship and discuss organising this most special of special event stations from the River Blackwater.

www.bxfactor.co.uk

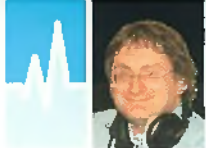
An interview with Keith G6NHU also features in episode 124 of the FrequencyCast UK Tech radio show, which can be heard at:

www.frequencycast.co.uk

If you're after any more information, there's a review of the activation here: www.martellotowergroup.com/gb5rc-report.html



Bob McCreadie, G0FGX from TX Factor in the Radio Caroline studio.



The Trilogy 850

70cm DMR Handheld Transceiver

Our DMR man, Tim Kirby G4VXE, looks at an interesting new handheld that started as a club project.

A month or two ago, *PW* was contacted by James Preece M0JFP of the Chertsey Radio Club, saying that they had been working on a project to make Digital Mobile Radio (DMR) easier to use for the average amateur. We wanted to find out more, so the Editor asked me to investigate.

I spoke to James who explained that the club had been working with one of the Chinese manufacturers, Kydera, to customise the rigs especially for amateur radio use. James had initially contacted several of the manufacturers but Kydera had proved the most responsive and helpful. In addition, one of the objectives of the project had been to make sure that users could easily keep their rig up to date with new repeaters, changes to DMR talkgroups and so on.

James explained how that would work, addressing a concern I've always had, that with the relatively dynamic state of the DMR network with talkgroups changing on a fairly regular basis, it would not be unusual for someone to have a rig and be wondering, "why don't I hear anything on this thing anymore?" James said that the rigs all come with a programming cable included as part of the package so the computer literate or modestly adventurous can make any required changes themselves. Alternatively, they can return the rig to the Chertsey Club to reprogram it, for a modest fee.

This all sounded great and James kindly offered me the loan of one of the Trilogy 850 rigs.

First Impressions

The rig arrived well packed and on unpacking, I was immediately impressed with the unit, which feels nice and robust but yet small enough to fit into a hand,

coat pocket or rucksack. The rig comes complete with a battery, rubber duck antenna, belt clip and a nice drop-in charger. No instruction manual is included but a quick start guide and an instruction manual can be downloaded from: www.trilogy.org.uk/?page_id=22

I didn't worry too much about the instruction manuals and decided to switch on and see what happened! When you order the radio, you can specify which repeaters you would like to have ready programmed along with your DMR ID. I'd asked for several DMR repeaters in Wiltshire, Berkshire and Surrey to be included as well as a number of analogue repeaters together with both digital and analogue simplex channels along with 436MHz for my DV4Mini.

Switching on, the rig was programmed to the GB7NS digital repeater and I found I could navigate around the different talkgroups using the up/down keys on the keypad. Because I was at home, I thought the first thing to try was the DV4Mini. Normally on a DMR rig, you change repeaters by selecting a different zone. Zone didn't appear in the menu but was a level below, under Utilities. I dropped in there and was able to change the rig to the frequency of my DV4Mini. I set up the DV4Mini, calibrating the frequency for use with the Trilogy 850 (it's important to do this for each different rig that you use with the DV4Mini). Having done that, I connected the DV4Mini to the Brandmeister network and talkgroup 4639, which sees a lot of traffic from the USA.

At this stage, when the receiver fired up, I noticed a slight drawback with the Trilogy 850 – the lowest setting on the volume control is quite loud indeed! I learned to put the rig face down when I was in the shack or living room, to avoid being too annoying to other people in the house. I also discovered that the Heil



headset that I use with my Baofeng UV-5R and Tytera MD-380 worked equally well with the Trilogy 850. I made a couple of QSOs and audio reports were good.

The following day I was working in London and popped out at lunchtime to try using GB7NS in Surrey, which is an excellent signal around Tower Bridge. I put a couple of calls out on the UK Wide talkgroup 235 and was pleased to make a contact and move over onto the user-activated talkgroup 80. Again, audio reports were excellent and I made some nice contacts. By this stage, I had discovered from the Quick Start Guide that I could change the Zone/Repeater from the front panel, which saved diving into the menu – a nice feature that I have yet to see on other rigs.

Over the next week or three, I kept the rig in my rucksack and used it to listen most lunchtimes as well as to make some contacts. Visibility of the front panel display was pretty good, although a little difficult to see in the brightest sunshine, but on most days it was fine. The battery life seemed excellent and the rig almost fell into the category of those that you charge and forget. I was quite surprised one day when I'd been using the rig for about three weeks that I needed to charge it. I don't actually remember the battery indicator showing low so that might be something to bear in mind. The drop-in charger worked well and from an aesthetic point of view, looks good on the desk.

Other features

Although you can't use it on the Phoenix DMR network, it is possible to send text

messages from the Trilogy 850 through Brandmeister network connected repeaters or on simplex. I had lots of fun sending messages from one DMR radio to another. You can use the keypad in the same way that you will remember typing text messages on early mobile phones.

There's a torch on top of the rig, which is quite useful and is activated by one of the buttons on the left hand side.

To use the rig on analogue repeaters or channels, you press the D/A button and keep it held down for a few seconds. You'll then be able to navigate through any of those that have been set up.

A variant of the Trilogy 850 is available with a built in GPS, which allows you to pass your location with each transmission. This is only usable on the Brandmeister network and is not currently passed if you are connecting to the network through the DV4Mini. If you want this option, you need to state it when ordering your rig because it cannot be fitted afterwards.

As is almost customary these days, there's an FM radio included and this seemed to work quite nicely for listening to local stations.

Although the review model was UHF, there is a VHF version available as well, should you live in an area served by a VHF DMR repeater or if you wish to experiment with simplex DMR contacts.

Programming

I wanted to try the programming software to update the rig's codeplug. The software is downloadable from the website below and installs easily. I installed it onto an old shack PC running Windows Vista and after a small amount of fiddling, I was able to get it to talk to the radio using the supplied connecting cable. Out of curiosity, I did try to use a programming lead for an MD-380 because the connections looked as though they might be the same but it didn't work. I repeated the installation on a Windows 10 machine and after some initial quirkiness, the connection to the rig worked solidly and I was able to tweak the codeplug settings for the GB7TC DMR repeater.

www.trilogy.org.uk/?page_id=96

I discovered that you can make the Trilogy 850 display the TX/RX frequencies as well as the channel information, which is quite useful for double-checking that everything is set up as you'd wish.

The software is simple enough to use although perhaps is not terribly visually appealing. I was able to modify frequencies, change the DMR ID in my radio and so on, all very simply. So, if you had a mind to, you'd be able to add a

Specifications as supplied

Model	DM-850	DM-850
Frequency Range (MHz)	VHF 136-174MHz	UHF 400-480MHz
Channels	256	
PLL Channel Spacing	12.5/25kHz	
Battery Voltage	7.4V DC (Li-ion)	
Antenna Impedance	50Ω	
Temperature Range	-2°C to +60°C	
Frequency Stability	±2.5ppm	
Case Size	126×56×37mm	
Weight	250g	
Packaging	Standard packing	
Receiver:		
Channel spacing	12.5/25kHz	
Frequency stability	±1.5ppm (-20°C +6°C +25°C)	
Analogue sensitivity	0.25 microvolts (12dB SINAD)	
0.3 microvolts (20dB SINAD)		
Digital sensitivity	5% BER: 0.3 microvolts	
Intermodulation	65dB	
Adjacent channel selectivity	60dB @ 12.5kHz 65dB @ 25kHz	
Spurious rejection	65dB	
Rated audio	0.7W	
Audio distortion	3% at 0.7W	
FM hum and noise	-40dB @ 12.5kHz -45dB @ 25kHz	
Spurious emission	-57dBm	
Transmitter:		
Channel spacing	12.5/25kHz	
Frequency stability	±1.5ppm (-20°C +6°C +25°C)	
Output power	5W/1W	
Modulation	±2.5kHz @12.5kHz ±5.0kHz @25kHz	
FM hum and noise	-40dB @ 12.5kHz -45dB @ 25kHz	
Adjacent channel power	-60dB @ 12.5kHz -65dB @ 25kHz	
FM modulation	12.5kHz 11K0F3E 25kHz 16K0F3E	
4FSK digital modulation	12.5kHz only data 7K60FXD 12.5kHz data and audio 7K60FXE	

new zone with new DMR repeater details should a new repeater come on in your area. You would also be able to upload

a codeplug file prepared by someone else into your radio, if you wished (having changed the DMR ID, of course).

Conclusion

I was impressed with the Trilogy 850. It works well and performs as well as a number of more expensive models. If you are planning to step into the world of DMR, it is a rig that you should definitely consider. The price is good at just under £100 (but check the price on the day because it does vary) and you will not have to spend extra to get a programming lead. The only real criticism was the high volume setting, which can be annoying in a confined space. James M0JFP has reported this back to the engineering team in the hope that it can be rectified in future production.

Particular thanks to James Preece and Ian Parbery of the Chertsey Radio Club for their enthusiastic and positive answers to my questions and to the club itself for their support of DMR activity.

The rig is available via the Chertsey Radio Club at the website below or for more information, e-mail info@trilogy.org.uk
www.trilogy.org.uk





The Double Sized G5RV Antenna

Vince Lear G3TKN has been using a double size G5RV antenna and, being a confirmed antenna experimenter, has been busy checking out its characteristics and performance.

Louis Varney G5RV invented his now very well known antenna in 1946. In 1958 he described its operation in an article entitled *Effective Multiband Aerial of Simple Construction*, which was published in the July 1958 *RSGB Bulletin* (now known as *RadCom*). He wrote further articles on the antenna, which were published by the RSGB in 1966 and 1984.

The standard (original) G5RV has a 31.09m top and is fed in its centre by either open wire or ladder line that is an electrical half-wavelength at 14MHz. Popular nowadays is a half-sized version that uses a 15.55m top fed in its centre with a section of open wire feeder (ladder line) that is an electrical half wavelength at 28MHz.

The double sized version, the subject of this article, has a 62.18m top, fed in its centre with open wire feeder that is an electrical half wavelength at 7MHz. It's not surprising that less has been written about this version of the G5RV because of its extra length requirement.

Why the Double Sized G5RV?

I erected the double sized G5RV for use as a temporary antenna while I had my tower down for maintenance. The reason I chose the double sized version was that I wanted to be able to work 160m in addition to some of the other bands. I had never used one before so I thought it would be interesting to analyse the antenna in some detail.

As a result of its greater length, it will provide slightly more gain on some of the higher frequency bands in addition to covering 160m. However, the lobes of

longwire antennas at HF tend to become narrower in both azimuth and elevation the longer the antenna and the higher the frequency. This can be a double-edged sword to some extent because the antenna can become very directional. If the station being worked is in the direction of one of the lobes, then all is well. However, there are also deep nulls in the pattern and stations in these nulls may not even be heard!

According to what I have read, Louis G5RV used both a standard sized and double sized G5RV at his QTH in Sussex. I can only assume that apart from the double sized version providing 160m coverage, it was used because it gave a different lobe pattern on HF compared with the standard version and that by using both antennas, a larger area of the world could be covered.

Feeding the Double Sized G5RV

Most G5RV antennas that are sold commercially are promoted as being 'multiband antennas' but sometimes with

the caveat that a tuner is required. It is often stated that the standard 31.09m G5RV covers 80-10m and the half sized 15.55m one covers 40-10m while the double sized 62.18m version covers 160-10m.

When any version of the G5RV is fed with coaxial cable at the base of the ladder line matching stub, its ability to operate as an efficient multiband antenna is compromised to some degree. An antenna tuning unit (ATU) will almost certainly be required on some bands if not all and the mismatched line loss on the coaxial feed going from the base of the matching stub to the shack will depend on the frequency, the quality of the coaxial feeder and its length.

If the ladder line is taken directly to a well designed and properly balanced ATU, then the ATU should be able to tune the antenna on all bands. However, at this point the G5RV now starts to resemble a doublet antenna. This is the most efficient way to operate the G5RV and Varney himself goes into great detail in a later article [1] about how to optimise a Z-Match ATU for use with the antenna when fed in this way.

The impedance seen at the base of the matching stub at any one frequency will depend on both the impedance of the balanced feeder and its length.

The G5RV antenna is often shown with its matching stub connected to 50Ω coaxial cable and it is this configuration that I particularly wanted to study with respect to the double sized G5RV.

Generally, it tends to be more convenient to route coaxial cable to the operating position than run in balanced line and the coaxial feed option is more convenient for many, myself included.

The G5RV Matching Stub.

The drawing, Fig. 1, shows the arrangement and dimensions of the

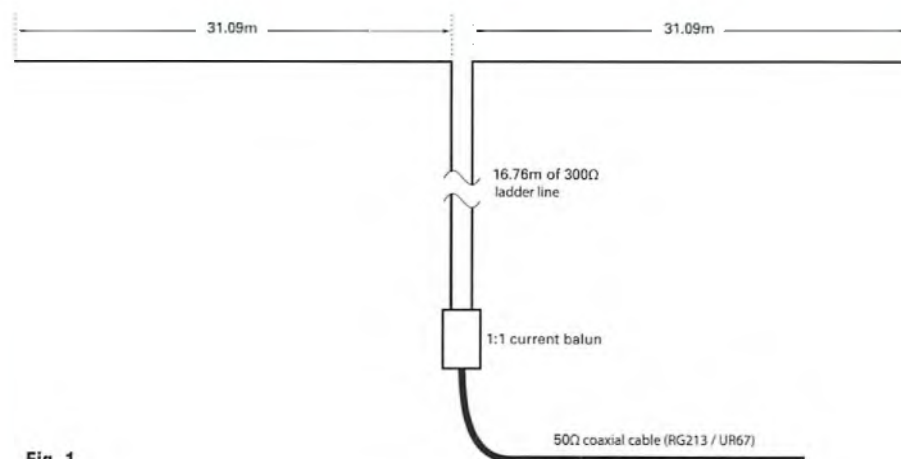


Fig. 1.

double sized G5RV. I used 16.76m of US manufactured 300Ω ladder line, which according to my measurements, exhibited a velocity factor of 0.79. I am aware that others have measured the velocity factor of what I believe to be the same feeder and come up with figures of 0.81 and 0.82.

My friend Chris G3VCR measured the same line with his Aim 4170 VNA using a more sophisticated measuring procedure, which included the use of a 1:1 balun (which was then calibrated out for the measurement) and came up with a velocity factor of 0.795.

Most diagrams for the double sized G5RV show a 300Ω matching stub of 18.9m. For this length to have an electrical half wavelength at 7MHz, the velocity factor of the cable would have to be 0.88. In fact, when I first connected up the double sized G5RV with an 18.9m matching section of 300Ω ladder line, 40m resonance was around 6.8MHz! Resonances on both 160m and 80m were lower than required and out of the band.

The photo, Fig. 2, shows two different makes of 300Ω ladder line. The top line shows the black US manufactured type that I used and appears to have a velocity factor of 0.795, while the bottom grey ladder line is of Swedish manufacture (type GMP6 from memory) and has a velocity factor of 0.85. I have not seen the latter available for some time.

I reduced the length of the 300Ω matching stub from 18.9m to 16.76m. This produced resonances in or near the following amateur bands: 160, 80, 40, 30, 17 and 15m.

However, it is important to remember that resonance (by definition) is when the inductive reactance is cancelled out by the capacitive reactance and we are left with a pure resistive impedance. This resistive component may not, of course, be 50Ω. On the double sized G5RV it was low on some bands and high on others.

The graph, Fig. 3, shows the resonance points between 1.8MHz and 30MHz at the end of the matching stub on my double sized G5RV at a height of 12m. These measurements were taken using a RigExpert AA54 running the supplied Antscope software on my laptop. The ladder line was connected to my antenna analyser via a commercial Unadilla 1:1 current mode choke balun.

Although the double sized G5RV shows resonances on or near the 160, 80, 40, 30, 17 and 15m amateur bands, all have SWRs greater than 2:1 (when measured at the base of the matching stub) because the resistive components of the impedance are somewhat higher or lower than 50Ω.

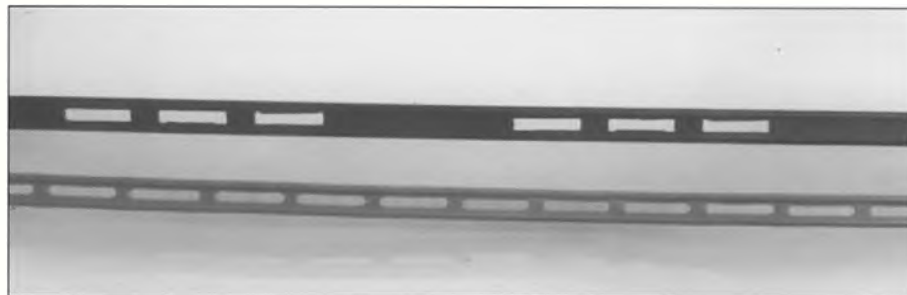


Fig. 2: Two types of 300Ω ladder line having different velocity factors.

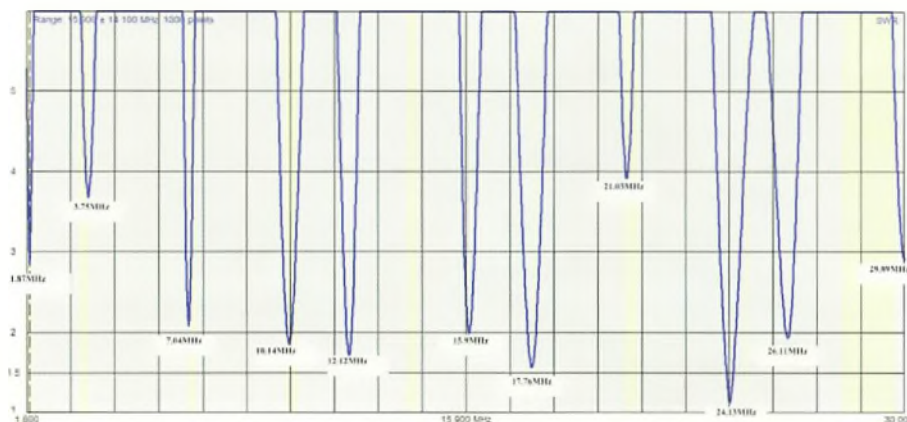


Fig. 3: A plot of SWR taken at the base of the matching stub using the RigExpert AA54 antenna analyser.

Balun

The photo, Fig. 4, shows the balanced feeder of the matching stub connected to the 50Ω coaxial cable via a commercial Unadilla 1:1 current mode choke balun. Such a choke balun is used so as to prevent common mode currents flowing on the coax.

There is a lot of useful information on the design of current mode choke baluns to be found at [2].

Basic Operation of the Double Sized G5RV

The double sized G5RV is really optimised for 7MHz where the antenna is three half waves at that frequency. Because the matching stub is an electrical half wavelength at 7MHz, it reflects the resistive impedance seen at the middle of the antenna to the base of the matching stub.

The three half waves top length is slightly longer than expected due to there being no 'end effect' on the middle half wave. Louis Varney showed the formula for deriving three half-wave resonance as:

$$492 \times (n - 0.05) / f(\text{MHz}) = \text{length in feet}$$

(where n = number of half waves)

$$[ft \times 0.3048 = \text{metres}]$$

The centre impedance of a three half wavelength antenna can be expected to be somewhere in the 100-120Ω region depending on the height and configuration of the antenna. Hence, we cannot expect a 1:1 SWR at 7MHz when the base of the matching stub is fed with 50Ω coax.

On 160m, the antenna operates as a



Fig. 4: Connection of 300Ω ladder line to 50Ω coax via a 1:1 choke balun.

'shortened half wave' with its centre folded up. This results in very low impedance at the end of the matching stub.

On 80m, the antenna operates as two 'shortened' half waves in phase. The matching stub brings total resonance (or near resonance) back to a low impedance point on 80m. As with 160m, the resistive component of the impedance 'seen' at the base of the matching stub is very low, which results in an SWR greater than 2:1.

All resonances shown in Fig. 3 are dependent on the top length of the wire and the length of the ladder line.

Mismatched Line Loss

As I said previously, resonance in an antenna system is when the inductive reactance cancels out the capacitive reactance and we are left with a pure resistance. This resistance may be far removed from 50Ω but the system still shows resonance. It is important not to confuse a high SWR with an antenna being non-resonant. If the inductive reactance is cancelled out by the capacitive reactance and we are left with a resistive impedance of say 10Ω, then an SWR of 5:1 results in a 50Ω system.

However, the actual impedance seen at the shack end of the coax will depend on the length of the cable and its impedance. If a length of 50Ω coax is terminated in a resistive impedance that is not 50Ω, then it is not operating in a flat condition and despite the fact that it is connected to a purely resistive impedance, the actual impedance at the far end (transmitter end) may well be quite different and have a reactive component introduced into the impedance. The impedance seen at the far end of the coaxial line (transmitter end) may take the form of either $(R + jX)$ ohms or $(R - jX)$ ohms. The '+jX' indicates inductive reactance while the '-jX' indicates capacitive reactance. The actual value will depend on the length of the coax at the specific frequency of interest.

A half wavelength (or multiple half wavelength) of feeder will 'repeat' whatever impedance it 'sees' at the load end.

It is for this reason that most G5RV antennas will require an ATU at the transmitter end on some if not all bands. However, if the transceiver has an internal tuner with a reasonably wide matching range, this might well be sufficient to allow the PA to 'see' a 50Ω resistive load and deliver full power, although any mismatch will still be present on the coaxial feeder.

Mismatched line loss on coaxial cable is always less when the load to which it is connected is purely resistive and no (or very little) reactance is present.

If the coax connected to the matching stub of a G5RV can be made as short as possible (let's say less than 5m), then mismatched line loss will be negligible on the HF bands if RG213/UR67 coax is used. Higher quality cables will be even better. I would definitely not advise the use of RG58 (5mm diameter) coax for feeding the matching stub of any G5RV.

I have disregarded the mismatched line losses on the ladder line matching stub because they are very small with this type of feeder.

I decided to stay with 300Ω ladder line

because I did not have any 450Ω ladder line to hand and the former type of feeder is lower profile. When I modelled the matching stub using 450Ω ladder line, the 160m resonance appeared considerably lower in frequency and was in fact out of band compared with the 300Ω feeder.

I wanted to see what the losses were when the base of the matching stub was fed with 30.48m (100ft) of RG213/UR67 coax.

To do this, I made use of **Dean Straw N6BV's** Transmission Line for Windows software, which allowed me to enter the frequency, load impedance, length of coax and type of coax to arrive at an overall loss on a specific length of coax. This loss includes both matched and mismatched line loss.

The total losses seen are approximately (but not exactly) in proportion to the length of the coax.

Practical Measurements Using a RigExpert AA54 Antenna Analyser

Although EZNEC is an excellent modelling tool, the actual behaviour of antennas when used on lower frequencies can be somewhat different due to environmental factors.

The plot in Fig. 3 of SWR vs. frequency was taken using the RigExpert AA54 coupled to my laptop running the associated Antscope software. It shows actual resonance (or near resonance where the reactance is small) between 1.8MHz and 30MHz.

Table 1 shows the impedances and SWRs on some spot frequencies (taken at the end of the matching stub) within the amateur bands. It also shows the total matched and mismatched line loss to be expected when the matching stub is fed

with 30.48m (100ft) of RG213/UR67 coax.

It is worth noting that the total loss on the coax is less than 1dB on 160, 80, 40 and 30m. Even at 17m, the loss is only about 1dB while on 15m it is nearly 2dB. The highest losses are on 60, 20 and 10m where the antenna does not show any resonance. If the antenna is to be used on these bands, then either a very short length of good quality coax should be used between the matching stub or, preferably, the matching stub should be directly connected to a balanced ATU.

Shorter lengths of coaxial feeder will lower these losses as would the use of better quality coax.

Losses in the ATU

It would appear that from both theoretical and practical analysis, the double sized G5RV will certainly work with acceptable efficiency on 160, 80, 40 and 30m even if the matching stub is fed with up to 30.48m (100ft) of coax. However, an ATU is generally required if an SWR of 1:1 is desired at the transmitter end.

Although ATU losses are outside the remit of this article, it is important to be aware that there is likely to be some loss in any matching circuit. It is sufficient to say that a good quality ATU will have fewer losses than a poor quality one.

It has been shown in reviews of various commercial ATUs that losses tend to be higher when the ATU is required to match very low impedances.

Radiation Patterns

I modelled the double sized G5RV in a horizontal configuration at a height of 12m over 'average ground' using EZNEC v6.0+.

On 160m the pattern is the same as a

Table 1: Table of Frequencies, Impedance, SWR & coaxial loss.

Freq. (MHz)	Impedance ($R \pm jX$) ohms	SWR	Coaxial Loss dB (30.4m RG213/UR67)
1.87	(17.1 + j0.6)	2.92	0.36
3.75	(13.5 - j0.7)	3.7	0.78
5.29	(1661 + j727)	39.6	5.1
7.04	(124 - j1.1)	2.5	0.71
10.14	(24.7 - j1.0)	2.0	0.81
14.09	(13.4 - j138)	32.6	6.0
18.10	(45.6 + j27)	3.9	1.0
21.09	(47 - j71.9)	4.4	1.8
24.9	(82 - j99)	4.4	2.1
28.5	(5.9 - j55)	18.8	5.6

The above readings of impedance and SWR are taken at the base of the matching stub. The actual impedance seen at the transmitter end of the coax will be different from that listed above and will depend on the length of coax and the frequency.

dipole, which is not surprising since the antenna is only some 12.8m short of a full sized half wave dipole at 1.9MHz. At such a low height the main lobe is at 90° (directly upwards). This should make it ideal for high angle inter-G contacts on 160m.

On 80m, both halves of the antenna are in phase but offer very little extra gain due to close spacing of the in phase elements. EZNEC shows about 0.8dB broadside gain over a standard dipole, which is negligible. This very small gain would easily be lost if the antenna's ends were dropped to make it tend more towards an inverted-V configuration.

Therefore on 80m, the antenna behaves like a normal 80m dipole with its major lobe at 90° when at a height of 12m.

On 40m, the antenna is three half waves long and the lobe pattern starts to split such that at the lower elevation angles of around 20° there are four major lobes, each some 38° to the wire. Compared to a dipole at 12m, these lobes offer about 1.75dB more gain than a dipole when the latter is optimised for the same direction.

On the 30m band, the lobe pattern again splits into four main lobes offering just under 2dB extra gain at the low angles between 10 to 20° compared with a dipole at the same height optimised for this direction.

Although the actual gain offered on both 40 and 30m is small, the main advantage is that it is offered in four lobes that may give slightly better coverage than a dipole, depending on the antenna's overall orientation.

The higher the frequency, the more the lobe pattern splits, with major lobes tending towards the plane of the wire. The actual 'gain' will also increase with frequency but the azimuth and elevation patterns will become narrower. This means that although there will be some useful lobes offering gain, there will also be significant nulls in the pattern.

The plot, Fig. 5, shows overlaid azimuthal patterns at an elevation angle of 15° for the 20, 15 and 10m bands. The double sized G5RV offers about 3dB more gain on 15m in its multi-lobe pattern at 15° elevation compared with a 15m dipole orientated broadside on for maximum gain in that same direction. On 10m, the increase is about 3.6dB.

Suggestions to Improve Efficiency

I now offer a few suggestions for improving the antenna's efficiency but it is worth noting that these suggestions are relevant to all versions of the G5RV.

- Extend or decrease the ladder line as required and take it to a properly balanced ATU. Do not use an ATU with a 4:1 voltage balun to obtain the balanced output. If a single-ended ATU is used, then use a 1:1 current mode choke balun to obtain the balanced-to-unbalanced conversion. This will allow the double sized G5RV to work more efficiently on all bands from 160 to 10m. However, some might argue that we have really turned the antenna into a doublet!
- Use a good quality ATU; preferably one designed to handle high power because this is likely to have lower loss components in it.
- If coaxial cable is used between the base of the ladder line matching stub and shack, keep it as short as possible; preferably less than 5m.
- Use the highest quality of coax possible because this will reduce mismatched line losses on the higher bands.
- If possible, try to run the antenna completely horizontal. EZNEC shows that gain drops when the antenna tends towards an inverted-V configuration.

Summary

So in summary, the question is what does the double sized G5RV offer that the standard one doesn't? Its main advantage has to be that it offers efficient performance on 160m where it is only 12.8m short of a half wave at 1.9MHz.

The double sized G5RV offers slightly more gain on the higher frequencies compared to the standard one although its radiation pattern on the higher frequencies will be somewhat different compared to the standard version as a result of its increased length.

On my own double sized G5RV, which is fed with 28m of RG213/UR67 coax at the base of the 300Ω ladder line stub, the only bands where the SWR is less than 2:1 at the shack end are 40, 30 and 17m. An ATU is required if the antenna is used on 160 or 80m if a 1:1 SWR is to be obtained. However, despite this, the mismatched line losses on both these bands have been calculated at less than 1dB.

I have made no calculations for any losses in the ATU but in reality these losses will add to the overall system loss.

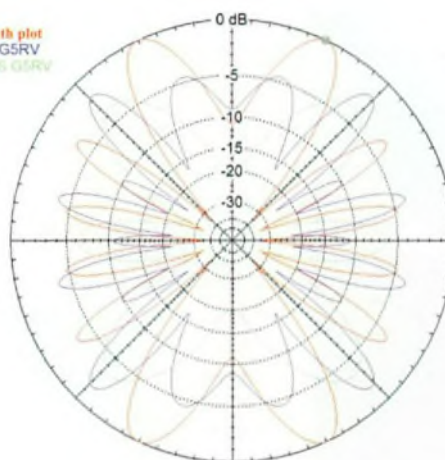
In practice, I have found the double sized G5RV to be a good, general purpose all round antenna. I feel it generally gives 'dipole performance' on 160 and 80m while offering slight gain on 40 and 30m.

If fed as a doublet (taking the balanced feeder to a balanced ATU) on 20 through to 10m, it does start to offer useful gain over a dipole although this gain is centred in some fairly narrow lobes.

It also has the advantage of not requiring traps or loading coils, which tend to weigh down the wire and make the antenna more noticeable.

The double sized G5RV is a cheap and simple antenna to construct and is able to give a good account of itself on all bands so long as the matching issues I have mentioned in this article are taken into account.

Total Field
* Primary - 10m azimuth plot
15m azimuth plot DS G5RV
20m azimuth plot DS G5RV



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Fig. 5: These are the lobes showing maximum gain at an elevation angle of 15° when the antenna is completely horizontal at a height of 12m. Peak lobe gains – 20m (green trace) 7.9dBi; 15m (blue trace) 9.2dBi; 10m (red trace) 11.21dBi.

References

- [1] A modified Z Match design by Louis Varney G5RV – RSGB *RadCom* October 1985.
- [2] Choke balun information: www.karinya.net/g3txq



A Remote-Controlled Homebrew Screwdriver Antenna Part 1

David Beard G8FMX describes how to homebrew the popular Screwdriver antenna, suitable for fixed or portable operations.



The Screwdriver antenna was originally the brainchild of the late Don Johnson W6AAQ, who was regarded as a legend in amateur HF mobile circles. He described it as a *"continuously tuneable high performance HF mobile antenna with no coil taps and a Q that remains reasonably high over the entire tuning range"*.

The key to the Screwdriver antenna's construction is the variable inductor, which is adjusted by raising or lowering it within a metal base tube by means of a motor-powered threaded rod. The motive power is supplied by a commonly available cordless screwdriver motor, hence the name. The top of the base-tube makes contact with the coil turns by means of a springy fingerstock and only the section of coil above this point is in circuit, providing resonance at a given frequency dependent on the number of turns exposed. The coil turns below the fingerstock are out of circuit within the base tube. By a combination of adjustment of this inductor and the length of the whip section above it, the antenna can be resonated between about 3.5 and 50.2MHz. As a bonus, control of the antenna's motor and the base-matching inductor tap-point is performed remotely using one of the commonly available wireless remote units that are otherwise popular for controlling domestic lighting, audio equipment, garage doors and the like.

Although there are a few excellent constructional articles for this antenna (see, for example, the *ARRL Antenna Handbook*, 23rd edition, Chapter 21 in Supplemental Files), they are challenging for the average constructor because

access to a screw-cutting lathe is required to place grooves on the coil former at the correct pitch to hold the windings. The construction method employed here circumvents that requirement and results in a properly spaced and serviceable inductor of robust construction. Instead of indenting a groove in the coil former, the turns are securely held in place with polypropylene cord squashed between the turns providing correct spacing with no marked detrimental effects on efficiency. Originally designed for mobile use, this antenna can be equally effective as a portable unit or in a fixed installation where space is at a premium.

The remote controlled Screwdriver antenna as described is constructed from readily sourced or home-built materials and for well under £100.

Construction Materials and Tools

All materials and tools used in the antenna's construction are listed in the sidebar and are readily available. The list includes suggested sources.

Constructing the Loading Inductor

If you are fortunate enough to have access to a screw-cutting lathe or pipe-threader, then use the tool to cut a shallow spiral along the tube for about 500mm. There should be eight to nine turns per inch although this is not critical. Use a wooden mandrel through the PVC tube to keep it rigid while cutting. For those who do not have access to a lathe, a perfectly serviceable alternative is to intersperse the coil turns with 2mm diameter polypropylene cord, as mentioned above.

Take your time and work methodically. Take a 600mm length of PVC pipe or electrical conduit, 35mm diameter



Fig. 1: The completed coil.

(not critical) and square off the ends accurately in a mitre block. Drill a 1.5mm hole about 50mm down from the top with a second 2mm hole adjacent to it. Drill two further holes as before about 25mm up from the other end. The coil is wound with 16SWG tinned copper wire over a length of about 500mm. Insert the wire through the first hole at the top and wind it round a small bolt so that it can't slide out. Ensure there is enough wire protruding to make a connection later.

Wind on fairly tightly about 180 turns then cut the wire a further 350mm along. Pass this end through the first hole at the lower end of the tube. The turns should remain fairly tight but movable. Go back to the top and thread the polypropylene cord through the other hole, securing it so it won't pull out. Now carefully wind the cord between each of the wire turns, pushing and twisting the coil turns up against the cord. Make sure that the cord doesn't slip under the wire; it should lie neatly between the turns and keep them tightly in place. You may need to add or remove a few turns of wire as you reach the lower end. Once complete you should end up with a neat, tight coil evenly spaced at about 9tpi (turns per inch) as shown in Fig. 1.

Pass the wire and cord through their respective holes at the end of the tube and secure tightly, cutting off and securing surplus cord. Cut the wire short and make a tight finish that cannot pull out. This end of the coil is left unconnected.

The coil former now needs to be fitted at each end with plugs to take the whip attachment at the top and the Allthread rod at the base. I made the plugs from nylon kitchen cutting board (not the XYL's of course!). Ideally, this board needs to be

about 10mm thick and can be cut using a hole borer, the sort with a drill bit through the centre, which has the advantage of placing a pilot hole in the dead centre of the plug. Alternatively, the plug can be cut out quite easily with a fretsaw then filed to fit the tube tightly. When you are happy with the fit of the top plug, check that it's flush with the top of the coil former and drill four equally spaced fixing holes (2 to 3mm) through the coil former and into the edge of the plug for about 10mm. Countersink the entry points by hand with a large drill bit for later flush fitment of retaining screws. These can be short, brass countersunk woodscrews. But first, the plug has to be fitted with some brass plumbing!

The nylon plug at the top end of the coil carries a 15mm to 10mm reducer (straight compression joint). Open out the hole in the centre of the nylon plug wide enough to allow the narrow end of the reducer to pass through. Cut away the underside of the plug if required so that the nut goes on the thread. Cut the pigtail at the top of the coil winding, just below the top of the former, and solder flexible wire to it. Connect the free end to a solder tag held in place with an M4 screw, drilled and tapped on the smaller end of the brass fitting. Attach the nut onto the brass fitting and tighten so you have the nylon plug sandwiched, see Fig. 2. Insert the plug into the top of the coil former, lining up your fixing screw holes and secure with four short brass countersunk screws. You should now have a closed end with the top of the coil internally connected to the brass fitting. Outside, the 15mm end of the brass fitting is uppermost, aligned centrally and ready to fit the first section of the 'whip' (copper tube).

Construction Materials and Tools

All materials used in the antenna's construction are readily available from sources and outlets listed below.

B&Q or other DIY outlet:

PVC pipe (for coil former) and 6mm Allthread rod.

15mm copper pipe and two straight brass compression joints.

Two 15mm to 10mm reducers.

eBay:

2mm diameter polypropylene cord.

Aluminium tube, acrylic (cover) tube.

Beryllium-copper fingerstock (optional).

600 x 600 x 3mm aluminium plate.

4-channel wireless remote control unit and key fob.

14SWG aluminium florists' wire.

Old cordless screwdriver – Bosch,

Black & Decker, Challenge or similar.

Maplin:

Telescopic antenna (Item code QT34M).

Other items:

Nylon kitchen cutting board (local hardware store).

Brass sheet (for optional home-made fingerstock) and brass mounting bracket (local model shop).

Sundry screws, nuts, bolts, 10 x 8mm

brass bar, split-pin (junk box).

To aid construction the following tools will be needed:

Set of hole borers for cutting collars and plugs from nylon board.

Set of metric taps.

Fretsaw, Rat's tail file, flat file, Mitre block and saw, screwdrivers, range of HSS drills.

Fitting the Threaded (Allthread) Rod

Refer to Figs. 3 and 4 before fitting the Allthread rod. Cordless screwdriver kits normally have an adaptor piece that inserts into the hexagonal drive shaft in order to extend their reach. This makes a convenient location for the Allthread, which should be a loose fit in the adaptor. A 6mm ($\frac{1}{4}$ in) diameter threaded rod was used. Screw two nuts of appropriate size onto the rod and run them up the rod for an inch or two. These serve as the lower stop-nuts and are adjusted later. Insert the end of the Allthread into the adaptor piece and drill a 2mm hole right through the adaptor and threaded rod, push in a small split-pin and bend the ends up to keep the rod from coming out. The rod should



Fig. 3: Threaded rod with stop nuts and screwdriver adaptor.

not be a tight fit in the adaptor but free to move slightly.

Cut another nylon plug to fit tightly into the base of the coil tube as you did for the top. Drill three retaining holes equally spaced and countersink as before but don't tighten up yet. Drill out this plug dead centre with a clearance hole through which the Allthread can pass freely then cut a short length of brass bar (I used 10 x 8mm square section), just wide enough to 'sit' across the end of the coil former, see Fig. 4. Drill a hole in the dead centre of the brass bar and tap a thread to take the Allthread. Then drill two 4mm clearance holes either side of the centre-threaded hole to take the retaining bolts, which will clamp the bar to the nylon plug. Line up the bar and plug, mark where the retaining bolts are and drill through the plug. Clamp the bar to the plug with M4 bolts and nuts. Run the Allthread into the bar and add two further stop nuts on the other end for later adjustment. Insert the assembly into the base of the coil tube so that the ends of the brass bar are resting on the sides of the tube, line up the retaining holes and screw up using countersunk brass screws as you did at the top. Ensure that



Fig. 4: Coil former base showing threaded rod fixing.

this plug is squared accurately and check that the coil former doesn't swing violently from side to side as you turn it on the rod, which would give a very jerky rise and fall motion when under motor power.

The Base Tube

The coil retracts or deploys from the base tube under motor power. The base tube was a 915mm (3ft) section of aluminium tubing for lightness and strength. It doesn't have to be aluminium but can be brass bedstead, copper tubing or chrome-plated water wastepipe. The wall thickness should be a minimum of 2mm and the inside diameter large enough to accept the cordless screwdriver and the coil, with clearance all round. An inside diameter of 2in (51mm) will accommodate most of the screwdriver units available. At this point, three identical nylon plugs need to be cut to fit tightly into one end of the base tube. These three plugs are drilled centrally then sandwiched together using a 10mm steel bolt and nut, which will also serve to mount the antenna onto the base plate later. Fit a plain washer and shakeproof washer under the nut to stop any tendency for rotation when the base tube is tightened onto the base plate. Drill a hole through the plug parallel to the mounting bolt, to thread the motor drive cable through.

Referring to Fig. 5, insert the nylon plug-and-bolt assembly into one end of the base tube so that two 'wafers' of the nylon plug are within the tube and one wafer protrudes. This is necessary to electrically isolate the base tube from the base plate. Drill eight equally spaced retaining holes through the metal tube casing and into the middle wafer of the three. Countersink the holes where the retaining screws will be inserted. The illustration shows small cuts made into the end of the base tube and the retaining screws placed between alternate cuts. These screws must not contact the central bolt. We have yet to fit the motor so remove the nylon plug and place it to one side.



Fig. 5: The base tube mounting plug.

Preparing the Motor

Open the cordless screwdriver casing and remove the batteries. Take care that the gearbox does not detach from the motor or you will have to spend time replacing all the gears! Unsolder all the leads from the battery to the switch and from the motor. Remove all of the switch mechanism. Across the two terminals on the back of the motor solder a 0.01µF disc ceramic capacitor. Connect at least one metre of twin cable to the terminals and route this out through a hole drilled in the end of the handle of the screwdriver casing. If you have space in the casing, insert as many ferrite beads as you can onto each lead to assist in choking stray RF and suppressing any interference from the motor. Close up the casing and test the motor at its recommended voltage using a bench power supply. Usually that will be between 2.4 and 3.6V depending on how many battery cells you extracted. If all is well, check that the modified screwdriver will insert into the base tube. If the switch housing on the screwdriver casing fouls the base tube, cut and file it away until it slides in centrally.

Place a short length of PVC pipe over the handle end of the screwdriver casing. The diameter of this sleeve should allow for a tight sliding fit but make sure that the motor still goes right into the metal base tube. Any slack can be taken out using insulating tape around the handle and elsewhere along the casing as necessary. The aim is to tightly fit the screwdriver into the base tube with the drive-end perfectly centralised to accept the adaptor on the end of the Allthread. The diagram, Fig. 6, gives a clearer idea of the setup.

Once the motor is lined up and firmly slid in the base tube, fit one retaining screw each side. These screws are inserted through the base tube either side of the screwdriver and into the PVC sleeve covering the handle. Insert the nylon end plug and bolt, passing the motor wires through the hole you previously drilled through it. Make sure the plug is square and in line with the previously drilled fixing

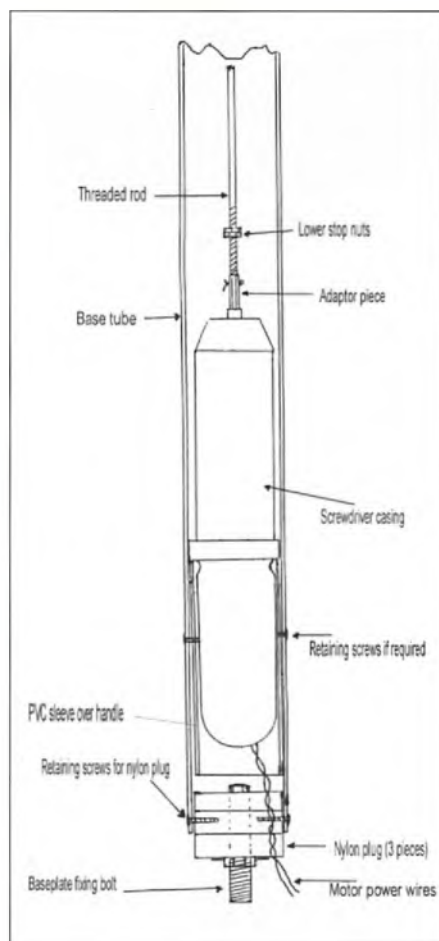


Fig. 6: The arrangement for fitting the motor in the base tube.

holes. Lock in place using eight short countersunk woodscrews and tighten up. Now is a good time for a quick function test so insert the coil and Allthread assembly in the other end of the base tube and locate the adapter in the drive end of the motor. If everything is centralised, there will be no problem in lining up and locating the adapter. Holding the other end of the coil centrally, energise the motor with its normal working voltage and make sure the coil moves up or down freely without excessive wobble or binding on the Allthread. Now is also a good time to adjust the lower stop nuts so adjust them at the point the coil is fully retracted into the base tube. In use, that should be at the topmost turn of the windings. When you have the correct adjustment, remove the coil and threaded rod and lock the stop nuts together.

Fitting the Fingerstock

Next prepare the fingerstock to encircle the top of the base tube so that it makes contact with the turns of the coil as it deploys. During construction, there was no beryllium-copper fingerstock available in the UK and the postal charges from

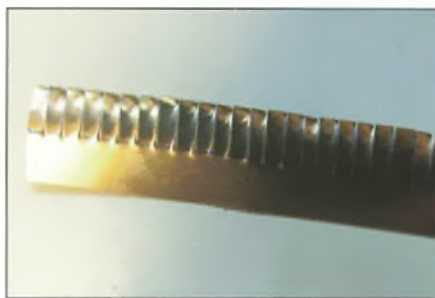


Fig. 7: The fingerstock after initial preparation.



Fig. 9: The fitted fingerstock, secured with M4 nuts.

the US were prohibitive but I eventually tracked down a supplier in Slovakia via eBay. Some readers may have their own supply from other projects but it is perfectly possible to make your own from brass shim and even better if you have access to a silver-plating bath or Plating Silver Cleaner solution. I used '10 thou' thick brass shim from the local model shop and cut off a strip approximately 20mm wide and long enough to go around the circumference of the base tube. Drawing a score line down the centre of the shim, cuts were made inwards from the long edge down to the score line. The width between cuts was 5mm, which resulted in a row of 'tabs' like that shown in Fig. 7.

Next, I bent every other tab back on itself, parallel to the uncut area, this part eventually being located around the top edge of the base tube. The remaining tabs were flattened so they were all parallel, then shaped as shown in Fig. 8 with a slight waist and bent slightly outwards at the top. Ensure they all look the same.

Place the fingerstock around the top of the base tube and cut to length. If you are using a brass or copper base tube, the fingerstock can be soldered on using a suitably robust blowtorch. Alternatively, the fingerstock and tube can be drilled through and threaded with an M4 tap. M4 bolts can then be used to retain the fingerstock in place along the top edge on the base tube. File the bolts flush inside the tube or use pop-rivets instead. The final product should resemble that in Fig. 9 or Fig. 10 if you are using the beryllium-copper finger-stock.



Fig. 8: The completed homebrew fingerstock.



Fig. 10: Beryllium copper fingerstock.

Insert the coil and Allthread rod assembly into the base tube from the top, taking care not to bend the fingerstock out of shape. Locate the drive adapter in the motor and adjust the contact of the fingers on the coil windings. You may need to bend in the 'fingers' in which case use your thumbnail in the waisted portion to ease the fingers until they make reliable contact but not too tight. Apply some power to the motor and ensure that the coil can move up and down freely on the rod without catching and bending the fingers. Check the electrical continuity between the base tube and the coil turns as they appear from the tube to ensure a consistent and reliable finger contact along the whole length of the coil. With the coil fully extended (on its last turn) you can now adjust the top stop-nuts, which will again require removal of the coil assembly. The stop nuts at this end can only be locked together after removal of the plug that carries the Allthread from the end of the coil tube. After locking the nuts together, reassemble into the end of the coil tube. This part does not have to be removed again.

Reinsert the coil assembly into the base tube and engage with the motor drive. Give yourself a pat on the back. You have now completed the lower part of the antenna.

Next Month

I will complete the description of the project next month. This month, though, I have included a parts list in the sidebar so that you can start to collect together the necessary hardware and tools.

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Mobiles

FTM-400XDE dual band digital mobile with 3
digital and 1 analogue mode, W/D, data FR
and Voice FR mode all at a great

.....our price £519.00

FTM-100DE Digital Dual Band Mobile Transceiver

with C4FM & FM 44/430 with 50W out at.....our price £299.00

FT-8900R Quad band 10/6/2/70cm 28-430MHz, 50 Watts output

.....our price £319.99

FT-8800E Dual band 2/70cm RX 10-999MHz, 50 Watts output

.....our price £299.99

FT-7800E Dual band 2/70cm 50/40 Watts with wideband RX

.....our price £249.99

FTM-3200DE is a ruggedly built yet compact C4FM/FM VHF mo-

bile transceiver, providing high output power of up to 65 Watts to

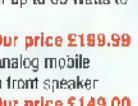
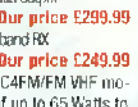
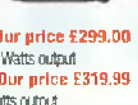
ensure stable long-distance communications

.....our price £189.99

FTM-3100DE 144MHz 65W FM Single band analog mobile

transceiver rugged & compact 2m mobile with front speaker

.....our price £149.00



All Yaesu accessories in stock on line at www.moonraker.eu

HF Transceivers

The **FT-991** is the next generation in all mode, all band MFAHF/HF/ VHF transceiver with C4FM (System Fusion) Digital capability. The FT-991 includes multi-mode operation on CW, AM, FM, SSB, and Digital Modes (Packet, PSK31, RTTY and C4FM) with 100 Watts of HF/50MHz Capability (50 Watts VHF/UHF).
Our price £949.00 (A version £1299.00)



FT-817ND The world's first self-contained, battery-powered, Multi-mode Portable Transceiver covering the HF, VHF, and UHF bands. Providing up to five watts of power output, the FT-817 is designed for operation on the 160-10 meter HF bands, plus the 6 metre, 2 metre, and 70 cm bands. Our price £599.99



FT-857D is the world's smallest HF/VHF/UHF mobile transceiver and provides base station-type performance from an ultra-compact package that's ideal for mobile or external battery portable work.
Our price £799.00



FT-450B is a compact yet superb HF/50MHz radio with state-of-the-art IF DSP technology configured to provide World Class performance in an easy to operate package. Suitable for all applications; beginners, casual operators, enthusiasts, portable/field users and emergency service providers at all a new low low price.
Our price £599.00



FT-DX1200 provides up to 100 Watts on SSB, CW, FM, and AM (25 Watts carrier) and a rugged state of the art highly balanced receiver circuit configuration for top performance on today's crowded bands. Similar to the high-end "YAESU FT DX" series, it uses 32-bit high speed floating point DSP for renowned proven performance and at an amazing low price.
Our price £1049.00 (with an extra £85 cashback from Yaesu UK)



NEW IN NEW IN NEW IN NEW IN

FT-891 HF/6 All Mode Transceiver -
Buy from stock now £689.00!

The NEW FT-891 offers up to 100 watts of HF/6m output power with efficient dual internal fans, coupled with Yaesu's legendary receiver design, triple conversion with a 1st IF frequency of 69.450MHz for really outstanding performance.



The **ICOM IC-7300** has
landed HF/6 & 4m Transceiver
at just £1199.95

The IC-7300 is a revolutionary
compact radio that will excite
HF operators from beginners to
experts. This new model has
a high-performance real-time
spectrum scope and employs
a new RF direct sampling
system. The IC-7300's real-time
spectrum scope provides top-level performance in resolution,
sweep speed and dynamic range. While listening to received
audio, the operator can check the real-time spectrum scope
and quickly move to the intended signal. The combination of
the real-time spectrum scope and waterfall function improves
the quality and efficiency of HF operation. The new RF direct
sampling system employed by the IC-7300 realises class leading
RMDR (Reciprocal Mixing Dynamic Range) and Phase Noise
characteristics. In addition, the IC-7300 features the 70MHz
band (European versions only), a large touch screen colour TFT
LCD, convenient multi-function dial knob, automatic antenna
tuner, voice recorder function and more.

ICOM
Authorised dealer



BAOFENG
Authorised dealer

"MASSIVE BULK
DISCOUNTS"

The every growing Baofeng family -
Quality products at amazing low prices

UV-5BR PLUS Amazing dual band handle, Full 4.5
Watts, 136-174/430-470MHz plus 66-108MHz RX comes
complete with desktop charger, antenna, belt clip, and an
amazing 1800mAh battery as standard and that's not the
best bit £49.95 Now just £29.99!



ALINCO New products arrive
at Moonraker

**New Alinco DR-735E 2/70cm Dual Band
Transceiver** £299.95

Full Duplex, Extended RX 108 - 174
MHz, 400 - 479 MHz, Large Display
with "rainbow" of colour options, 1,000
Memories, Scan facility, Power 50/20/5w
output. Computer programmable with free downloadable
software, Internal duplexer allows single antenna socket for dual
band antennas.



**Alinco DJ-MD40 UHF Digital and analogue FM Handheld
Transceiver** £179.99

The Alinco DJ-MD40 Handheld Transceiver is built to commercial
standards, being both rugged, dust and splash proof (to IP54
standard).

The radio covers 400 to 480 MHz and will work on both analogue
FM and OMR digital modes.

Output power is selectable from: 5, 2.5, 1 or 0.2 watts.

Alinco DM-30E Switch Mode Power Supply £89.95

This CE-Approved, affordable switching power supply packs a lot
of features into an ultra-compact, lightweight design that features
9-15VDC variable output and delivers up to 20A continuous, 30A
peak. Convenient for radio users, the Noise Offset Circuit moves
unwanted switching noise to another frequency. Other features
include a large illuminated digital Volt/Amp meter, rear panel
binding posts (30A peak/a pair), front panel quick terminals (5A
peak/a pair, banana for E, Anderson power Poles for T), voltage
adjust (9-15V) or fixed at 13.8V,
ripple less than 80mVp-p and
triple circuit protection for short-
circuit, over temperature, and
current limiting.



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Moonraker MT-270 25W dual band mobile transceiver
at an incredible £79.95

Now over 600 units
sold and counting.
Amazing radio
at an amazing
price with all the
basic features you need to get up
and mobile

Frequency: 136-174, 400-480MHz

Channels: 200

Channel Spacing: 25KHz, 20KHz, 12.5KHz

Phase Lock Step: 5KHz, 6.25KHz, 10KHz, 12.5KHz, 15KHz, 25KHz

Working Voltage: 13.8V DC CTCSS, DCS, 5 Tone, 2 Tone, DTMF

Size: 90(W) x 35(H) x 118 (D) mm Weight 408g



LEXION

VV-898 Dual Band Mobile Transceiver

What a great entry level dual band rig, with only 10 Watts it is
ideal for the new foundation pass holders. Comes complete
with radio bracket and keypad
microphone - all for a price
you just won't believe

Moonraker

Super Special

£99.95 Now £59.95!



PRICE MATCH! Due to Brexit prices are going up weekly! But massive stocks mean we
still have some stock at old prices - Call or email us now for the **BEST DEAL** around

Visit us now at www.moonraker.eu

A very Merry Christmas to all our customers now and in the future!

We look forward to serving you again in 2017



Chris Taylor G6WTZ joins the ever expanding Moonraker Team – after spending over three decades in the industry we are pleased to have him on board. If you know Chris why not call for a catch up, or drop him an email at chris@moonraker.eu I am sure he will be glad to hear from you

MOONRAKER

Yagi Antennas

All Yagis have high quality gamma match fittings with stainless steel fixings! (excluding YG4-2C)

YG27-35 Dual band 3/5 element 3.5/12.5 dBd gain with one feed!	£79.95
YG4-2C 2 metre 4 Element (Boom 48") (Gain 7dBd)	£29.95
YG5-2 2 metre 5 Element (Boom 53") (Gain 10dBd)	£69.95
YG8-2 2 metre 8 Element (Boom 125") (Gain 12dBd)	£99.95
YG3-4 4 metre 3 Element (Boom 45") (Gain 8dBd)	£79.95
YG5-4 4 metre 5 Element (Boom 104") (Gain 10dBd)	£99.95
YG3-6 6 metre 3 Element (Boom 72") (Gain 7.5dBd)	£99.95
YG5-6 6 metre 5 Element (Boom 142") (Gain 9.5dBd)	£119.95

ZL Special Yagi Antennas

The ZL special gives you a massive gain for the smallest boom length... no wonder they are our best selling Yagis!

ZL5-2 2 Metre 5 Ele, Boom 95cm, Gain 9.5dBd	£69.95
ZL7-2 2 Metre 7 Ele, Boom 150cm, Gain 11.5dBd	£79.95
ZL12-2 2 Metre 12 Ele, Boom 315cm, Gain 14dBd	£149.95
ZL7-70 70cm 7 Ele, Boom 70cm, Gain 11.5dBd	£49.95
ZL12-70 70cm 12 Ele, Boom 120cm, Gain 14dBd	£59.95

HB9CV

Brilliant 2 element beams... Ideal for portable use

HB9-70 70cm (Boom 12")	£24.95
HB9-2 2 metre (Boom 20")	£29.95
HB9-4 4 metre (Boom 23")	£39.95
HB9-6 6 metre (Boom 33")	£49.95

Halo Loops

Our most popular compact antennas, great base, mobile, portable, or wherever!

HLP-2 2 metre (size approx 300mm square)	£24.95
HLP-4 4 metre (size approx 600mm square)	£39.95
HLP-6 6 metre (size approx 800mm square)	£44.95

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QRP Antennas

The Moonraker Whizz range are great for getting on HF in a real compact and totally portable way

Whizz Whip HF/VHF/UHF portable antenna with telescopic whip - ideal for any situation where a long wire or vertical antenna is just not an option - get on air today for just £99.95



Whizz Loop 20-60m compact loop - is ideal for QRP Transceivers when space is limited or using portable with a Yaesu FT-817ND or similar. Can be used indoors with surprising results and handy for travelling due to its "pocket" size antenna ideal for indoor or out can be packed away and all for just £69.95

Back in stock at last MD-7400 40-70cm Multiband Mobile Antenna at a new lower price!

This is a wideband mobile whip that is manually tuned by sliding the telescoping coil at the base. The telescopic whip may also be adjusted for fine tuning and optimizing the VHF/UHF performance. Maximum length of the antenna is 1.77m and maximum power handling is 130W

One antenna HF/VHF & UHF and one amazing new low price £79.95

Whizz Loop V2 same as above but with a frequency range from 40-10m... £79.95

Portable Telescopic Masts

LMA-S Length 17.6ft open 4ft closed 2-1" diameter... £79.95

LMA-M Length 26ft open 5.5ft closed 2-1" diameter... £89.95

LMA-L Length 33ft open 7.2ft closed 2-1" diameter... £99.95

CARPLATE-HDT brilliant drive on plate with tilt - ideal to be used in conjunction with the portable telescopic masts and only... £44.95

20ft Swaged Mast Sets

These heavy duty mast sets have lovely push fit swaged sections to give a strong mast set. Ideal for portable or permanent installations... also available singly

MSP-125 4 section 1.25inch OD mast set	£39.95
MSP-150 4 section 1.50inch OD mast set	£44.95
MSP-150 heavy duty 2.65mm 1.50 inch OD mast set	£99.95
MSP-175 4 section 1.75inch OD mast set	£49.95
MSP-200 4 section 2.00inch OD mast set	£59.95
MSPX-200 heavy duty 2.65mm 2.00 inch OD mast set	£79.95

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Mobile Antenna Mounts

TRIMAG-S Triple magnetic mount with SO239 antenna fitting with 4m

RG58 and PL259 fitted - ideal for those larger antennas... just £39.95

TURBO-S single 170mm magnetic mount with SO239 antenna fitting with 4m

RG58 and PL259 fitted - will suit most antennas upto 5ft... £19.95

HKITHD-SO Heavy duty hatch back mount with SO239 antenna fitting with 4m

RG58 and PL259 fitted... £32.95

HKITM-S Mini hatch back mount with SO239 antenna fitting with 4m

RG58 and PL259 fitted... £32.95

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Multiband Mobile

Why buy loads of different antennas when Moonraker has one to cover all! SPX series has a unique fly lead and socket for quick band changing

SPX-100 9 Band plug n' go portable, 6/10/12/15/17/20/30/40/80cm, Length 165cm retracted just 0.5m, Power 50W complete with 38th PL259 or BNC fitting to suit all applications, mobile portable or base - brilliant!

£44.95

SPX-200S 6 Band plug n' go mobile, 6/10/15/20/40/80cm, Length 130cm, Power 120W, PL259 fitting

£44.95

SPX-300S 9 Band plug n' go mobile, 6/10/12/15/17/20/30/40/80cm, Length 165cm, High Power 200W, PL259 fitting

£59.95

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VHF/UHF Mobiles

GF151 Glass Mount 270cm, Gain 2.9/4.3dBd, Length 78cm complete with 4m cable and PL259

£29.95

MRM-100 MICRO MAG 270cm, Gain 0.5/3.0dBd, Length 55cm, 1" magnetic base with 4m coax and BNC

£19.95

MR700 270cm, Gain 0.3/3.0dBd, Length 50cm, 3/8 fitting

£9.95

MR777 270cm, Gain 2.8/4.8dBd, Length 150cm, 3/8 fitting

£19.95

MRQ525 270cm, Gain 0.5/3.2dBd, Length 43cm, PL259 fitting (high quality)

£19.95

MRQ500 270cm, Gain 3.2/5.8dBd, Length 95cm, PL259 fitting (high quality)

£26.95

MRQ750 270cm, Gain 5.5/8.0dBd, Length 150cm, PL259 fitting (high quality)

£36.95

MRQ800 6/270cm Gain 3.0dBd/5.0/7.5dBd, Length 150cm, PL259 fitting (high quality)

£39.95

MRQ273 270/23cm Gain 3.5/5.5/7.5dBd, Length 85cm, PL259 fitting (high quality)

£49.95

MRQ900 10/6/270cm Gain 10m (2.15dB) 6m (2.5dB) 2m (2.8dB) 70cm (5.5dB) Length: 125cm PL259 fitting

£49.95

PAM Kit

A great portable freestanding tripod which can be extended to 4m. Perfect for field days at a perfect price. Just £59.95 complete

Telescopic Masts

TMF-1 Fibreglass mast * 4 sections 160cm each * 50mm to 30mm * Approx 20ft erect 8ft collapsed... £179.95

TMF-1.5 Fibreglass mast * 5 sections 200cm each * 60mm to 30mm * Approx 30ft erect 8ft collapsed... £249.95

TMF-2 Fibreglass mast * 5 sections 240cm each * 60mm to 30mm * Approx 40ft erect 8ft collapsed... £299.95

TMF-3 Fibreglass mast * 6 sections 240cm each * 65-23mm * Approx 50ft erect 8ft collapsed... £349.95

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Single, Dual, Triple and Quadband Verticals - we have the lot

Diamond quality - Moonraker prices! These high gain antennas have been pre-tuned for your convenience, easy to use, easy to install, and a choice of connection... look no further

SQB1100P 270cm 3.0/6.0dBd, RX 25-2000MHz, Length 100cm SO239... £49.95 special offer £39.95

SQB200P 270cm, Gain 4.5/7.5dBd, RX 25-2000MHz, Length 155cm, SO239

£54.95 special offer £44.95

SQB500P 270cm, Gain 6.8/9.2dBd, RX 25-2000MHz, Length 250cm, SO239

£74.95 special offer £69.95

SQB800P 270cm, Gain 8.5/12.5dBd, RX 25-2000MHz, Length 520cm, N-Type

£139.95 special offer £99.95

SQB1100P 6/270cm Gain 3.0/6.0dBd, RX 25-2000MHz, Length 250cm, SO239

£84.95

SQB223N 270/23cm, Gain 4.5/7.5/12.5dBd, RX 25-2000MHz, Length 155cm, N-Type

£79.95

SQB401P Quadband 10/4/270cm Gain 2.5/3.2/3.8/5.5dBd, Length 120cm

£69.95

SQB601P Quadband 10/6/270cm Gain 2.5/3.2/3.8/5.5dBd, Length 120cm

£69.95

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HF Wire Antennas

All our HF wire antennas are made with complete waterproof potted baluns and high quality "original" flexweave antenna wire.

MDHF-80 3.5MHz balun matched mono dipole, length 40m... £59.95

MDHF-40 7.0MHz balun matched mono dipole, length 20m... £49.95

MDHF-20 14MHz balun matched mono dipole, length 10m... £39.95

OSHF-80 3.5-30MHz balun matched off set dipole, length 40m... £59.95

OSHF-40 7.0-30MHz balun matched off set dipole, length 22m... £44.95

OSHF-20 14-30MHz balun matched off set dipole, length 11m... £39.95

LWHF-160 1.8-50MHz unun match end fed antenna, length 42m... £49.95

LWHF-80 3.5-50MHz unun match end fed antenna, length 20m... £44.95

LWHF-40 7.0-50MHz unun match end fed antenna, length 10m... £39.95

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Get great results with the Moonraker range of HF mobiles! ... from as little as £19.95!

HF Mobiles

AMPRO-10 Slim line design 28MHz 2m approx. 3/8th fitting... £22.95

AMPRO-11 Slim line design 27MHz 2m approx. 3/8th fitting... £22.95

AMPRO-12 Slim line design 24MHz 2m approx. 3/8th fitting... £22.95

AMPRO-15 Slim line design 21MHz 2m approx. 3/8th fitting... £22.95

AMPRO-17 Slim line design 18MHz 2m approx. 3/8th fitting... £22.95

AMPRO-20 Slim line design 14MHz 2m approx. 3/8th fitting... £22.95

AMPRO-30 Slim line design 10MHz 2m approx. 3/8th fitting... £22.95

AMPRO-40 Slim line design 7MHz 2m approx. 3/8th fitting... £22.95

AMPRO-60 Slim line design 5MHz 2m approx. 3/8th fitting... £24.95

AMPRO-80 Slim line design 3.5MHz 2m approx. 3/8th fitting... £27.95

AMPRO-160 Slim line design 28MHz 2m approx. 3/8th fitting... £59.95

Other frequencies available. Call or see online for more details.

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No longer do you need to be stuck on the M25 when in the centre of the country just south of Milton Keynes we have everything you could need from stock - we look forward to seeing you soon!





Cable

RG58 Standard, 5mm, 50 ohm, per metre	£0.35
RG58-DRUM-50 Standard, 5mm, 50 ohm, 50m reel	£14.95
RG58-DRUM-100 Standard, 5mm, 50 ohm, 100m reel	£24.95
RG58M Mil spec, 5mm, 50 ohm, per metre (best seller)	£0.60
RG58M-DRUM-50 new 50m reel of mil spec RG58 in a great handy size only	£24.95
RG58M-DRUM-100 Mil spec, 5mm, 50 ohm, 100m reel	£44.95
RG61M18 Mil spec, 7mm, 50 ohm, in grey per metre (amateur favourite)	£0.75
RG61M18-DRUM-100 Mil spec, 7mm, 50 ohm, in grey 100m reel	£64.95
RG213 Mil spec, 9mm, 50 ohm, per metre	£1.30
RG213-DRUM-50 Mil spec, 9mm, 50 ohm, 50m reel	£59.95
RG213-DRUM-100 Mil spec, 9mm, 50 ohm, 100m reel	£109.95
WESTFLEX103 Mil spec, 10mm, 50 ohm, per metre	£1.50
WESTFLEX-DRUM-50 Mil spec, 10mm, 50 ohm, 50m reel	£69.95
WESTFLEX103-DRUM-100 Mil spec, 10mm, 50 ohm, 100m reel	£129.95
300-20M Ladder Ribbon, best USA quality, 300 ohm, 20m pack	£17.95
300-DRUM Ladder Ribbon, best USA quality, 300 ohm, 100m reel	£69.95
450-20M Ladder Ribbon, best USA quality, 450 ohm, 20m pack	£19.95
450-DRUM Ladder Ribbon, best USA quality, 450 ohm, 100m reel	£79.95

Antenna Wire

Perfect for making your own antennas, traps, long wire aereals etc.

SEW-50 Multi stranded PVC covered wire, 1.2mm	£19.95
SCW-50 Enamelled copper wire, 1.5mm	£24.95
HCW-50 Hard Drawn bare copper wire, 1.5mm	£29.95
CSS-50 Genuine Copperweld copper clad steel, 1.6mm	£29.95
FW-50 Original Flexweave bare copper wire, 2mm	£34.95
FWPVC-50 Original clear PVC covered copper wire, 4mm	£44.95
FW-100 Original high quality flexweave antenna wire, 100m reel	£59.95
FWPVC-100 Original PVC coated flexweave antenna wire, 4mm, 100m reel	£79.95

Rigging Accessories

Get rigged up, for full list of all options visit our website!

PULLEY-2 Adjustable pulley wheel for wire antennas, suits all types of rope	£24.95
GUYKIT-HD10 Complete heavy duty adjustable guying kit to suit up to 40R masts	£54.95
GUYKIT-LD10 Complete light duty/portable guying kit to suit up to 40R masts	£39.95
SPIDER-3 Fixed 3 point mast collar for guy ropes	£5.95
SPIDER-4 Fixed 4 point mast collar for guy ropes	£6.95
PTP-20 Pole to pole clamp to clamp up to 2" to 2"	£5.95
DPC-W Wire dipole centre to suit either 300 or 450ohm ladder line	£5.95
DPC-S Wire dipole centre with SO239 to suit cable feed connections	£6.95
DPC-A Dipole centre to suit 1/2 inch aluminium tube with terminal connections	£7.95
DPC-38 Dipole centre with SO239 socket with two 3/8th sockets to make mobile dipole	£6.95
DOGBONE-S Small ribbed wire insulator	£1.00
DOGBONE-L Large ribbed wire insulator	£1.50
DOGBONE-C Small ceramic wire insulator	£1.20
EARTHROD-C 4R copper earth rod and clamp	£24.95
EARTHROD-CP 4R copper plated earth rod and clamp	£16.95
GSRY-ES In-line SO239 replacement socket for 300 or 450 ohm ladder line	£6.95
AMA-10 Self amalgamating tape for connection joints, 10m length	£7.50

Mounting Hardware & Clamps

We have all the mounting brackets you could possibly want - for all options see our website

TRIPOD-HDA Free standing, heavy duty, fold away tripod, which adjusts from 50-65mm	£149.95
TRIPOD-25L Free standing heavy duty tripod to suit masts 65mm or less	£79.95
TRIPOD-20L Free standing heavy duty tripod to suit masts 2 inch or less	£74.95
TRIPOD-15L Free standing heavy duty tripod to suit masts 1.5 inch or less	£69.95
TK-24 Heavy duty galvanised pair of T & K brackets, 24 inches total length	£29.95
TK-18 Heavy duty galvanised pair of T & K brackets, 18 inches total length	£24.95
TK-12 Heavy duty galvanised pair of T & K brackets, 12 inches total length	£19.95
SO-9 Heavy duty galvanised single stand off bracket, 9 inches total length	£9.95
SO-6 Heavy duty galvanised single stand off bracket, 6 inches total length	£6.95
CHIM-10 Heavy duty galvanised chimney lashing kit with all fixings, suitable for up to 2 inch	£24.95
CAR-PLATE Drive on bracket with vertical up stand to suit 1.5 or 2" mounting pole	£24.95
CROSS-2 Heavy duty cross over plate to suit 1.5 to 2" vertical to horizontal pole	£14.95
JOIN-200 Heavy duty 3 nut joining sleeve to connect 2 X 2" poles together	£19.95
PTM-S Pole mounting bracket with SO239 for mobile whips, suits up to 2" pole	£19.95

RM Linear

These superb linear amps have just arrived from Italy, great range to suit all bands and at realistic prices. In stock now!

NEW LOW PRICES ON RM AMPS



HF Linear

NEW DESIGN 8LA 350 mains powered solid state amplifier with a 300W output covering top band to 10m. ~~£649.95~~ now just **£599.95**

HLA 305V 12v 250W Professional Wideband HF 1.8-30MHz Amplifier with LCD. With LCD and built in fans ~~£599.95~~ now just **£579.95**

HLA 305 12v 250W Professional Wideband HF 1.8-30MHz Amplifier with LCD but without fans ~~£599.95~~ now just **£429.95**

HLA 300V + 12V 300/350W SSB output 1.8 to 30MHz with cooling fans ~~£449.95~~ now just **£429.95**

HLA 300 + 12V 300/350W SSB output 1.8 to 30MHz without fans ~~£449.95~~ now just **£349.95**

HLA 150V + 12V 150/250W SSB output 1.8 to 30MHz with cooling fans ~~£399.95~~ now just **£349.95**

HLA 150 + 12V 150/250W SSB output 1.8-30MHz without fans ~~£349.95~~ now just **£249.95**

KL 505 12v 300/600W SSB 3.6-30MHz adjustable amplifier with Pre-Amp... ~~£499.95~~ now just **£229.95**

KL 506 12v 300/600W SSB 3.6-30MHz amplifier with Pre-Amp... ~~£299.95~~ now just **£279.95**

KL 405V 12v 200/400W SSB 3.6-30MHz adjustable amplifier with Pre-Amp... ~~£179.95~~ now just **£149.95**

KL 405 12v 200/400W SSB 3.6-30MHz adjustable amplifier with Pre-Amp... ~~£149.95~~ now just **£129.95**

KL 203P 12V 100W output with pre-amp 20-30MHz without fans ~~£49.95~~ now just **£39.95**

KL 203 12V 100W output 18-30MHz without fans ~~£44.95~~ now just **£37.95**

VHF/UHF Amplifier

LA 250V 12V 200W 140-150MHz Professional amplifier with fans ~~£499.95~~ now just **£449.95**

LA 250 12V 200W 140-150MHz Professional amplifier without fans ~~£449.95~~ now just **£419.95**

ULA 100 12V 100W 420-140MHz ideal for handies due to 5w input power ~~£449.95~~ now just **£399.95**

KL 145 12V 100W 100-150MHz solid state linear amp ~~£149.95~~ now just **£129.95**

LA 145 12V 85W 135-175MHz wideband linear amp ~~£149.95~~ now just **£129.95**

LA 144 12V 70W 135-175MHz wideband linear amp ~~£99.95~~ now just **£89.95**

Patch Leads

PL58-0.5 1/2m Standard RG58 PL259 to PL259 lead ~~£3.50~~ now just **£3.50**

PL58-10 10m Standard RG58 PL259 to PL259 lead ~~£8.95~~ now just **£8.95**

PL58-30 30m Standard RG58 PL259 to PL259 lead ~~£16.95~~ now just **£16.95**

PL58M-0.5 1/2m Mil Spec RG58 PL259 to PL259 lead ~~£4.50~~ now just **£4.50**

PL58M-10 10m Mil Spec RG58 PL259 to PL259 lead ~~£12.95~~ now just **£12.95**

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Making Waves

The Skip Zone

Steve White G3ZVW looks this time at skip zone and what it means for HF propagation.

When you listen for signals on High Frequencies (HF or Short Wave) there are distances away from you from which you don't usually hear other stations. It's known as the Skip Zone and it is a widely misunderstood and misquoted aspect of propagation. In this instalment I will try to cast some light on it for you.

The Skip Zone

When a signal is transmitted it leaves the antenna and spreads out. Although real antennas don't spread signals out equally in all directions, let's pretend for the moment that we have an antenna that does. The diagram, Fig. 1, illustrates this in a simplified form, showing signals of equal strengths leaving a transmitting antenna at angles of 0, 20, 40, 60 and 80 degrees above the ground. For the

sake of simplicity I do not show it but the antenna will also be radiating signals in all directions of the compass. As I said in the Ground Wave instalment of *Making Waves* in July 2016, because of the curvature of the Earth there is a distance beyond which signals radiated parallel to the ground don't reach. The distance varies with frequency. It is thousands of miles at really low frequency (tens of kilohertz) and gradually reduces to a few tens of miles at HF. Beyond that range you don't hear stations via Ground Wave propagation. Ground Wave propagation remains about the same, irrespective of other radio conditions.

Sky Waves

Now let's start to look at what happens when signals are transmitted skywards. We know from the March 2016 instalment of *Making Waves* that the ionosphere consists of various Regions at various heights above the ground, but for the moment I am going to ask you to look at Fig. 2, in which I simplify the situation and show the ionosphere as a single line. In this illustration I have also eliminated the signals that are going towards the left of the diagram. If they were still present, they would just be a mirror image of what the illustration shows.

The ionosphere refracts radio signals back to earth, so you might expect signals to be refracted back as shown in Fig. 2. Unfortunately, things aren't this simple because the ionosphere isn't a perfect reflector. At HF the situation is more likely to be as shown in Fig. 3. At high angles (say 80°) the ionosphere is more likely to be transparent. Signals might well go straight through it and out into space, with practically none returned to earth. At 60° some of the signal is likely to be returned, at 40° most of it is likely to be returned, while at 20° and below all of it might be returned. If we liken the situation to visible light, the ionosphere gradually changes from a completely transparent sheet of glass above your head into a mirror out at the horizon. The diagram, Fig. 4, is like Fig. 3, except that on the surface of the Earth I show (as green lines) the areas covered by the Ground Wave signal and the signal returned from the ionosphere. The latter is known as Sky Wave. In terms of signal strength, the Ground Wave gradually fades out, after which the Sky Wave gradually gets stronger and then fades out.

The Doughnut of Silence

Some radio enthusiasts are wont to say things along the lines of "I worked him via the skip". In reality the Skip Zone – which



Fig 1: Signals leaving a transmitting antenna.

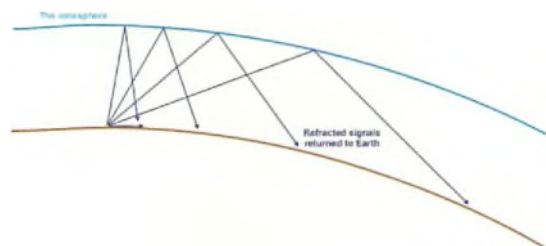


Fig 2: How you might think the ionosphere would refract signals back to Earth.

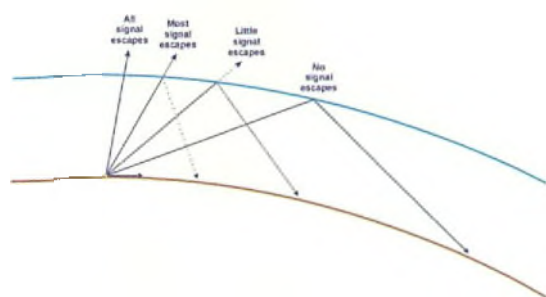


Fig 3: How the ionosphere actually refracts signals back to Earth.

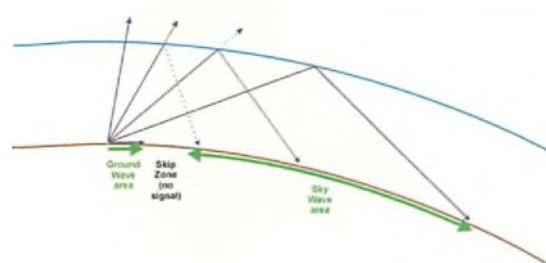


Fig 4: The areas of the ground that might actually be covered by an HF transmitted signal.

is sometimes also called the Dead Zone – is the doughnut shaped ring between the green areas where there is a gap in the signal coverage and is shown in Fig. 5a as an overhead view of the same.

It's useful to appreciate that the size of the Skip Zone changes with frequency. For example, the Doughnut of Silence isn't the same size on 7MHz as it is on 14MHz and to complicate matters, it doesn't remain constant, even on one frequency. When radio propagation changes such that there is stronger ionisation, the ionosphere can act more like a mirror. This results in something known as Short Skip propagation, where the Skip Zone is much narrower. The diagram, Fig. 5b, illustrates this. Under certain conditions, when there is really Short Skip propagation at HF, high angle signals might be refracted back to earth so close to the transmitter that they almost meet – or sometimes even overlap – the far edge of Ground Wave propagation, providing continuous coverage out to over a thousand miles.

Practical Example

Listen to the 14MHz band during the daytime and find someone from Continental Europe calling CQ on it. The way propagation is currently, you'll probably receive some signals quite strongly. Make a note of the stations being worked by the Continental. Let's say you come across someone in Sweden. He might well be called by people in countries such as Britain, Spain and Italy. Because of the Skip Zone you are likely to hear the stations in Italy and Spain much stronger than stations in Britain; indeed you might not hear any British stations he works at all. The same will apply if you tune around the band to see what you can hear yourself, rather than checking out what others are working. If you're in Britain you're likely to hear signals from numerous Continental countries but not Britain (except for any stations within maybe the 30 mile or so radius of Ground Wave propagation). This is because the vast majority of the British Isles will be in the Skip Zone. It may seem counterintuitive but you are likely to hear stations 500 to 1500 miles away much stronger than you hear stations much closer.

Exploiting Reality

Earlier I said that "real antennas never spread signals out equally in all directions". People who understand antennas and propagation exploit this.

If you look through advertisements for commercial beam antennas for the HF

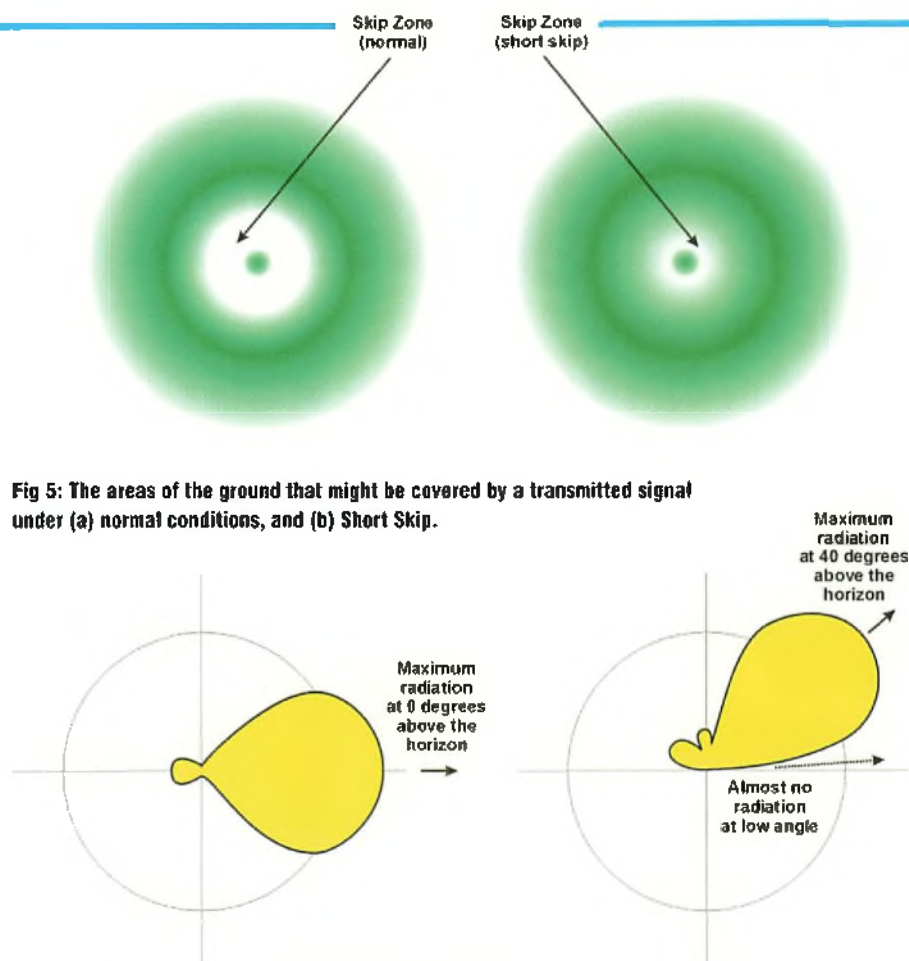


Fig 5: The areas of the ground that might be covered by a transmitted signal under (a) normal conditions, and (b) Short Skip.

Fig 6: (a) How an advertisement might depict the radiation pattern of an HF beam and (b) what it is more likely to be if it is too close to the ground.

bands, you are likely to see gain figures quoted. A 3-element HF beam might have a quoted gain figure of about 7dBd (which means five times more signal than a dipole in the direction it is pointing). Now let's consider something that the adverts never mention – Radiation Angle. Radiation Angle is the term used to refer to the angle that the main lobe of the beam will send/receive the strongest signal. The advert for the antenna might show a diagram along the lines of Fig. 6a, but this only applies if the antenna is in Free Space – in other words, a long way from anything that might distort the pattern. If the antenna isn't in Free Space – that is to say, it is close to the ground – the radiation pattern is more likely to be something like Fig. 6b. Here the strongest radiation is at 40° and there is almost no radiation at low angles. Low angle radiation is what you need for long distance working.

Before I go any further, please be aware that the shorter wavelengths of VHF mean that a VHF beam antenna only needs to be a few metres above ground to be operating in what is effectively Free Space although greater height is something to aspire to, to get it clear of local obstructions and reduce the potential for causing and receiving interference.

So how high does an HF beam need to be for the radiation angle not to be

seriously compromised and pushed upwards? The answer to this question depends on the frequency and the local terrain but 20-30 metres would not be an unreasonable figure. A 20m tower is a practical proposition for some people but what about DXpeditioners who travel to all parts of the world to activate rare countries and tiny islands? They aren't likely to ship a 30m tower half way round the world but, equally, they know that an HF beam antenna at, say, 5m-10m above the ground isn't going to get them heard at long distances.

The solution to the problem might seem surprising – it's a vertical dipole (that has 0dBd gain) or a vertical dipole with a reflector (that has modest gain). So how is it that the vertical dipole can out-perform the beam? It's all down to Radiation Angle. A vertical dipole or a vertical dipole with a reflector has a low Radiation Angle, especially if it is located close to the sea – and close to the sea is exactly where lots of DXpeditions choose to operate. Even at a metre or two above ground this will radiate more signal at low angle (like Fig 6a), which the ionosphere will refract back at the greatest possible distance.

Yes, at HF a simple vertical dipole can out-perform a beam if the beam isn't high enough.

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Capacitance Meter Kit

Having overviewed the kit market last month, Colin Redwood G6MXL decided to get his soldering iron out and build a capacitance meter from a kit. Hopefully his detailed instructions will encourage readers to join him.

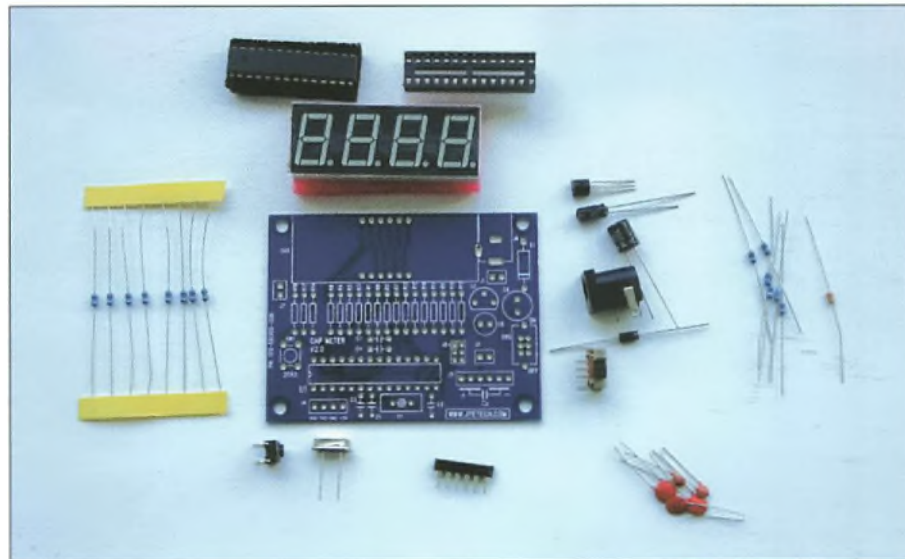


Fig. 1: The PCB and components as supplied.

When I was looking at the kits market last month, the capacitance meter kit from the Chinese company JYE Tech particularly caught my attention. This is an auto-ranging capacitance meter, covering from 1pF to 500µF and requiring a supply of 8 to 16V DC. Few, if any, analogue multimeters can measure capacitance. Likewise the cheapest digital multimeters don't usually have a capacitance range and even if they do, they often don't cover such a wide range of values. So I thought it would be a useful project for many PW readers.

The kit is available from a number of sources. Initially I ordered one through the Amazon UK website but about a month later the order was cancelled by Amazon

for no apparent reason. I then searched JYE Tech's website at: www.jyetechnology.com

On JYE Tech's website I discovered that there is a UK distributor that sells the kits on eBay with stock in the UK so I placed my order through that route. A few days later, an already assembled printed circuit board (PCB) arrived by post! I was determined to build the capacitance meter as a kit so, not to be put off, I dug around the internet again and found that a kit of parts is available from Hobbytronics. I placed an order through their website and a day later a kit of parts with PCB arrived in a sealed bag. www.hobbytronics.co.uk

What's Included?

The kit includes all the necessary

components and the double-sided, through-hole plated PCB, Fig. 1. To obtain good results with low value capacitors, the instructions suggest fitting the board in a small metal box, with the ground side of the circuit connected to the box. The PCB has holes in each corner to facilitate this but you'll need to obtain the box separately. You'll also need to provide a power supply with a lead terminated in a 2.1mm power plug (centre positive). Alternatively you could use a battery clip and a PP3 type battery, both of which you'll need to provide. The leads from the battery clip could be soldered to the board at J1, paying particular attention to getting them orientated the correct way round.

Who Is the Kit Suitable for?

I think the kit is suitable for any constructors who can reliably solder small components onto 0.1in matrix Veroboard without bridging the tracks. Fortunately there is a coating on the PCB to which solder does not adhere, which reduces the likelihood of solder bridges. This certainly makes it easier than Veroboard. The components are all small (1/8W resistors for example) and are packed quite densely on the printed circuit board. Many of the components are laid out with pins at 0.1in (2.54mm) separation, including the display, the microprocessor integrated circuit (supplied with a suitable socket) and a row of resistors that drive the light emitting diode display.

Instructions

The assembly instructions that come with the kit are minimal, directing the constructor to install the components onto the well-labelled PCB and ignoring places on the PCB where components are not included on the parts list. Some guidance on installing the two electrolytic capacitors correctly is provided but without helping inexperienced constructors to know which lead on the capacitors is positive and which negative. Hopefully what follows will help readers.

Circuit Diagram

The photocopied circuit diagram, Fig. 2, is quite small. It uses American circuit symbols – a zig-zag line for resistors, for example, while electrolytic capacitors are shown with a rounded end for the negative.

What You'll Need

You'll need a soldering iron with a really small tip. You'll also need some good lighting so that you can see what you are soldering and can follow the tracks on

both sides of the board. This project is a good test of your eyesight. Some readers may find that they will need some form of magnification to assist them, although I managed without difficulty.

Building

Where possible, I like to build projects by building and testing as I go. For this project, I decided to deal with the DC input and regulation first. It will be needed to test all other aspects of the project and it is good to know that the input voltage is correctly being dropped to the +5V DC that is needed for the main part of the circuit.

The components needed for this stage are D1 (the 1N4001 diode), the two (black) electrolytic capacitors (C5 and C6), the voltage regulator integrated circuit LM78L05 (U2), the on-off switch (SW2) and the DC socket (J6).

It is vital that the two electrolytic capacitors are inserted the correct way round. The negative leads (the shorter ones) and the white band with the black negative sign on the side of C5 and C6 are both closest to the on-off switch. The voltage regulator looks like a small transistor and is the only component with three leads, which must each be inserted in the correct holes as shown on the PCB. The PCB clearly shows the correct orientation of the 1N4001 diode.

Once I had built this stage, Fig. 3, I connected a current limited power supply and applied about 9V DC to the input socket. Using my digital multimeter, I was pleased to read 5.07V on the output of the regulator circuit on the positive lead of C5 on the PCB when I switched on. If you don't get a value close to 5V, then I suggest that you stop building and double check everything.

Resistors

With the DC power supply regulation working, I continued the build with the remaining components, starting with the resistors. The resistors supplied in my kit were a mixture of mainly the four-band plus tolerance band variety. Because the resistors are so small and the colours not very distinct, I measured each on a digital multimeter to be certain before fitting them. Don't rely on the colour of the body of the resistors shown in the photos because these vary between batches of the kits. Note that although resistors R10,

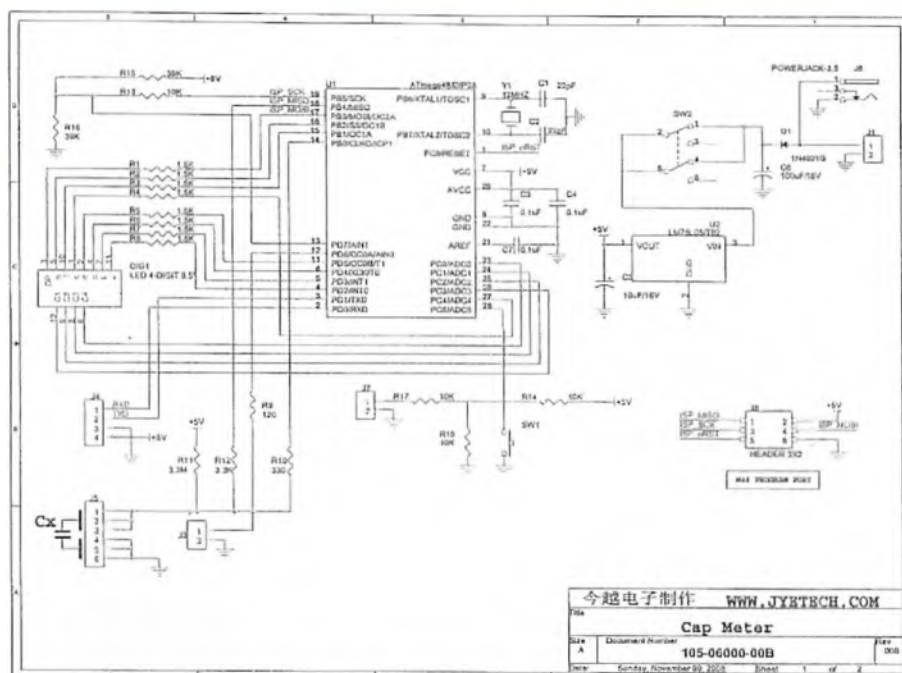


Fig. 2: The circuit diagram.

Table 1 – Specification of the Capacitance Meter.

Board Size (no components)	74 x 67mm
Power supply	8V to 16V DC
Current drawn	Less than 30mA
Range	1pF to 500µF
Error	Less than 2%

R17 and R18 are shown on the circuit diagram and there are places on the PCB for them, they are not supplied or required.

Capacitors

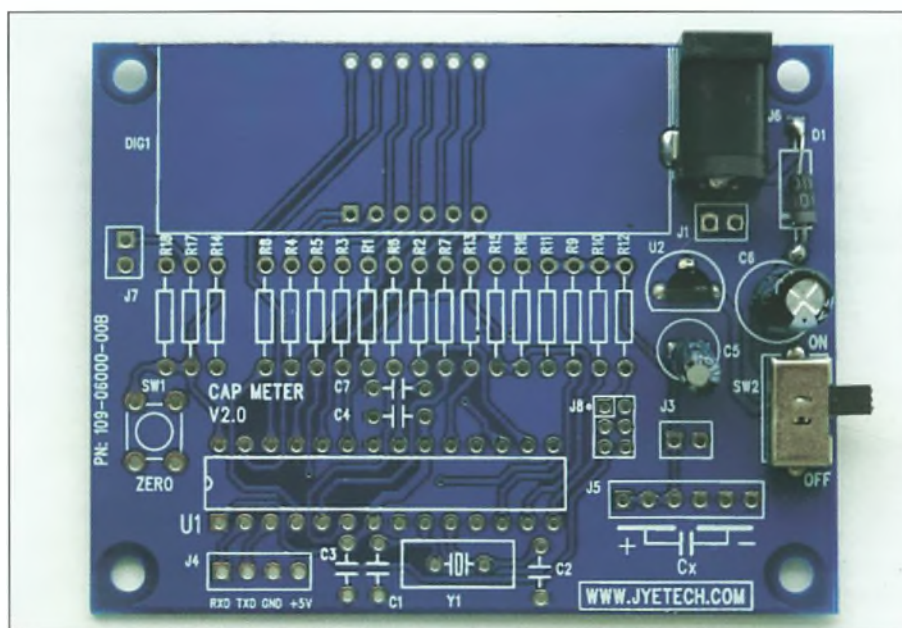
Apart from the capacitors used in the supply regulator, the remaining capacitors are all small ceramic types. The ones supplied in my kit were red in colour. Because ceramic capacitors can be installed either way round, I suggest

making sure that the value side is visible. Table 2 provides identification guidance for all the capacitors used in the project.

Remaining Components

The next step is to solder the crystal (Y1), the zero switch (SW1), which will need to be pushed into the board, and the test socket (Cx). I found it helpful to solder just one pin of the test socket and to make sure it is vertical before soldering the

Fig. 3: The PCB with the DC power supply regulation components installed.



remaining pins. With these in place, the integrated circuit socket (U1), which has a little dimple at one end (and is also shown on the PCB), can be inserted into the PCB and soldered. I suggest soldering just one pin initially and checking that the socket is firmly seated on the PCB before soldering the remaining 27 pins.

Now the display itself can be inserted and soldered. The display has a reference number (5461AS), which faces the resistors in the centre of the PCB. If in doubt, the decimal points of the display also face the resistors in the centre of the PCB. Finally, the integrated circuit can be correctly orientated and carefully pushed into its socket. The integrated circuit has a little dimple at one end and adjacent to it pin 1 is also marked with small indentation. These are both diagonally opposite the DC supply socket on the PCB. I found I needed to very gently press the pins from the two sides of the integrated circuit slightly towards each other to get them to fit the socket. Don't force the integrated circuit into the socket or you risk bending some of the pins far too much and them snapping off.

Testing

To check out the completed project, connect a suitable power source, switch on and check that the display lights up. Press the zero switch and after a second or two you should see 0P displayed. If you don't get this, the instructions that come with the kit include a section on troubleshooting. You are now ready to measure your first capacitor!

Because I don't have any way of making comparisons with other capacitance meters or capacitors of known accuracy, I couldn't reliably establish the accuracy of the results. I tried measuring a number of unused capacitors of various ages and types from my junk box. The display on the capacitance meter changed a little about every second so I took a middle figure. As you can see from **Table 3**, the capacitance meter certainly delivered plausible results and got the correct unit (pF, nF or μ F), bearing in mind that tolerance of many capacitors is $\pm 20\%$ or even more for electrolytic types. I certainly have no reason to doubt the accuracy of the results.

In Use

Once built, using the capacitor meter is quite easy. Capacitors where the leads are close together (0.1, 0.2, 0.3, 0.4 or 0.5in separation) can have their leads pushed into the multi-pin socket. Alternatively, for capacitors with greater separation such

Table 2 – The capacitors used to build the Capacitance Meter.

Designator	Value	Identification
C1, C2	22pF	Small red capacitor with 22 on one side.
C3, C4, C7	0.1 μ F	Larger red capacitor with 104 on one-side.
C5	10 μ F 16V	Small black electrolytic capacitor with value on side.
C6	100 μ F 16V	Larger black electrolytic capacitor with value on side.

Table 3 – Test results.

Claimed Value	Capacitance Meter Reading
390pF	380pF
450 μ F	431 μ F
150pF	150pF
15nF	12.7nF
1.5nF	1.28nF

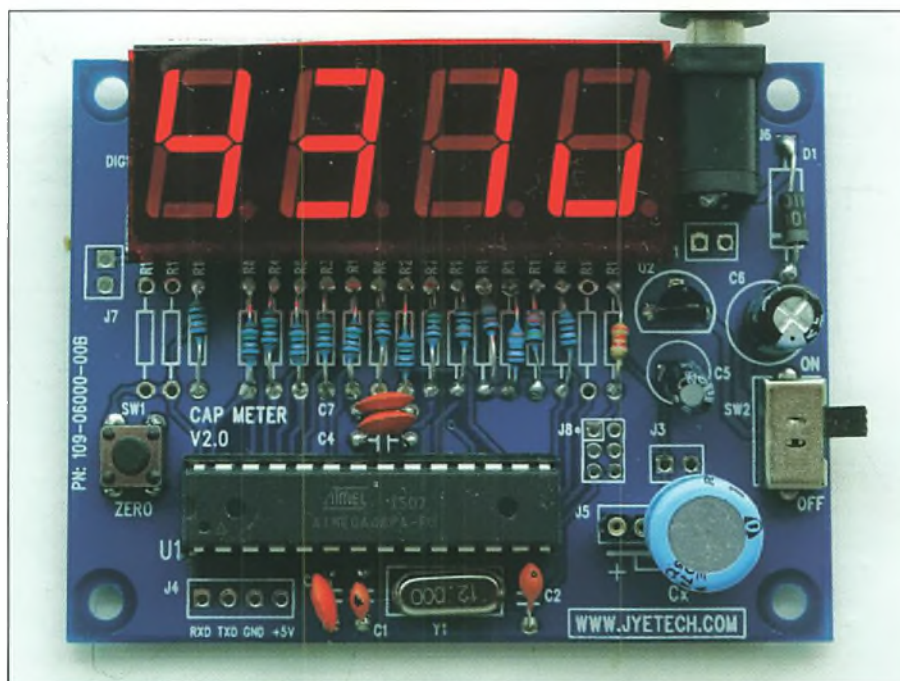


Fig. 4: The fully assembled PCB – measuring an electrolytic capacitor. Note the red filter over the display.

as larger electrolytic capacitors, pads are provided on the PCB for short leads to be used. Remember to correctly orientate electrolytic capacitors (see the PCB). Initially I found the display a little difficult to read in daylight. I put a piece of red-coloured plastic filter in front of the display. This improved the contrast and hence the legibility, **Fig. 4**.

Stray Capacitance

One of the challenges in measuring capacitance is the effect of stray capacitance. With no capacitor connected, you can press the button labelled ZERO on the board. The meter will then display C0 and the stray capacitance will be compensated for. This can be repeated any time the capacitance meter is moved to a new location, in order to take into account any variations in the stray capacitance at the new location.

Conclusions

For a price of well under £15 and for an evening's work with a soldering iron, I think the capacitance meter is a useful addition to my shack's meagre range of test equipment. I can see me using it when constructing other projects to confirm the value of capacitors before fitting them and to check suspect capacitors when repairing equipment.

New Year Resolution

This issue of *PW* marks the start of the 2017 *PW* year. It's not a bad time to consider your achievements in the hobby during 2016 and perhaps make some New Year resolutions, such as trying a new band or mode, making improvements to your station or perhaps constructing some equipment.

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SSTV on the Raspberry Pi

Mike Richards G4WNC reports back on his activities at the RSGB Convention and takes readers through installing SSTV software on the Raspberry Pi.

I attended the RSGB Convention again this year. As well as getting to a few of the lecture streams, I also delivered a lecture on the Saturday covering use of the Raspberry Pi and the Red Pitaya in the shack.

Because the 45-minute lecture slots are never enough to get into any detail, I experimented with an extra drop-in workshop on the Sunday afternoon. The idea here was to have an open session with an assortment of Pi and Pitaya projects on demonstration so people could see them in action and have time to ask me questions. This session went very well with lots of interaction and I think those that attended found it very useful. It was certainly a good way for me to get some direct feedback.

I was also on airport pick-up duty for the Convention so had the opportunity spend a few hours with Gerald Youngblood, founder of FlexRadio Systems®. Gerald is a wonderful character and it was fascinating to learn a bit more about his experience developing FlexRadio from a kitchen table project to the large radio business it is today.

SSTV on the Raspberry Pi

I've had a few enquiries about using the Pi for SSTV so I recently set about trying to find the best solution. I looked at several options but the standout application for Linux seems to be QSSTV by ON4QZ. This is an up-to-date SSTV package that's undergoing continuous development so seems to be ideal. QSSTV handles all the standard SSTV modes including the digital, DRM-based modes. The Q in the name comes from the use of the Qt cross-platform application framework to build the project.

I installed QSSTV on the latest Raspbian build with the PIXEL desktop and the installation went without incident. Details of the installation process can be found in the installation section of the QSSTV user guide and that can be found at this site:

<http://users.telenet.be/on4qz/qsstv/manual/index.html>

I will also run through the process here because there are a few tweaks along the way. I recommend starting with a fresh installation of the latest Raspbian Jessie image. This is available from the Raspberry Pi site at: www.raspberrypi.org/downloads/raspbian

Once that is up and working, you need to install the prerequisites for QSSTV. To do this, open a terminal session and enter the command line shown in Table 1. This is a single line that will automatically install all the required modules.

The next step is to download the latest version of QSSTV and the simplest way to do this is to open the browser on your Raspberry Pi and navigate to:

<http://users.telenet.be/on4qz/qsstv/downloads>

At the time of writing, the latest version was v9.2.4 dated October 22nd 2016. Click on the latest tar.gz file to automatically download the compressed source file to your downloads directory. The next step is to unpack and compile the software and that's a straightforward process run from a Terminal session. With a Terminal session open, use the following installation process:

1. Change to the Downloads directory by typing: `cd ~/Downloads`
2. Unpack the source file with this command: `tar -xvzf qsstv_9.2.4.tar.gz` (If using a later version make sure

you use that version number in this command).

3. Change to the new directory containing the source code with this command: `cd qsstv_9.2.4` Don't forget to use the latest version number.
4. At this point, we are ready to start the build process and the first command is: `qmake`
5. When qmake finishes enter: `make`
6. To complete the installation, enter: `sudo make install`

That completes the installation of the software and you can test it by typing `qsstv` at the command prompt in a Terminal session. You will see a LibEGL authentication failure but you don't need to worry about that because it doesn't affect the operation of QSSTV. To tidy up the installation, it would be good to have a start menu entry for QSSTV so you don't have to run it from a Terminal session. Adding a program to the start menu is straightforward as follows:

1. Click on the Start menu button (Top left).
2. Select Preferences and the Main Menu Editor.
3. Click on Applications in the top left of the menu editor and then click New Menu.
4. This will create a new Application menu and you can call this Radio Apps or whatever else you prefer. Click OK to complete this and your new menu entry will appear on the left. You don't have to do this step but it does provide a convenient placeholder for all your radio related software.
5. In the left panel, click on your newly created entry (Radio Apps) and click the New Item box.
6. This opens the application launcher panel, Fig. 1, where you can enter QSSTV as the name and you should press the Browse button to find the executable file for QSSTV.
7. You will find the executable file in `/usr/bin/qsstv`. Navigate to that file, select it and press OK

It's also helpful but not essential to add an icon for the installed software. To do that while the New Item panel is open, click on the icon placeholder, Fig. 1, navigate to `/home/pi/qsstv_9.2.4/qsstv/icons` and click on `qsstv.png`. If you want to also have QSSTV available via a desktop icon, simply click the start button and navigate to your new QSSTV entry via the Radio Apps and then right-click on the icon and you will see an option to add it to the desktop.

Do note that for those that prefer to avoid dealing with the Linux command

Table 1 – Installing the QSSTV prerequisites from the command line.

NB: Use a single space between each entry and enter this as a single line.

```
sudo apt-get install -y libfftw3-dev qt5-default hamlib-dev libasound-dev libv4l-dev libopenjp2-7 libopenjp2-7-dev
```

line, I have recently added QSSTV to my popular FLDIGI pre-installed SD cards for the Raspberry Pi model 2 and 3. You can find these via my web shop at the URL below. Just select the FLDIGI card and you get FLDIGI, WSJT-X and QSSTV pre-installed on the one micro-SD card, complete with printed instructions! www.g4wnc.com/shop

Configuring QSSTV

With the installation complete, it's time to set up QSSTV. To do this, start QSSTV, go to the Options menu and select Configuration. This will open the main configuration window, Fig. 2, where you can start entering your station specific details. The General tab is fairly self-explanatory so just enter your name and station details. While on this page it's worth putting a short message in the Online Status Text box. I normally use a summary of my station such as *Raspberry Pi-3, - IC7100 – Butternut HF9V*.

The next important item is the Sound tab because this is where you select the soundcard that you're using for QSSTV. As you're probably aware, the Raspberry Pi doesn't include an audio input so we need to add an external USB soundcard. I have been recommending the Daffodil US01 for quite some time now because it's very cheap at just over £5 from Amazon and works well with the Pi. An alternative that I've been using recently is the Vention USB soundcard, also from Amazon but slightly cheaper at £4.55. This is supplied in an aluminium enclosure so is a bit more robust than the Daffodil unit. Both cards will need to be used with a short USB extension cable, Fig. 3, because they're a bit bulky to plug straight into the Pi. An alternative is the Ugreen USB external Sound Adapter, also available from Amazon. Although slightly more expensive at £6.99, it is fitted with a short USB tail, thus making it a complete solution for the Pi. The Ugreen uses the C-Media audio chipset that is known to work well with the Pi so I think that is now my preferred Pi soundcard for data modes.

Getting back to our QSSTV installation, you need to make sure your soundcard is plugged-in before starting QSSTV or it won't be listed in the audio devices. To select your soundcard, open the configuration panel and select the Sound tab, Fig. 4. Here you will see check

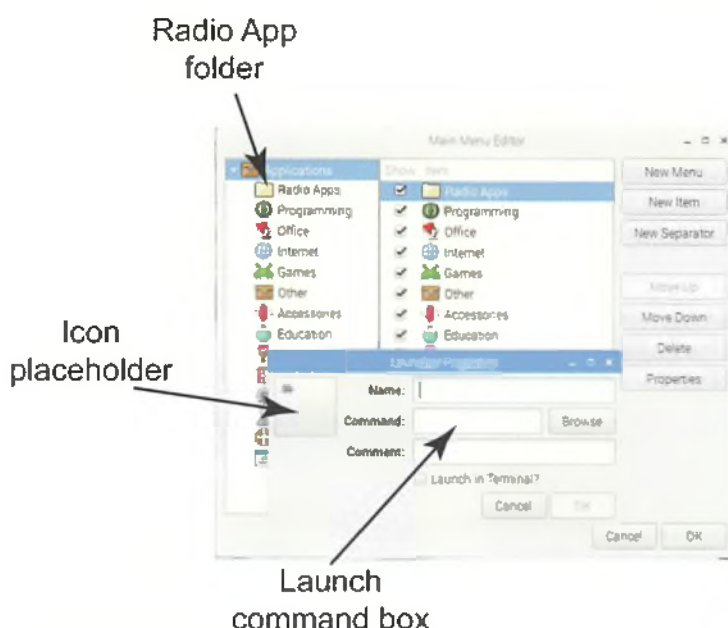


Fig. 1: The Pi Application Launcher.

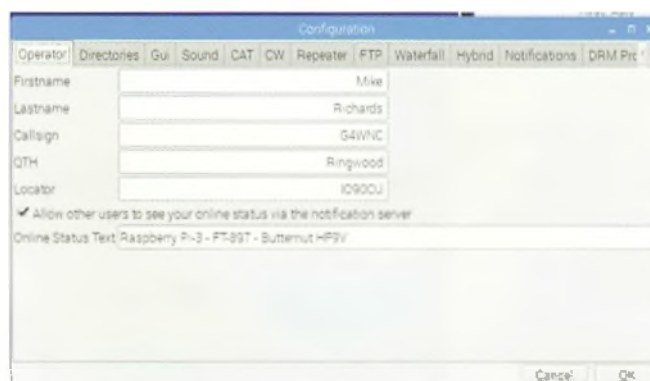


Fig. 2: QSSTV Configuration panel, General tab.



Fig. 3: Pi compatible soundcards.

boxes for ALSA or PulseAudio. Use the ALSA option for the Pi and you can use

the drop-down menu on the right to select the in put and output devices. The

markings here are a bit obscure but you need to look for the entries that begin thus: hwCARD=SetDEV=0-..... If you have just one external USB soundcard attached, it is usually the last entry on the list. For now, you can leave the Input clock frequency at its default of 48000.

To receive properly aligned and formatted SSTV images, accurate timing is critical and one common cause of error is the clock oscillator in the soundcard. Like many other data-modes software, QSSTV includes a correction facility so you can compensate for that error. To use this, make sure your Pi is connected to the internet, go to the Options menu and choose Calibrate. This will start the calibration process that will run for several minutes, Fig. 5. In fact, it's lots of minutes on the Pi so this is a good time to go and make a cuppa or do the washing-up! At the end of the calibration process, the corrected clock frequencies for the soundcard will be displayed and the OK button will be active. To accept the calibration, you should click OK. That completes the basic configuration but you may want to revisit this later to set up CAT control and other features to make operation easier.

Listen First

At this point you are ready to receive SSTV images so I suggest that's what you do first. That way you can check that your setup is working but also start learning about SSTV operating techniques before you start transmitting. One of the many great features of QSSTV is its fully automated reception that enables it to automatically identify and decode all the common SSTV modes. To start receiving, press the start button – a forward arrow at the top left of the display window. However, I found that you do need to feed it with a healthy input level. When I first tried QSSTV, everything seemed to be fine and I had a good signal indication on the waterfall and spectrum display but no picture. The solution was to increase the incoming signal level whereupon the display burst into life. For successful operation, I found that the signal peaks had to be near the top of the QSSTV spectrum display, Fig. 6.

To control the input level on the Pi, click on the Start button, choose Preferences - Audio Device Settings. Alternatively, you can right-click on the speaker icon at the top-right of the Pi main screen and choose External Device Settings. Both techniques will launch the settings panel, Fig. 7, where you start by selecting your soundcard, click the Capture tab and then

Soundcard selection

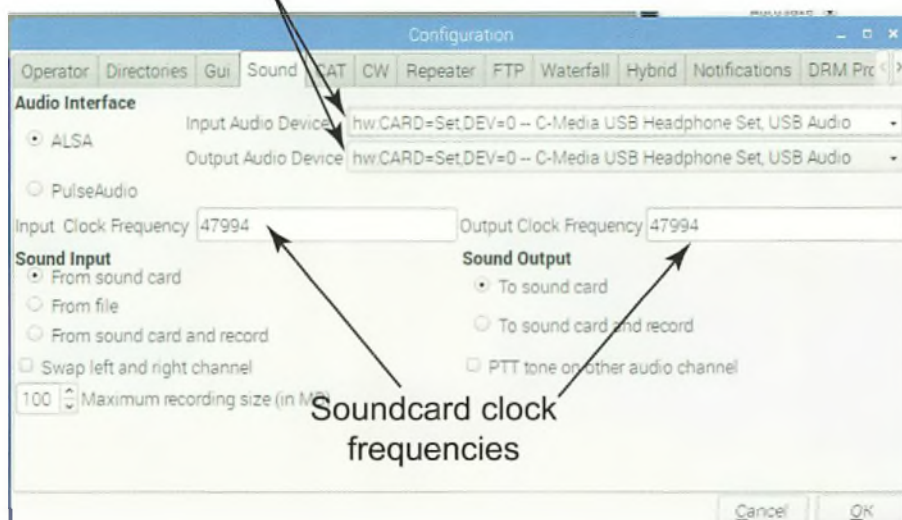


Fig. 4: QSSTV soundcard selection.

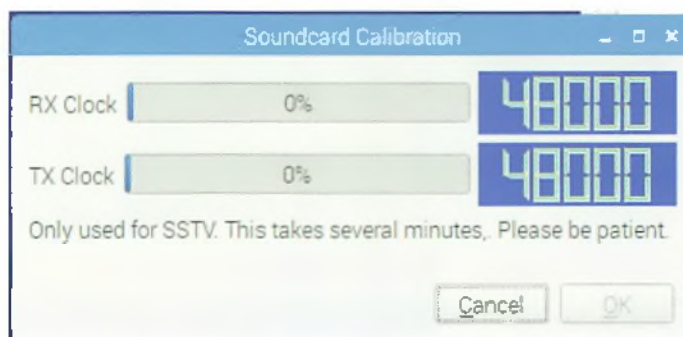


Fig. 5: QSSTV calibration panel.

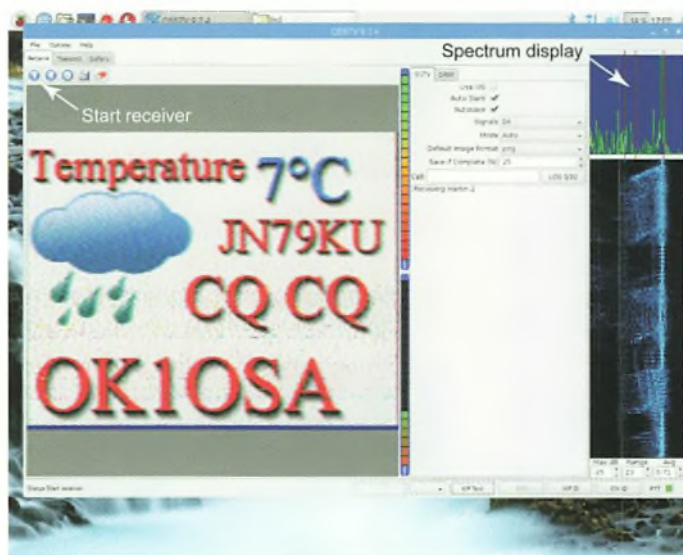


Fig. 6: QSSTV receiving a Martin 2 transmission.

adjust the Microphone Capture slider to adjust the input level. While testing QSSTV, I found it useful to tick the Auto Slant and Auto Save boxes. One point to note here is that the reception will occasionally pause. This is not a problem but occurs while QSSTV carries-out its slant correction. After the delay, the image will reappear properly aligned.

Next month I'll show you how to create images to send, along with a few other SSTV tips.

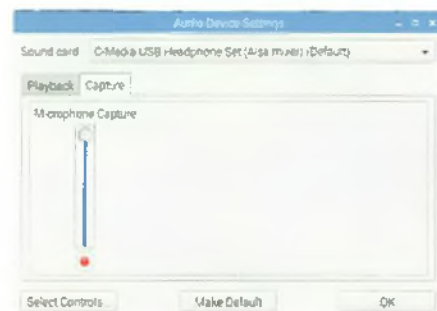


Fig. 7: Pi audio level adjustment panel.

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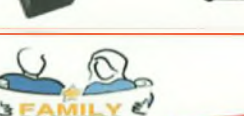
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GB3UHF

A New Dual-Band Propagation Indicator

Chris Whitmarsh G0FDZ has a report on recent developments concerning GB3VHF and the new GB3UHF propagation beacon.

For the last 50 or more years and, since 2010, from its present site at the BT radio station at Fairseat, GB3VHF has been transmitting a beacon signal on 144MHz primarily for the purpose of propagation indication.

Since the move to Fairseat, a large number of reports have been received and the coverage of the beacon is very encouraging, particularly in tropo lift conditions where coverage of the UK and Western Europe is seen to be very good.

Because we had been suffering a shortage of UK 432MHz beacons for some time, following the Olympic Games in 2012 Ofcom were in a position to be able to licence a number of 70cm beacons that would eventually form a coordinated network across the UK. Thus the idea of GB3UHF was born.

Description

The GB3VHF beacon uses two 3-element Yagis pointing at 288° and 348° and this gives good coverage across the entire UK and Ireland. It was thought to be a good idea to repeat this arrangement for GB3UHF. With the proposal for the 70cm beacon to use the same type of antennas in the same directions and a similar ERP to GB3VHF, the plan was in place to have a dual beacon facility where the propagation on two frequencies could be compared simultaneously under both normal and tropo lift conditions. We believe that never before in the UK has there been such a long-term facility available for this type of amateur research and the project was enthusiastically supported by the RSGB Propagation Studies Committee (PSC).

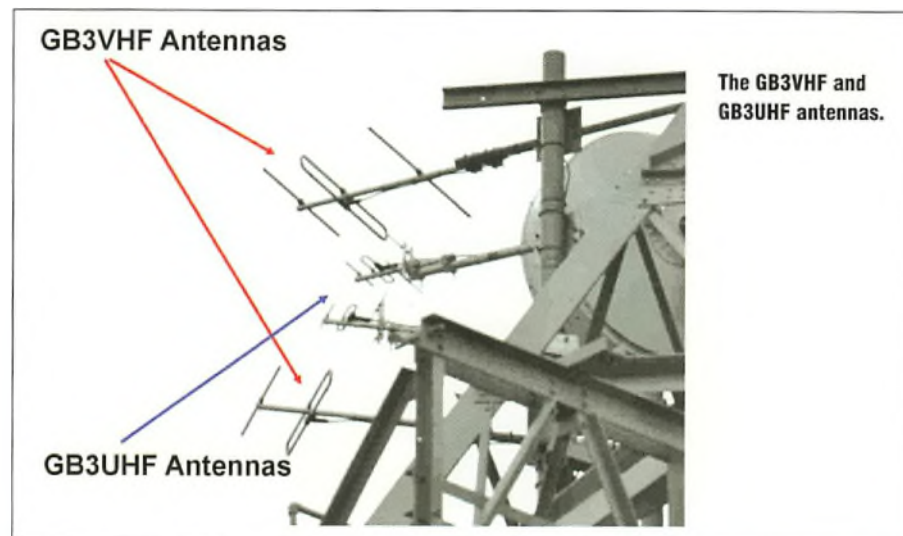
Siting

With the licensing process under way,

thought was given to obtaining a suitable site agreement with the BT site owners and to building the hardware. The GB3VHF beacon had been built some six years earlier and I decided to build GB3UHF in the same way using separate driver and PA units. The PSC made available a UHF fractional N PLL board and this hardware was considered ideal for the purpose because it could be programmed not only to generate the required frequency but also to have a timed keying format in the same way as GB3VHF and to use both FSK CW and JT65B keying. The reference oscillator is GPS disciplined so the frequency accuracy that was part of GB3VHF's makeup was maintained as was the timing of the coordinated keying sequences. With the driver providing 20mW of power, the Mitsubishi RF module PA can be driven to its full output of around 25 to 30W, which was ideal for the GB3UHF beacon. With any transmitter of this type used as a beacon, the output spectrum has to be very clean and filtering at both the driver level and after the PA is essential. Lowpass filters fulfilled this requirement.

The eventual idea was to purchase a new 19in rack that would accommodate both GB3VHF and the new GB3UHF in the same enclosure but both beacons would be entirely separate apart from a common mains supply feed. Each beacon would have its own GPS antenna system and the beacon antennas would have their own 144 and 432MHz feeders to increase resilience. The two beacon Yagis, as on virtually all commercial sites, are required to be commercially produced to a known specification. In the case of GB3UHF I again decided to use Jaybeam-Amphenol 3-element Yagis with their associated power divider. With the feeder run being nearly 100m in length, low loss was of prime importance so, again like GB3VHF, I used 7/8in Heliax/Cellflex type feeder.

With the beacon transmitter built and under long-term soak test and the antennas and feeder acquired, much energy was now devoted to obtaining permission from BT to have the equipment and antennas installed and to operate the system. This eventually turned out to be a protracted exercise and it should be remembered that with any beacon project the hardware production is often the easy part. Eventually the permission to operate and install the beacon was given and the BT riggers did an amazingly good job with the installation of the antennas, which are located at 35m AGL between the existing two 144MHz GB3VHF Yagis. With the new rack ready, the two beacons were installed and we were ready to go.



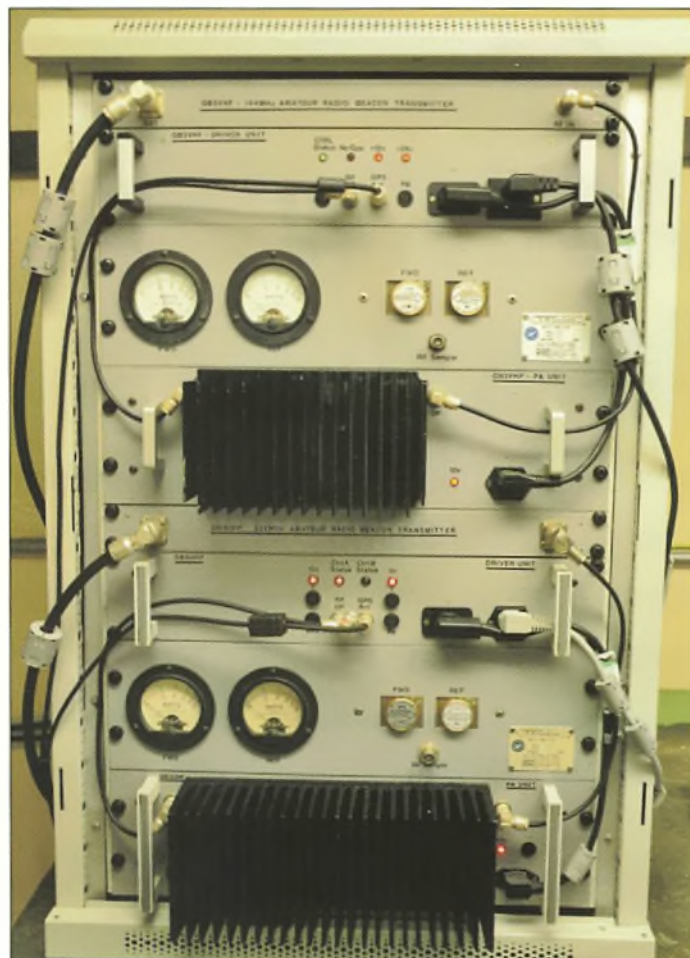
Initial Results

After switch-on in June 2016, I have received reports from locator squares in most of the UK, Ireland and the near continent. Comparisons between the two beacons has been interesting, with GB3UHF often being the stronger beacon close in as expected in an urban environment and GB3VHF being stronger farther away. However, under tropo lift conditions and particularly over the North Sea, it has been reported on some occasions that GB3UHF is strongest. This observation work over a longer period of time will be very interesting for the future and much about the correlation in propagation between the two frequencies is yet to be fully understood.

Very grateful thanks are due to those who have very kindly donated hardware and written software to build the beacon and particularly to the BT Radio engineering staff and BT Wholesale staff. Without their enthusiasm and hard work the project would not have been possible.

Much more information on both beacons can be found on the website: www.gb3vhf.co.uk

Front panel of the transmitter rack.



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Activity Improves

The combination of an autumnal improvement in band conditions and the CQWW Phone contest means that Steve Telenius-Lowe PJ4DX has quite a postbag this month.



Fig. 1: A view from the main antenna field at ZL7G. The operating location, Ultimate Hideaway, is the building with the red roof and the takeoff over the sea is to the north (short path to Europe, Japan, North America).

As this is the January 2017 issue let me start by wishing all readers a very happy and DX-filled New Year. Congratulations to PW Editor Don G3XTT and the rest of the ZL7G team (Don G3BJ, Chris G3SVL, Nigel G3TXF, Mike G3WPH, Justin G4TSH and Hilary G4JKS) on a successful DXpedition to the Chatham Islands, Fig. 1. They made over 42,000 contacts at the end of October and early November and no doubt the ZL7G callsign will feature in some of the HFH readers' reports next month.

The CQ World Wide (CQWW) DX Phone contest at the end of October brought enormous activity to the bands, despite poor propagation. Geomagnetic storms caused auroras and the HF bands were 'flat' with weak signals, a fact nearly

all our correspondents commented upon. Along with Scott W4PA, Peter PJ4NX and Bert PJ4KY I was a member of the

PJ4Q team, Fig. 2, operating in the multi-operator single-transmitter category. We made 6500 QSOs during the 48 hours but were soundly beaten by our friends and rivals at P40L on the neighbouring island of Aruba.

Readers' News

Kevin Jackson M0XLT was one who commented on those auroras, saying, "In one week I had many aurora alerts from Lancaster University, one of them a red alert. I heard K8AZ in Ohio with auroral flutter on 20m and he was weak. I thought it may have been a KL7 until he gave his callsign." Kevin still managed to work into California, Reunion and Ethiopia on 15m as well as Angola and Lebanon on 10m, commenting, "good to hear the band open".

Terry Martin M0CLH says, "Good to see some reasonable propagation at last, although CQWW over the weekend could have been better – a bit of a struggle with just an R8 vertical and 400W. It was, however, a good opportunity to check out the filtering of the IC-7300 in the crowded SSB bands. I have to say that I was delighted by its performance. It was also a chance to try out the contest mode built into the RUMLogNG logging program: many contests are now supported and this was a first for me. I treated it as a learning exercise but over a hundred QSOs were entered into the log. Overall, a pretty good month considering the not over-generous propagation conditions."

Mike Clark M0ZDZ went out portable on October 8/9th. He had a great signal here in Bonaire so I gave him a call and we had a short chat. Mike worked ZL3JAS, VK7ROY, VK3EY and VK1AD/P on 20m plus VK6ANC on 15m, who was, "peaking over S9 on an otherwise dead band." He also operated as G7Y in CQWW but, as he entered the field where his portable station



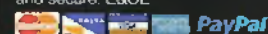
Fig. 2: Scott W4PA operating PJ4Q in the October CQWW contest. In the background, Bert PJ4KY.

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is located. "I must have startled a large flock of Canada geese. As they flew off in the pitch dark they couldn't see the 40m beam. Two broken elements later (cheap 10m fibreglass fishing poles) and that was the end of hopes for 40m. I had also set up a vertical with 16 elevated radials. In the end this was next to useless with all the noise it draws in. I gave up at 0300UTC and slept till 0600 in the hope that 20m would open long path to VK and ZL but that didn't happen for me. Even in my list of disastrous contests it must go towards the top. I never liked Canada geese before and even less now!" Nevertheless, he made nearly 900 QSOs and "managed to work some nice DX and fill some bands slots so not a wasted time."

Jonathan Kempster M5AEO wrote to say that he is recovering well after his heart attack, reported in the October column. He says that lethargy had turned his shack into chaos but he has now had time to reorganise it, **Fig. 3**, and set up a separate listening post for broadcast band monitoring. "I have also sorted out my amateur band antennas and everything now works like a dream. I have six antennas outside this tiny east London flat; so far nobody has noticed. I have replaced my 40m dipole with a Spiderbeam 'Antenna 51' Windom, which gives me five-band working. This was recommended by **Chris G6XDI**, who has used it to good effect while portable. I have added a second-hand IC-7400 to the shack and this is now my main rig; it is a joy to use and the internal ATU tunes anything I throw at it." Jonathan's highlights included contacts with his BBC colleague **Jim Lee G4AEH**. "After working together for many years, at last our first QSOs on 80 and 40m!" Jonathan concludes by thanking those "who have sent their best wishes for a speedy recovery. Rest assured I am feeling very fit and healthy and enjoying radio more than ever before!" Great news, Jonathan.

Steve Cole GW4BLE has also had health issues and a spell in hospital, **Fig. 4**. He wrote, "During my post-op period getting to the shack hadn't been possible so I'm really grateful to local amateur **Richie Samphire MW0LGE** who kindly brought over an Icom IC-7100. He set it up in the shack, connected to a Butternut HF9V (my 'standby' HF antenna) and a 2m collinear for local chats. A CAT5 cable connected to the transmitter was carefully run (with XYL approval) into a bedroom on the first floor, thus enabling me to be QRV. Best DX during the period was a VK8 on 10m and PJ4DX, who commented the signal wasn't quite up to the usual 'BLE



Fig. 3: The newly reorganised shack of Jonathan M5AEO, October 2016.

level! Things are improving health-wise and I've now been able to get into the shack, albeit only for short periods. One of those was for an hour or two in the UK/EI DX SSB contest [see October 2016 HFH – Ed], with a check-log entry of 150 QSOs. I've been informed by the team that the entry level in the contest was up 21% over last year so we appear to have a winning formula." Steve also had a "laid-back dabble" in the low-power 'Classic' category of CQWW Phone.

Owen Williams G0PHY "gave out a few points in the UK/EI DX contest the weekend before CQWW but with one exception all the contacts were with Europe. During CQWW I did an overnight stint at G8B, the Shefford club's contest callsign, operating on 80 and 160m. These are bands I don't operate at home because I don't have enough space for the antennas. On the Saturday of CQWW I listened at home and was pleasantly surprised to hear that 20m was open to the Caribbean and Central America at about 1300UTC. I heard V47T, PJ4X and VP6DX. Later I also heard ZR6K on 10m. On the Sunday I managed to work V26B on 20m and V47T on 15m."

New contributor **Reg Williams G0OOF** from Coleford, Gloucestershire, wrote that last year he "was on holiday with my family in Nova Scotia. We spent a couple of days in Halifax, well known for its connection with the Titanic. I was also fascinated to read about the history of Sable Island, 300km off the coast of Nova Scotia." Back in the UK, Reg recently moved house and has set up a Kenwood TS-870 and 4-band vertical with ground radials. "I was tuning around 20m and heard a weak station calling CQ which turned out to be CY0I VA1AXC. I could not believe my luck – it was Sable Island. With no great confidence in being able to work him, I replied and he heard me. A short QSO and a valid contact was made. I was excited and received his card via QSL manager JE1LET with just one week turn-around." Reg dabbled in

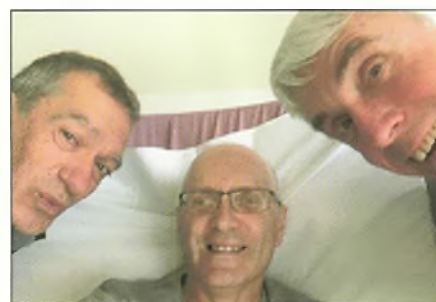


Fig. 4: While laid up in hospital Steve GW4BLE had a visit from Ian G3WVG (left) and Nigel G3TXF.

CQWW and agreed with my comments in the November column, saying that the DX was "somewhat easier to work under contest conditions than through non-contest pile-ups." We hope to hear more from Reg now that he is back on the air again.

Tom Morgan ZS1AFS wrote to let readers know that, "Once again ZT1T will be on over Christmas until Twelfth Night, celebrating our sixth Christmas since abandoning our yacht and our rescue from the mid-South Atlantic Ocean. We will be on 40, 20, 17, 15 and 10m, propagation permitting. PSK31 will be available."

Writing from Queensland, **Martin Burch VK4CG** said, "I have to get round to fixing up a better antenna system. I can then improve my reports to you but at the moment it comes down to time – the work's been keeping me busy." Martin's logs would be the envy of most in the UK (see the band reports), albeit they are semi-local stations for him!

Victor Brand G3JNB reported, "Atrocious HF conditions prevailed for the opening days of October." Not until the 5th did nature relent, when Victor worked HT7AAA from Nicaragua mid-afternoon on 17m at RST 339. "Things improved over the next few days and 17m yielded contacts with ZF1DX Cayman, ZP6CW Paraguay, FM5FJ Marinique, S9YY on

Sao Tome and an 'ESP' level QSO with ZS1ANF in Cape Town. I really do wonder that he heard my 50W to a small vertical while the propagation was almost non-existent!" Victor added that later in the month the solar flux was low and the A-index rose to 60. The French team operating TL0A from the Central African Republic appeared able to defy nature and had constantly good signals but were not hearing Victor's few watts. "I had to wait for their last but one day to get lucky. The immaculate operator was booming in on 17m but dodging about on the 'split'. Hard concentration and some knob twiddling did the business eventually, with a repeat performance on 20m a couple of hours later."

Tony Usher G4HZW made an interesting comparison with his other hobby of birdwatching: "Both are fascinating pastimes and you can make both as challenging or as straightforward as you like but there is a big difference in timescales. Birding gets a little quiet at the end of the breeding season and the end of winter but only for a few weeks before things improve rapidly. Thankfully this is an annual cycle whereas the sunspot cycle is an 11-year affair!" Tony was active on 10m only using 100W on SSB and 2W on WSPR to a 4-element Yagi. He says, "I caught a few openings to the Caribbean and South America with a path to Africa on most days but little activity from there. PZ5RA was worked on the 7th with a good signal and I fleetingly copied VP6AH on Pitcairn shortly after. The following day I had a QSO with 9J2BO who was surprised to find so much activity on 10m. My 2W of WSPR was copied in VK and HS on the morning of 13th, followed by PJ4DX on SSB – pre-auroral enhancement because the bands were dead the following day. Africa again on the 16th with ZS1HL. On the 30th during the CQWW, as well as Europeans I worked CX, LU and PJ4Q."

Our QRP Portable specialist **Carl Gorse 2E0HPI** has been operating from home for a change. "I have been operating PSK 31/63 and JT9/65 and had some excellent results at 10W, and some at 5W, with the Elecraft KX2 and 20m dipole located in the loft space. I also managed to work all the AN400 stations [see last month's HFH – Ed] but could only claim the Silver award. At times it was very hard to get through the pile-ups but I enjoyed it and am happy with the result, mostly with the indoor antenna. I have been having some problems with cable thefts and have pulled down the 40m antenna at home so 40m is off the cards for now but the indoor dipoles for 20 and 17m are working well in the loft."

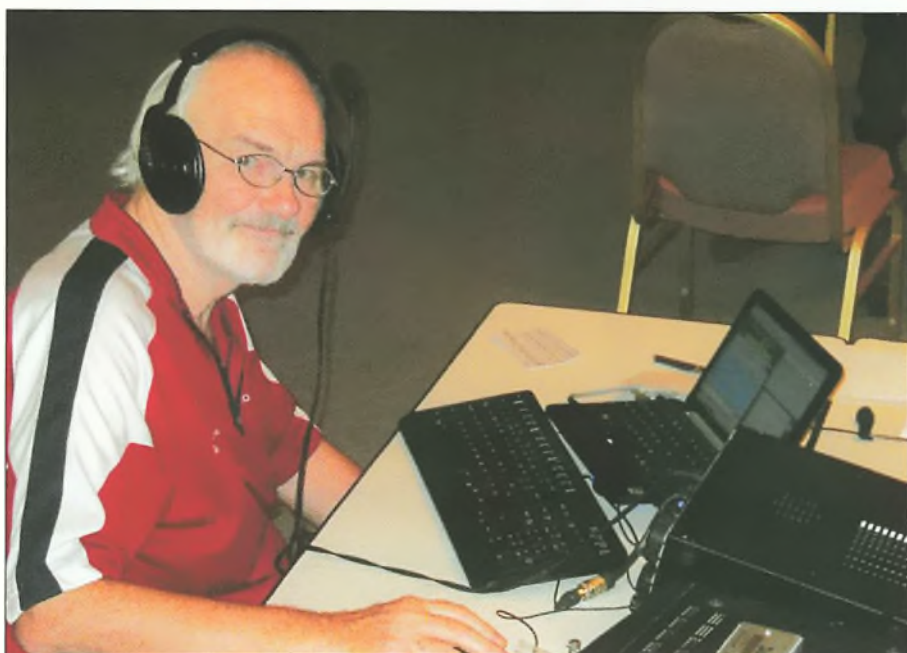


Fig. 5: John 9M6KRO operating RTTY.



Fig. 6: Email received by Carl 2E0HPI following his PSK contact with KF3AA.

David Smith M0OSA/M said, "I prefer the higher HF bands and therefore I hadn't worked EI until I got EI6H2B in the UK/ EI DX contest. I heard MU0GSY but he was also working 'search and pounce' so Guernsey escaped me for another day. I also spent about three hours battling conditions during the CQWW contest. I only made 56 contacts so am not expecting a good position this year but I did get my second All Time New One of the month with Suriname, PZ5K. I'm now at 132 DXCC with 98 confirmed on Logbook of The World. Hopefully conditions will improve but I seemed to get out reasonably well on 40m during the UK/ EI DX contest so I'll be on the lower bands over the next few months if not." David was another who achieved the Cervantes Silver award.

Band Reports

Terry M0CLH submitted a log of over 200 stations, including: 40m CW: HB0/DL5YM. 30m PSK31: C31MF. 20m SSB: C4A, KP3Z. 20m CW: PZ5K, S9YY, VP2EGR, VU2TMP. 20m RTTY: 9M6XRO (Fig. 5), S9YY. 17m CW: 9G5AM. 17m RTTY: S9YY. 15m SSB: 9G5AM, CO6HLP, KG4WV,

VU3JWI. 15m CW: PZ5K, S9YY, PJ4/ NA2AA. 15m RTTY: 8P2K, 9M2TO, CN8LI, HK1T, HP3SS, S9YY. 15m PSK63: VQ96JC (British Indian Ocean Territory), YC4KRZ. 12m SSB: FR4NT. 12m CW: S9YY. 12m RTTY: YB3EDD. 10m SSB: A61CP, A92GE, OD5TX. 10m CW: S9YY. 10m RTTY: S9YY.

This is the best of the log from **Martin VK4CG**. 40m SSB: V6Z (Micronesia), VK9NZ (Norfolk I). 20m SSB: JA3YBK, VK5CE/P (Granite I, IOTA OC-228). 15m SSB: KH6J.

Victor G3JNB worked, on 30m CW: D66D, JT5CO, OX3XR, S9YY, TF3JB, TZ4AM, VR2XAN. 20m CW: OX5T, S9YY, TL0A, VB5TL, VK4FW. 17m CW: HT7AAA, TL0A.

Reg G0OOF worked these stations in CQWW: 20m SSB: 8P5A, T4BK. 15m SSB: PJ4X, ZD8W. 10m SSB: CW5W, LU7HN, PQ5B, PZ5K.

Carl Gorse operated both from his home and as 2E0HPI/P from various locations to work: 80m SSB: F2YT, G1EXK, G14AH, ON2LVC, SM6CNX. 40m SSB: 2E0SLO/P, GB16NH (Newark Hamfest), M0PAI/M. 40m PSK: EM25M, LY2EW, OE3EGN, UT4UO. 40m JT65: LZ1UBO, SV6COH. 20m SSB: HG44FY (HAFF-0027). 20m PSK: K9QVB, KF3AA (Fig. 6), N1F (National Fire Prevention Week), OH3GTL, RN6AJ, SV2LLQ. 20m JT65: LU5EW, VA3MJR. 17m SSB: F5PCV.

Signing Off

Thanks to all contributors. Please send all input for this column to my e-mail address by the first of the month (January 1st for the March magazine, February 1st for the April issue). 73, Steve PJ4DX.



The Chakophone Story

The acquisition of an Ebonite panel led Andrew Humphriss 2E0NDZ on a quest to determine its history.



The Eagle works in 1921.

In the early 1980s I was working in Royal Leamington Spa, Warwickshire. My work brought me into contact with a wide variety of people in many diverse professions. Around that time, I was given a home-made crystal set by a member of the family in exchange for a small display cabinet I had picked up on my travels.

I made friends with a cabinetmaker in the old part of Leamington Spa town and thought that because of his profession, he might know where I could get a suitable cabinet to house my crystal set. It's actually still in need of a suitable box some 30 years on!

A Mysterious Ebonite Panel

Anyway, one day I asked the cabinet maker about the sort of box I was seeking for the crystal set and he told me he had been approached by a gentleman in

Kenilworth who had a box of old wireless parts to go to a good home. Maybe this gentleman could assist me.

After arranging a meeting, I called on an elderly gentleman who had a box full of odds and ends, among which was an ebonite panel with some components attached, albeit they were very corroded having been stored in a damp environment for many years.

On further investigation and after placing adverts in magazines at the time, I determined that the ebonite panel was marked Chakophone No.1B three valve but there was nothing to indicate where it was made or anything else about it. However, I was in luck. A member of the British Vintage Wireless Society responded to my request for help and brought to my attention the book *Early Wireless* by Anthony Constable, which described the Chakophone No.1B (described in the sidebar) and identified

the manufacturer as the Eagle Engineering Co. Ltd. At the time of my search the company was still in existence, trading as Hestair Eagle, and the factory was still in Saltisford, Warwick.

I was living in Hampton Magna near Warwick at that time and passed the factory every day on my way to work in Leamington Spa. One day, while out walking our Yorkshire terrier, I happened to run across the personnel manager who told me he remembered the wireless days and some of the workers who put the Chakophone sets together.

Since I wanted to find out more about the local connection, I started to research the Eagle Engineering Company, the wireless sets they made and the people involved.

A Long Search

Having spent the last 30 years or more searching for certain missing parts from what I have of the Chakophone No.1B in order to get it working, it's only in the last two years or so that I have attempted the restoration. This is feasible now that I have obtained the cabinet dimensions and a source of well-seasoned old English oak. I am also grateful to a British Wireless Society member who is able to replate some of the original nickel parts. This is now an ongoing project.

The Eagle Engineering Company

For now, here is a summary account on how the Eagle Engineering Company started manufacturing wireless sets. It's a curious one because they were specialist in the manufacture of a wide range of vehicle bodies at that time and today are still operating on the Heathcote Industrial Estate, Warwick, as Dennis Eagle manufacturing. They specialise in the refuse vehicles that can be seen on today's roads, used by many local authorities.

The Chakophone wireless manufacturing journey, I believe, started at the end of WW1, when in 1919-1920, **Guy Henry Champ** and his partner **George Ernest Osborne Kay** operated as Champ, Kay and Company from the wharf and shedding next to the canal in Saltisford, Warwick.

They offered repairs and overhauls to motorcar lighting and starting sets along with recharging batteries (having the Exide battery agency). They also both offered their services as electrical engineers and were engineers of small hand tools.

In 1922 Champ and Kay started operating wireless installations and offered the supply of parts and, as reported in

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Set only £10 0 0

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Marconi Royalty £1 17 6

Set in Mahogany, extra £1 0 0

Advertisement from a radio shop catalogue of around 1926.

the local press, also operated a wireless receiving station for customers to see and hear the wonders of wireless.

I have never seen any pre-January 1923 wireless set manufactured by Champ and Kay but I believe they did manufacture sets back then.

In January 1923, it was announced that Messrs Champ Kay & Company had decided to throw in their lot with the Eagle Engineering Company, Eagle Works, just up the road from where Champ and Kay had been operating. Guy Henry Champ was absorbed into an Electrical and Wireless department in Eagle Works, supplying any electrical requirements, lighting sets and maintenance of the Exide battery service.

The Eagle Engineering Company was an all-round manufacturer of vehicle bodies and every type of tradesman was employed so manufacturing wireless sets in wooden cabinets was easy for them to adapt to.

During the period January 1923 to around 1936, a wide range of Chakophone wireless sets was manufactured at the Eagle Works and later in the former brewery building at the rear of the factory up to the winding-up of the wireless manufacturing around 1936.

During the years 1923 to around the early 1930s, the Eagle Engineering

Company attended the wireless shows in London, displaying their products, as did so many other similar companies of the day.

Finale

Mr Kay moved on in the early 1920s, lived in Birmingham and died in the 1970s. Little seems to be known of what he finished up doing.

In 1936 Guy Champ opened a retail shop, the Eagle Wireless Supply Company, in Smith Street, Warwick, where he sold Murphy radio and televisions, having the Murphy radio agencies. He manufactured primary batteries, as reported in *Murphy News*, and also sold photographic equipment. Mr Champ was well known in Warwick. He served as a conservative councillor and was a Special Constable. Sadly the journey ends with the death of Guy Champ in Warwick Hospital on March 31st 1951.

PW acknowledges the assistance of John Koster (website below), who very kindly allowed the use of the Chakophone photographs and advertisement and the material in the sidebar.

www.vintageradio.nl/radio/s/chakophone_1b_engels.htm

(the preceding article was first published in the RAFARS magazine QRV and is reproduced here by permission)

The Chakophone 1B

The Chakophone 1B was built in a Jacobean oak cabinet with two folding doors. In England, these models were called 'smoker's cabinet'. The radio has an ebony faceplate and knobs made of Bakelite and ebonite. This set is older than the model depicted in the book *Radio! Radio!* That model has only two rheostats, an on/off switch in place of the middle rheostat and a switch in place of the two phone jacks. The Chakophone logo is in a different position on the front.

The upper row of knobs are filament current rheostats. The current of the three valves can be regulated individually. The position switch in the middle can be used to select a tap of the wavelength coil. At the bottom left is a variometer gain control and at the right a tuning knob with fine tuning. Two telephone jacks are situated below the position switch. These can be used to listen with two or three valves at will. The 90V HT battery and the grid bias battery are located in the lower compartment. All terminals are on the back of the cabinet. The valves (detector plus two LF) were probably a PM1 and two PM2s but in 1925 they may also have been older valves. In advertisements, a somewhat smaller valve can be seen in the middle. Wave range is 250-2000m (medium wave and long wave). The cabinet was made by furniture restorer Ruben Spelbos in Utrecht. The original price of the receiver in 1925 was £14/2/9 (complete, without loudspeaker). The Marconi royalty was £1/16/6. A mahogany cabinet was £1 extra. In 1926 the radio was sold for £11/1/6 (complete, with Amplion horn loudspeaker).



A front view of the Chakophone 1B with the cabinet doors open.



The Chakophone 1B as a piece of furniture, unlike most modern radio receivers!



The rear of the Chakophone 1B with the back panel removed for access and maintenance.



A rear view of the Chakophone 1B showing the speaker terminals.

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Emerging Technology

Chris Lorek G4HCL shows how we might soon have batteries as well as two-way radios a sixth of the size and weight of those we currently use.

Nuclear Batteries for Portable Two-Way Radios

As many readers of *Emerging Technology* will know, battery technology is often the major limitation to the size and weight of portable two-way radio equipment. We started out many years ago in rechargeable battery technology with lead acid types, then NiCad (Nickel Cadmium) batteries and, somewhat later, with NiMH (Nickel Metal Hydride) chemistry. Later on we evolved to Li-ion (Lithium Ion) batteries. I remember that, over 30 years ago in my then-job in exploring new technology for portable two-way radio, I was looking at Lithium batteries and wireless recharging but my ideas were poo-pooed by my boss and were never taken up. Look at where we are now! The firm went bust two years after I left – is it any wonder? On a related subject, at around the same time I also had an idea for using binary-switched capacitors and inductors along with electronic VSWR sensing circuitry for automatic antenna matching; again poo-pooed by my boss and never used. But I received an international patent for this and subsequently had my paper presented at an International IEE Consortium on Radio Communication. This AATU (Automatic Antenna Tuning) method is currently used by the likes of SGC, Icom, MFJ, Codan and many others. Maybe I should be asking for royalties?

Back to emerging battery technology. What is arguably the safest and most cost-efficient method of power generation for the size of the power-generating plant is that of nuclear power, which has for many years been used in our submarines as well as for

widespread domestic electrical power and many other applications. Right now work is being done by a team at the University of Missouri for the use of nuclear power for portable equipment and their goal is to find a solution to portable power problems that is appropriate, literally, to the nuclear age.

Portable power has always been a problem and there were some priceless moments from the early nineties where thrusting young city executives roamed the streets with handbag-sized phones attached to large batteries. Mind you, I also did this myself with a Nokia Mobira Talkman analogue cellphone, **Fig. 1**, over my shoulder in a carry case, powered by a lead-acid battery. However, it was a phase of technology that lasted for a just a year or two but even the phones that replaced them, for all that they were at least recognisable as modern mobile phones, are the objects of ridicule for the youth of today on account of their brick-like size. Yes, I migrated to a Nokia Cityman, **Fig. 2**,



Fig. 1: The Mobira Talkman.



Fig. 2: The Nokia Cityman.

which cost me £1000 and was around the size of a house brick!

Whatever the portable application, there is always a demand for longer battery life and yet more functionality, with demands on battery life and size becoming greater as time goes on. There are three main ways to remedy this. Firstly, to get additional power from another source, such as harvesting solar energy, for example, or radio frequency charging. The second main focus of the electronics industry has been to reduce power consumption. By improving processor architectures, reducing the number of passive and heat generating components and so on, the amount of power required, by using clever design, has been reduced considerably.

The third option is just to make better batteries, with the definition of a better battery being one that is smaller yet can produce more power for longer. This is where the University of Missouri comes in. Their researchers are developing a nuclear battery, **Fig. 3**, that has a power density six times greater than a conventional chemical battery. The battery is no bigger than a coin. Apparently, the problem with nuclear batteries is that the radiation affects the structure of the power semiconductor, breaking down the lattice framework. The University team have got round this problem by using liquid semiconductors and they believe that further development will yield a battery with the thickness of a human hair.

Water Based Nuclear

For the technically minded, utilising the radioactive isotope strontium-90 to enhance the electrochemical energy produced in a water-based solution, the researchers have incorporated a nanostructured titanium dioxide electrode acting as a catalyst for water decomposition. That is, the catalyst assists the breakdown of water in conjunction with the applied radiation into assorted oxygen compounds. As a result, when high-energy beta radiation passes through the platinum and the nanoporous titanium dioxide, electron-hole pairs are produced within the titanium dioxide, creating an electron flow and a resultant electric current.

Of course, one obstacle is the 'Nuclear' word. It's still a subject that will bring a certain amount of distrust with it for some people. Although many people wouldn't worry too much about the chances

of a nuclear meltdown starting in their trouser pocket, the thought of radiation taking place around you may take a bit of getting used to. In reality, nuclear power has been used in pacemakers so maybe we shouldn't worry too much.

Maybe a more significant concern would be if one of the 'unstable' countries developed a manufacturing facility for mobile phone batteries based on this technology. Surely this would be considered hard evidence of a weapons of mass destruction development programme! The details about how the University are making this technology work and how it can be usefully employed will probably only start to emerge when the patents have been filed but I will report further to you on this as soon as I can. But maybe the batteries in our portable and transportable HF and VHF/UHF transceivers might shrink incredibly in size in the future. I'm sure hill-topper amateurs and portable contest participants will welcome such a decrease in size and weight.

Graphene Two-Way Radios Now Being Developed

Regular readers will be familiar with my mention of graphene technology in past columns and its relevance to two-way radio communications, especially by miniaturising the size of radio communication equipment.

Recent research at the University of Buffalo in New York has now shown that miniature radios made from graphene that broadcast on the little-used terahertz band could enable an 'Internet of Nano-Things', according to a team there. Terahertz radiation falls in between infrared radiation and microwave radiation in the electromagnetic spectrum and shares some properties with each of these. Like infrared and microwave radiation, terahertz radiation propagates along a line of sight path and is non-ionizing. Like microwave radiation, terahertz radiation can penetrate a wide variety of non-conducting materials. It can thus pass through clothing, paper, cardboard, wood, masonry, plastic and ceramics. The terahertz spectrum is sandwiched between radio waves (part of the electromagnetic spectrum that includes AM radio, radar and smartphones) and light waves (remote controls, fibre optic cables and more) but is seldom used by comparison with either of those.

The researchers' work centres on the

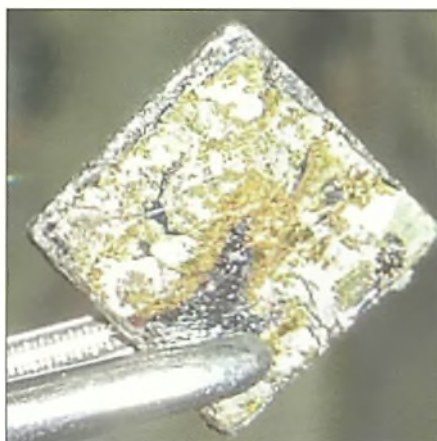


Fig. 3: The inner workings of a nuclear battery.

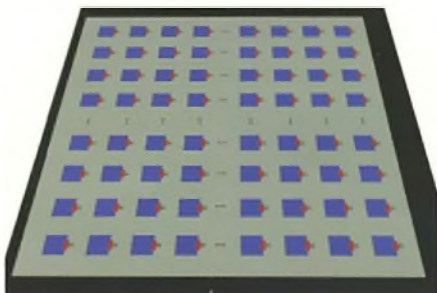


Fig. 4: An array of graphene antenna strips.

development of extremely small radios made of graphene and semiconducting materials that enable short-range, high-speed communication. The technology could ultimately reduce the time it takes to complete complex tasks, such as migrating files from one computer to another, from hours to seconds. Other potential applications include implantable body nanosensors that monitor sick or at-risk people and nanosensors placed on ageing bridges, in polluted waterways and other public locations, to provide ultra-high-definition streaming.

Graphene is a two-dimensional sheet of carbon that, in addition to being incredibly strong, thin and light has tantalising electronic properties. For example, electrons move 50 to 500 times faster in graphene compared with silicon. In previous studies, researchers showed that tiny graphene antenna strips 10-100 nanometres wide and one micrometre long, **Fig. 4**, combined with semiconducting materials such as indium gallium arsenide, can transmit and receive

terahertz waves at wireless speeds greater than one terabit per second.

Although technological advancements have made wireless data transmission more efficient, bandwidth issues still cause a limitation problem because wireless devices are all around us and, as the demand for data grows, they are ever increasing. The solution could be found by using the terahertz band and the Buffalo University team believes that graphene-based radios could help overcome the main problem with terahertz waves because they don't keep their power density over long distances.

To make these radios viable outside the laboratory, however, the antennas need other electronic components such as generators and detectors that work in the same environment. **Josep Jornet**, **Fig. 5**, assistant professor at the University at Buffalo, is currently working to develop these components to make graphene radios a reality. He says thousands of these arrayed radios working together could allow terahertz waves to travel greater distances and that the nanosensors could be embedded into physical objects, such as walls and street signs as well as chips and other electronic components, to create an 'Internet of Nano-Things'. He adds, "For wireless communication, the terahertz band is like an express lane. But there's a problem: there are no entrance ramps. We'll be able to create highly accurate, detailed and timely maps of what's happening within a given system. The technology has applications in health care, agriculture, energy efficiency, basically anything you want more data on."



Fig. 5: Josep Jornet.

On a related subject, in September 2016 a team demonstrated how baking graphene in a microwave oven imbued it with properties that make it

perfect for next-generation electronic and energy devices, showing that it definitely has a future. Maybe our dual-band 2m/70cm handhelds will in the future be the size and even possibly the width of a credit card? This, of course, relies on battery technology. Maybe we'll all have a micro-nuclear power plant in our top pocket?

I'll be back next month with a further *Buying Second-Hand* feature. See you then.

See you soon as I explore the future on behalf of PW readers. Chris G4HCL.



Setting Up a Work Area

As many *PW* readers will know, Phil Ciotti G3XBZ enjoys home construction. Here he advises on how to set up your home work area.



Bench as operating position.

I am sure that in many radio clubs or societies there are members who give up their time to help others. By assembling patch leads, audio leads and so on, they get the satisfaction of a task well done and the owner gets a cable ready to attach to their equipment.

Helping one another like this has been a regular occurrence for many years, and long may it continue. However, there will come a time, perhaps, when these people will, for some reason, not be able to assist anymore. So what happens when we reach this state? Hopefully it will never get to the stage where there is no one to help. However, I would encourage you to have a go yourself.

Similarly, you may be recently licensed and keen to give the constructional side of the hobby a try.

"Where do I start?" I hear you say. The answer is a work area or workshop. Before your imagination runs away with visions of lathes, mills or pillar drills, let me point out that it need not be that complicated or grand. It is surprising what can be produced from a small work surface.

Locations For Your Work Area

Finding a suitable area is the key to an enjoyable and fulfilling experience. Take time over making this decision because it is important to choose the right area for your requirements.

There are a few locations that come to mind when undertaking this exercise. Each one will have its merits and drawbacks. The following are a few suggestions to get your ideas flowing.

Part of a Room within the Property

One option is to, in effect, take over part of an existing room in your home. To make this work successfully it does require the cooperation of the other members of the household. Will the work in progress, for example, cause disharmony when items are dropped on the floor or will you disrupt family life in other ways? However, it usually has the advantage of being warm and dry with a mains supply readily available nearby.

The Loft Space

Using the loft space was very popular years ago but is less practical in modern

properties due to the use of more roof trusses, hence very little area between them. It can be very hot in summer and cold in winter, causing any enthusiasm to wane rapidly. However, one advantage is that it is hidden from view, so can be left as is when the access hatch or door is closed. Mains power will need to be correctly terminated locally and you may need to lay floorboards, install lighting and generally make the area habitable.

The Garage

Looking around the neighbourhood where I live, I see that few vehicles are parked in garages overnight. Most garages nowadays seem to be used for the storage of unwanted household items, lawnmowers, barbeques and bicycles. A good sort out might be required to generate a sensible sized area.

The ones that are built into newer properties tend to be a better proposition than the older style detached ones, located in the garden. Single brick wall or pre-cast concrete styles can suffer badly from condensation and/or dampness problems during wet spells of weather.

A plus point is that garages are isolated from most other household activities and offer a much quieter area in which to concentrate on the project in hand. Again, some work may be needed, perhaps adding some insulation, improving the lighting and installing some additional electrical outlets, not to mention a workbench.

The Garden Shed

The garden shed has to be the most popular area chosen by many radio amateurs. It has the benefit of offering a layout that suits the occupant precisely. The shed used to be a male dominated space but ladies are now entering the scene, running businesses from them, and of course, operating and using them equally.

If a shed already exists, a tidy-up might be required to generate some working area. Take a good look at its general condition and repair any faults that might be discovered.

Insulating the walls and roof, will help in providing a comfortable working environment. A brand new shed can be purchased with the insulation fitted when it is erected. Indeed, some sheds offered for sale these days are more impressive than many houses, albeit so are the prices!

Having decided on where your work area is to be sited, the next question that arises is, "How big should the bench be?" The answer really depends on the projects

you are likely to tackle. In general, the answer would be the bigger the better but bear in mind that storage of components, tools and other items also has to be catered for.

Going back to my original scenario about making patch cables or interface leads, a small lightweight structure should suffice. Obviously, the larger, heavier items will need a more substantial construction to support the extra weight.

I would advise a square or oblong shape to the work surface because this offers the maximum working area to be used. A circular table, although attractive to look at, does not offer the best working area. For a number of years, I used a solidly built dining room table, with pull out leaves at each side, which when extended, nearly doubled the surface area.

These days I use a small office desk, which has three drawers on the right-hand side and measures 1070mm wide by 635mm deep. This desk has two functions, the first being the operating area for all the radios. This leaves enough room at the front for small projects to be undertaken. If I need more elbow room, the radios are removed completely, leaving the total area of the desktop free for a work area.

Second-hand shops can be a good source of suitable tables or desks, usually at reasonable prices. While looking, a solid chair with good back support is high on the agenda. I personally prefer a chair without wheels or castors, for safety reasons.

AC Mains Power

For indoor use, a four or six way extension block will suffice for mains power. Each of the outlets on the block would preferably be individually switched, although this is not mandatory. Trailing leads will need to be carefully positioned to avoid becoming a trip hazard.

Outbuildings, such as a shed or garage, will require a proper installation with all the necessary safety trips. The services of a qualified electrician are advisable in this instance.

A master on/off switch to completely isolate the mains supply is recommended in all work areas.

Lighting

A well-lit area is a prerequisite for good electronic construction. Daylight is best but, even on bright days, some form of additional lighting may be needed. Anglepoise desk lamps are very helpful to put extra light in the right place. They can be fitted with a daylight bulb to give a more natural lighting effect. These lamps



Bench as work area.



Small bench 850 x 300mm in corner of summerhouse in the garden, just to prove how small an area can be used.

can also be purchased with a magnifying lens to help identify pin numbers on small connectors such as mini-DIN and similar. Recently I have been using an LED bulb, which I find gives a better quality of light compared with either a CFL or a standard incandescent one.

Storage

To help keep the area relatively tidy, some form of storage is required. This can range from a collection of biscuit tins right up to 30 litre plastic containers placed on a rack of shelves. When using metal tins in outbuildings, do try to keep them dry because condensation and/or dampness will cause them to rust and possibly to ruin their contents.

Labels attached to the outside of the container will give an idea of its contents, hopefully avoiding the question of "where did I put that eight-pin microphone socket?" or similar.

Heating

When the workbench is located inside the property, heating is taken care of by the household system. Sheds or garages will need heating during the winter months to maintain a suitable working temperature. Another layer of clothing and wearing a hat will help to keep the body temperature up. The object here is to be warm enough to enjoy the hobby and not sit shivering

in the cold! Cold, numb hands and fingers are not conducive to successful construction.

Ventilation

A regular change of air around the workbench will give a pleasant area to work in. Opening more than one window creates a flow of air through the space. Even on a cold day, a window that is slightly open is beneficial. Do remember, however, to close/lock all windows and doors at the end of your day's efforts.

Encouragement

While I was preparing this article I was reminded of the fact that from time to time we all need some encouragement to get projects underway. Starting to set up a work area may seem a daunting task but breaking it down into more manageable units, it becomes much easier to complete. The workbench can always be adapted over time to suit your particular requirements so don't get disappointed if it's not quite right the first time.

I hope I have sown a few seeds to get you thinking about your work area and trust you will enjoy any electronic projects that you may undertake. If you have additional suggestions of your own, perhaps from hard-won experience, do drop the editor a line for possible publication or to feed into a follow-on article.



Multiband Multimode Receiver Project

Tony Nailer G4CFY brings readers the final part of his multiband multimode receiver project.

This article brings the design of the Multiband and Multimode High Frequency Receiver (MMRX) project almost to completion. The full assembly has yet to be put through its paces and there are likely to be issues when it is.

In the previous *Doing it by Design (DiBD)* I found that it was not practical to use crystals recovered from damaged filters to create upper and lower sideband carrier oscillators. I don't know the cut of the crystals but they stubbornly wouldn't move more than a few hundred Hertz from 1.4MHz. Consequently, I decided to use both USB and LSB 1.4MHz filters switched and to have a single crystal 1.4MHz carrier oscillator.

So the circuit that appeared in *DiBD* in September *PW* has been modified to include the additional filter and its matching and switching circuitry. It also includes a DC blocking capacitor between the secondary of the oscillator coil L7b and the input of the buffer device Tr8. **Tex** spotted this omission in the latest circuit in addition to other mistakes that had crept in to the updated circuit. Hopefully a correct and complete circuit of the MMRX front part is shown in **Fig. 1**.

MMRX Rear Part

Creation of the rear part of the receiver brings together circuits developed and described in a number of *DiBD* articles.

These include, firstly, from the *DiBD* article in November 2016 *PW*, the amplitude modulation (AM) and single sideband (SSB) intermediate frequency (IF) amplifier integrated circuit (IC) with its associated automatic gain control (AGC). The circuit of the single crystal carrier oscillator, buffer and product detector is explained in the same issue.

From the circuit, **Fig. 3**, in my May 2016 *DiBD* article, the frequency modulated (FM) IF amplifier IC together with its noise filter and squelch circuitry, **Fig. 4**, are the first section. In **Fig. 5** of the same issue I showed a switch wafer to select carrier crystals and IF filtering and a separate switch wafer to select the appropriate demodulated audio.

This approach would have required screened wiring from the rear board to the front panel mode switch as well as unscreened wires to the mode switch from both front and rear circuits.

New Audio Switching

To simplify the wiring and also, hopefully, to reduce unwanted noise pick up, I have incorporated circuitry to switch the required audio path from each demodulator using diodes.

The rear-end part circuit appears as **Fig. 2** and shows how a PNP transistor Tr4 is added to the AM demodulator output from IC2 pin 7 and when selected, passes current through D2 down through the volume control. Similarly for the output of the FM discriminator on pin 9 of IC3, Tr5 performs exactly the same function and passes current through D5.

It was much simpler with the product detector because I chose to use the DC path through the secondary of the driver transformer T1 to pass current through D6. When each of these audio outputs is selected, the voltage across the volume control will be about 10V will thoroughly reverse bias the diodes not chosen.

Now that the audio is being switched by DC it was a simple matter to use D9 and D10 to create the single switching voltage necessary for the AM/FM filtering of the front board. Likewise D7 and D8 combine the individual front board USB and LSB filter selection lines to select the carrier oscillator and product detector supply.

Audio Amplifier

Output from the volume control wiper needs to go to an audio amplifier circuit that includes an input DC blocking capacitor. The circuit **Fig. 5** of *DiBD* May 2016 shows the audio circuit I intend to use although there just wasn't the room on the circuit of **Fig. 2** of this article to include it.

I do have a small board already suitable for that stage and developed and described years ago in *DiBD*. Maybe I should not include it because some constructors have their own audio amplifier preferences, such as the low component count LM386.

Front-End Filters

We have now almost arrived at the point of putting all the pieces together except that no details have previously been published in *DiBD* or *T4T* regarding the front end filters.

The circuit shown here as **Fig. 3** is for a development I did in 2012 and 2013 for filters for each of the high frequency (HF) amateur bands and produced a 5-band printed circuit board to suit.

By choice of components, I created a filter kit type 5A to cover 80, 40, 20, 15 and all of 10m and filter kit type 5B to cover 160, 60, 30, 17 and 12m. The two boards can be mounted back-to-back and have their inputs and outputs paralleled to provide a module with DC selection of all the amateur HF bands. By juggling around the filters, I can easily create the lowest five frequency bands on one board and the highest five on the other.

Filter and Synthesiser Switching

The 12-band synthesiser developed and described in the September 2015, November 2015 and January 2016 *DiBD* columns is required in this project to produce the required first local oscillator for 160 through to all four 500kHz sections on 10m but excluding 60m.

The receiver is basically a 5.0-5.5MHz (60m) single conversion

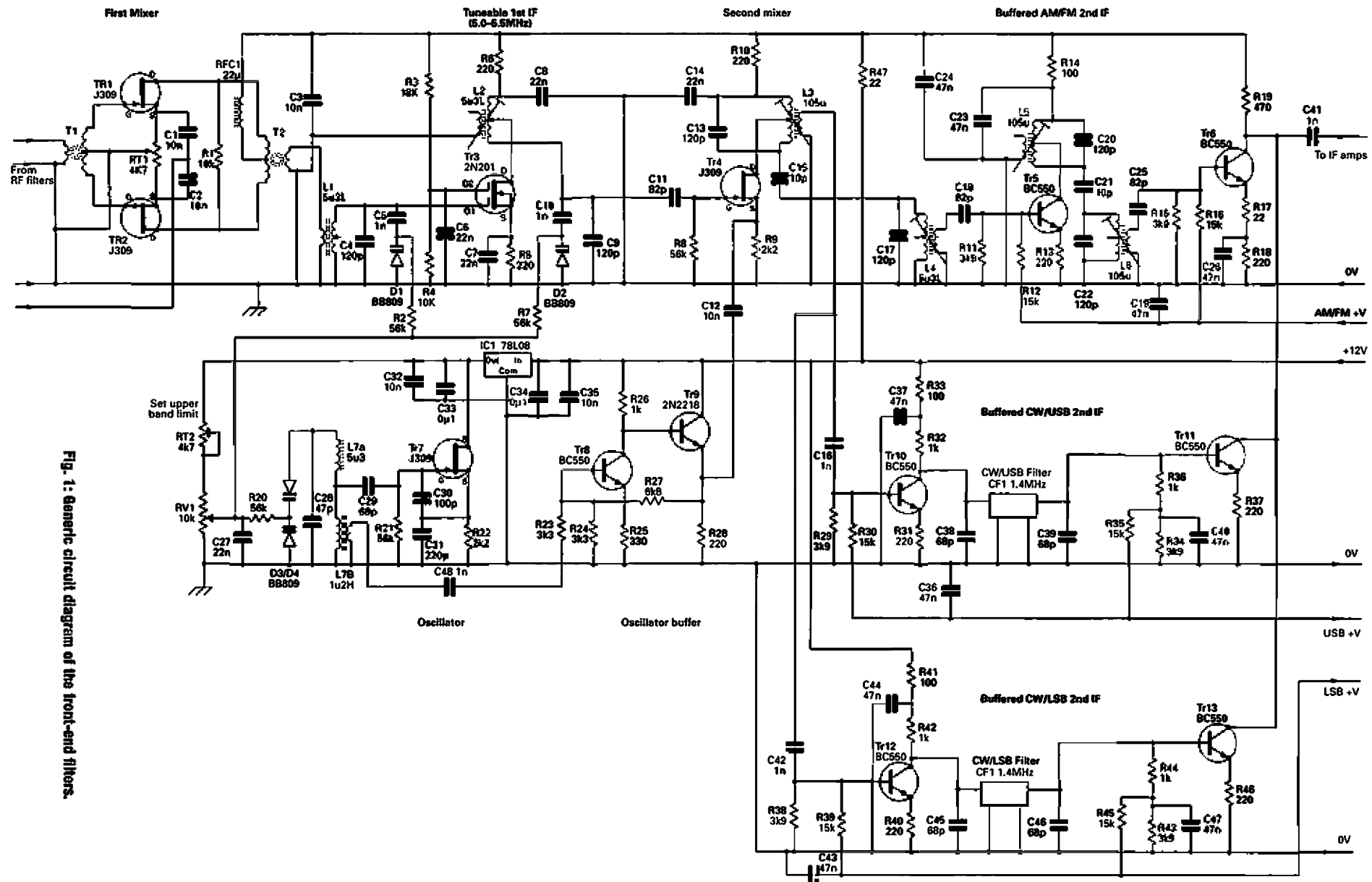


Fig. 1: Generic circuit diagram of the front-end filters.

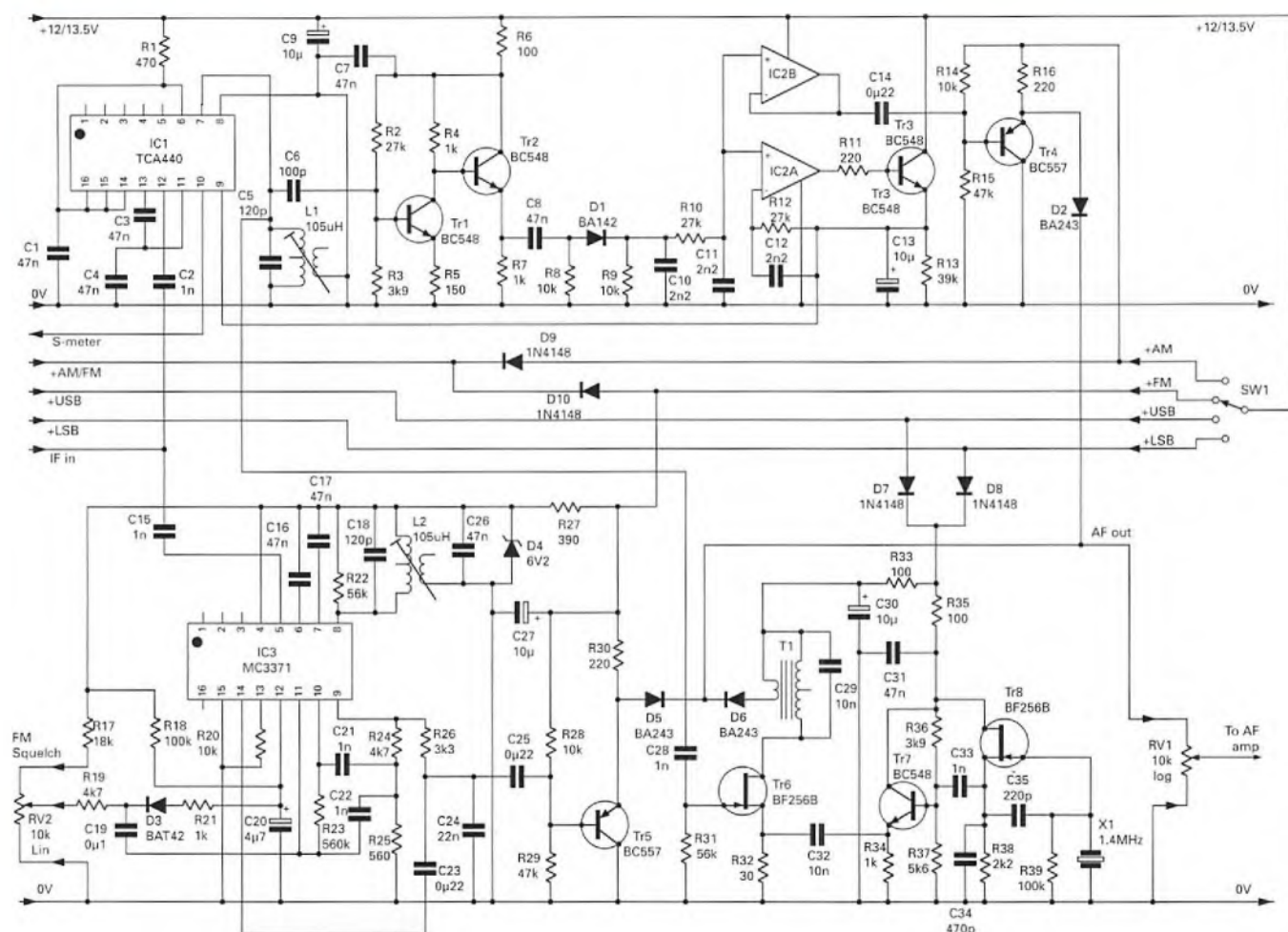


Fig. 2: The rear-end part circuitry.

receiver with the first mixer in Front Circuit being unbalanced with respect to the input signal. This will act as a radio frequency amplifier on 60m and as a mixer with injection from the synthesiser on all other bands.

The synthesiser band coding also provides power to the three voltage controlled oscillators (VCO) so when there is no band selection there are no VCOs either. This slightly complicates things, requiring a toggle switch to select the 60m front-end filter with one way and the other bands with the other way. Only one line is required to the front end 10m filter so it is necessary to use four diodes to combine together the four separate bands 10A – 10D of the synthesiser.

Composite Assembly

All the various parts now come together as shown in the Composite Assembly in Fig. 4.

The toggle switch and 12-way rotary switch select either single conversion 60m band to 1.4MHz or any of the other 12 bands and dual conversion first to 5-5.5MHz then 1.4MHz.

I realise now that I will need to provide a separate scale on the main tuning for 160m because I programmed the synthesiser for 1.8MHz and all other bands start at 0.5MHz or 1.0MHz. Maybe I will re-program the synthesiser so on that band it is notionally 1.5-2.0MHz. Then the band switch can be marked 1.5, 3.5, 5.0, 10.0, 14.0, 18.0, 21.0, 24.5, 28.0, 28.5, 29.0 and 29.50. The main tuning can then have two scales, 0-500kHz and 500kHz – 1MHz.

The front board has screened wiring for RF and Synthesiser input and for 1.4MHz IF output. It also has unscreened wires for +12V, 0V, +AM/FM, +USB and +LSB connections with the rear board. There is only one control associated with the front board and that is main tuning but it may be necessary in future to add a small value potentiometer in series with the main tuning to provide $\pm 2.5\text{kHz}$ of fine tuning.

The rear board has the Mode Switch, FM Squelch and Audio Volume as controls and a moving coil meter drive for signal strength. On condition that when the hardware is put together and commissioned I can make it work as well as it should, then its use should be simplicity itself, with only the following controls:

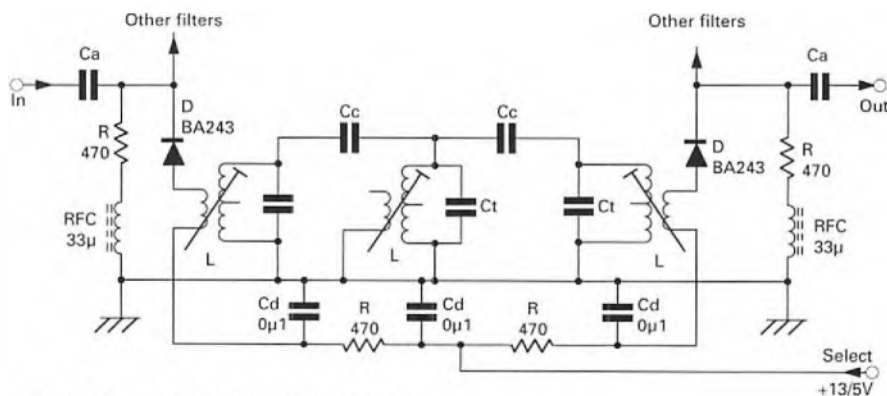


Fig. 3: Front-end part of the MMRX circuitry.

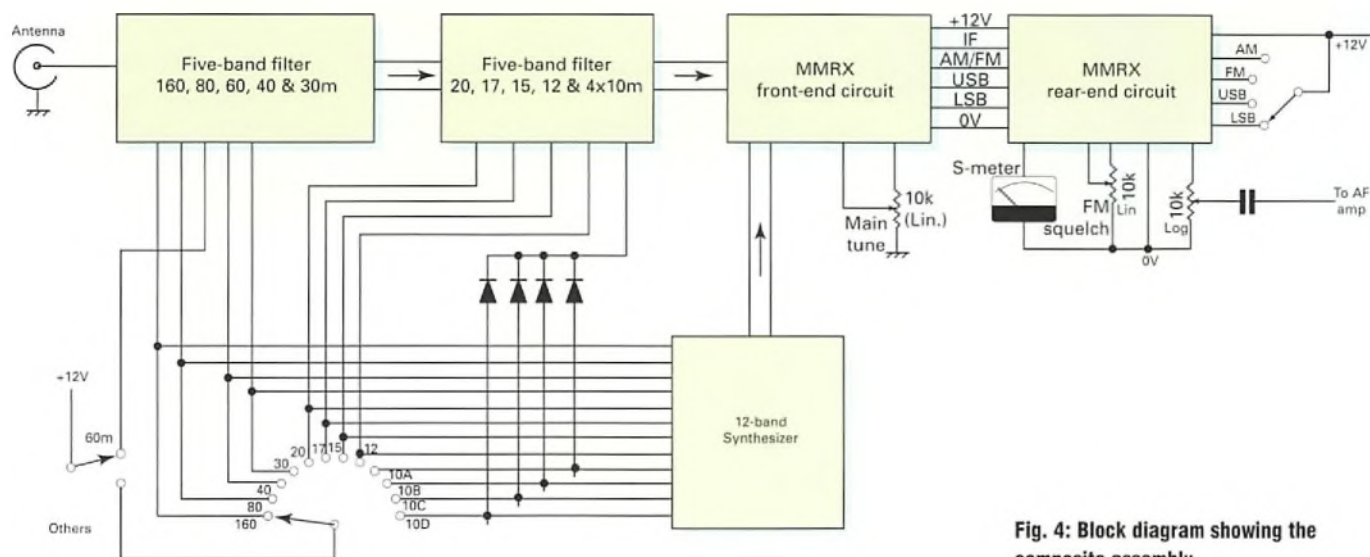


Fig. 4: Block diagram showing the composite assembly.

1. Toggle Switch, 60m Band or Others.
2. Rotary Switch, Other Bands 160 –10m.
3. Main Tuning.
4. Switch Rotary AM, FM, USB, LSB.
5. Variable, FM Squelch.
6. Variable, Audio Gain.

Final Remarks

I am a bit concerned that the receiver will be so quiet that operators might think it is faulty. Hopefully it will be very low

background noise compared to most modern commercial equipment because it only contains a single digital IC, the MC145151P with a large frequency step of 100kHz with good suppression of control voltage noise.

There are no PICs or microprocessors, no strobed LED/LCD display, no dual or triple step high speed synthesisers, no waterfall display, no spectral display, no memories, no menus, no touch screen and no computer interface. I just wonder if it will be any use to the modern amateur or shortwave listener.

Job opportunity

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The PW Christmas Quiz

Welcome to the 2016 Christmas Quiz. Our questions have been compiled by Bob Glasgow GM4UYZ of the Cockenzie and Port Seton Amateur Radio Club. We asked Bob because he always does a great *Test Your Knowledge* quiz in the club's magazine *Elements*. The questions are based on the three tiers of the amateur radio licence and taken from a selection of topics. The answers appear on page 64, where you can also see from which part of the examination syllabus they were taken.

1. A Foundation amateur, callsign M3ABC, is mobile in Wales. The callsign used may be
 - a. M3ABC/M
 - b. MW3ABC/M
 - c. W3ABC/M
 - d. M3ABC/W
2. An Intermediate licensee may operate
 - a. in any European country
 - b. only in the UK
 - c. in any country that has implemented CEPT recommendation T/R 61-01
 - d. in any country that has implemented CEPT recommendation T/R 61-02.
3. To operate abroad under CEPT recommendation T/R 61-01 you must operate
 - a. only from the station of another amateur licensee in that country
 - b. in accordance with your UK licence conditions
 - c. in accordance with requirements of the host country
 - d. only with the permission of a host country licensee.
4. A filament bulb is placed in a continuous circuit with 12V battery and glows. What is the effect if the battery is replaced with a 12V alternating current source?
 - a. The bulb goes out
 - b. The bulb will glow brightly and burn out
 - c. The bulb will glow very faintly
 - d. The bulb will continue to glow as before
5. A small base current will cause
 - a. An opposite current through the collector
 - b. A smaller current through the collector
 - c. An equal current through the collector
 - d. A larger current through the collector
6. What is the purpose of a high value resistor connected across a high voltage capacitor?
 - a. To prevent electric shock after switch off
 - b. To dampen any parasitic oscillation
 - c. To increase the current carrying capacity of the component
 - d. To limit the power supply current to a safe value
7. An amateur decides to change the frequency band of operation but forgets to check the antenna matching. An effect of this may be that the
 - a. antenna is overloaded
 - b. wrong frequency is transmitted
 - c. transmitter may be damaged
 - d. transmitted signal sounds distorted.
8. Harmonic radiation from a transmitter may be reduced by
 - a. Adjusting the receiver's audio gain control setting
 - b. Fitting a lowpass filter in the antenna feeder to the transmitter
 - c. Placing a highpass filter in the mains lead
 - d. The state of the sunspot cycle
9. In a double conversion Superhetrodyne receiver the function of the first mixer is to
 - a. Demodulate CW or SSB signals
 - b. Convert radio frequency signals into intermediate frequency signals
 - c. Convert intermediate frequency signals into audio frequency signals
 - d. Produce a signal that is separated from the wanted frequency by the intermediate frequency
10. Which one of the following antennas can focus the radio signal in a particular direction?
 - a. Dipole.
 - b. End fed.
 - c. Ground plane.
 - d. Yagi.
11. A dummy load for radio use must be
 - a. Non-inductive
 - b. Colour coded
 - c. Tuned to the band in use
 - d. Wire wound
12. A 1/4 length of solid polythene coaxial cable is required to match an antenna for the 2 metre band. Its length will be approximately
 - a. 25cm
 - b. 33cm
 - c. 50cm
 - d. 66cm
13. The ionosphere is the
 - a. region close to a high power transmitting antenna
 - b. layers of conductive gases just above the ground
 - c. layers of conductive gases above 70km in height
 - d. region that reflects VHF and UHF waves back down.
14. The main mode of propagation for long distance contacts (DX) on the HF bands is by
 - a. ionospheric reflection
 - b. ground wave
 - c. meteor scatter
 - d. direct wave
15. Communications with satellites often use circular polarisation because
 - a. The satellite is often below the horizon
 - b. The orientation of the satellite changes
 - c. This avoids interference to earth based stations using horizontal or vertical polarisation
 - d. Reflections in the ionosphere will change the polarisation by varying degrees
16. RF breakthrough onto speaker leads of hi-fi equipment is prevented by ferrite ring filters on the leads. Where should the rings be placed?
 - a. Behind each loudspeaker
 - b. Half way between each speaker and the equipment
 - c. As close as possible to the equipment
 - d. A quarter wavelength from the loudspeaker
17. Interference conducted out of a transmitter along its power supply leads can be detected by
 - a. Replacing the transmitter antenna with a dummy load
 - b. A sensitive receiver tuned to multiples of the transmitter frequency
 - c. A de-sensitised receiver tuned to either side of the transmitter frequency
 - d. Disconnecting the power supply unit
18. Signals from a transmitter working on 3.56MHz are reported as causing interference over the whole of the FM broadcast radio band. This is probably caused by a harmonic of the RF signal getting into the
 - a. RF amplifier
 - b. 10.7 MHz IF amplifier
 - c. AF amplifier
 - d. Power supply
19. When you are calling 'CQ' on 145.500MHz and another station replies you should
 - a. state your name and location
 - b. remain on this frequency
 - c. exchange signal reports
 - d. arrange to move to a clear channel.
20. Which one of the following is MOST likely to be effective under poor propagation conditions?
 - a. CW
 - b. SSB
 - c. FM
 - d. SSTV
21. Contests are a regular feature of amateur activities but the bandplans advise that contests should not occur in the
 - a. 10, 12 and 15m bands
 - b. 12, 15 and 17m bands
 - c. 12, 17 and 30m bands
 - d. 15, 20 and 40m bands
22. Before investigating or repairing equipment,
 - a. switch the equipment off and disconnect it from the mains supply
 - b. ensure that there is good earth for the investigator to hold
 - c. check the First Aid supply
 - d. make sure that a fire extinguisher is within reach.
23. A mains powered piece of radio equipment has a maximum input rating of 800W at 230V. The MOST appropriate fuse rating for the fuse to be fitted in the mains plug to the unit would be
 - a. 3A
 - b. 5A
 - c. 7A
 - d. 13A
24. Thunderstorms are a risk to an amateur station because
 - a. A lightning strike has the potential to induce eddy currents in the earth system
 - b. Lightning is attracted to electromagnetic radiation
 - c. Static build up on the antenna system can damage electronic equipment connected to it
 - d. Antenna systems are always connected to earth
25. What is the value of a resistor coloured green, green, gold
 - a. 5.5Ω
 - b. 55Ω
 - c. 555Ω
 - d. 5.5kΩ
26. The power output of a piece of equipment is specified in Peak Envelope Power. What type of output is this?
 - a. The AF power to the transmitter modulator
 - b. The RF power output of an SSB transmitter
 - c. The AF power output of an SSB receiver
 - d. The DC input power stage of an SSB transmitter

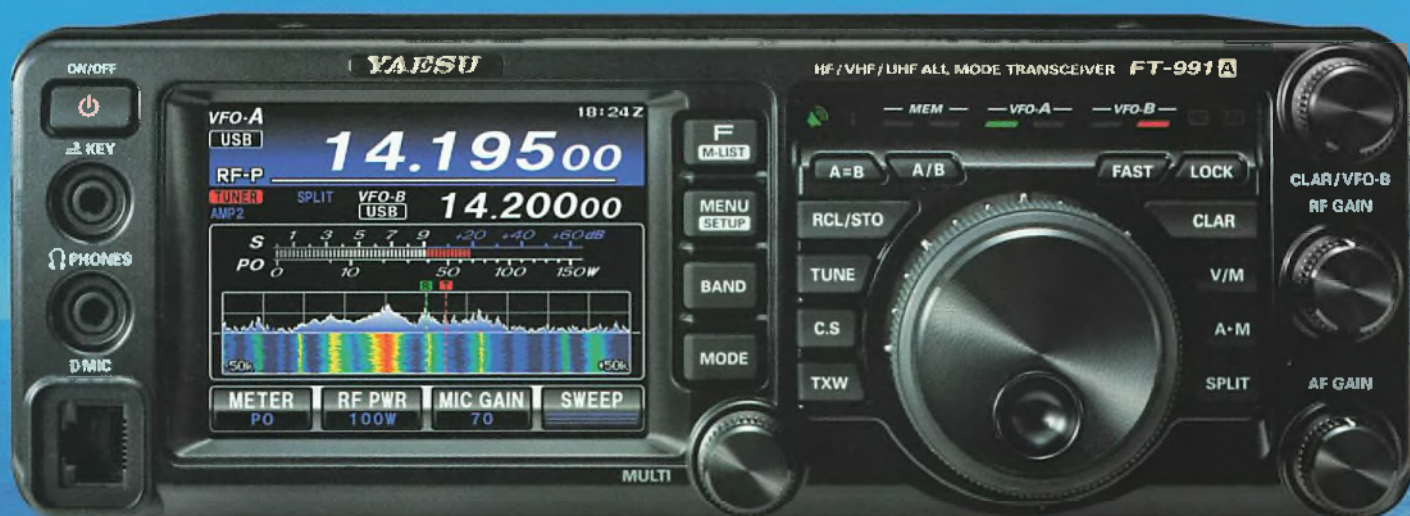
Answers on page 64.

Introducing the New **FT-991 A**

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FT-991 A



ISS Amateur Radio Station News

Tim Kirby G4VXE has his usual roundup of VHF news, including some late season sporadic E.

When a piece of equipment breaks down, it can be inconvenient for most of us. Some of us have the skills to mend it ourselves. In some cases a friend will help to mend it while for others of us, we send the equipment off to a service point for repair. It can be inconvenient but not a disaster. Imagine though, that you are in orbit, 270 miles above the earth and your VHF station breaks down.

That's exactly what happened recently in the International Space Station (ISS) to the equipment used by the astronauts in the Columbus module for making voice contacts and for the packet digipeater on 145.825MHz. The equipment had been in use for well over ten years before the failure. This has caused a rethink of equipment on board. There's another radio in the Russian portion of the station and it appears that this will be used for now.

One of the side effects of these equipment problems is that the popular APRS digipeater on the station will move from 145.825 to 437.550MHz where it is expected to remain for at least a few months. This provides an interesting new operating challenge for many of us. Of course, the Doppler shift is more significant on the 70cm band so it does mean that your transmitter and receiver will have to be retuned through the course of the pass, as opposed to being able to leave both transmitter and receiver on 145.825MHz.

As soon as the change to 70cm was announced, good friend of PW, Patrick Stoddard WD9EWK helpfully published

some details of how to set up some of your transceiver memories so that you can simply change memory through the course of the pass and your transmit and receive frequencies will be adjusted accordingly. This is summarised in Table 1.

Simply start off with your rig on channel 1 and then follow the signal through the channels as the Doppler shift reduces and your transmit frequency will automatically follow.

I used the Kenwood memory program to add these frequencies to my THD-72E handheld but you could also use the CHIRP program that we have mentioned before, which is an excellent tool for programming memory channels on a wide variety of radios. You can find CHIRP at: <http://chirp.danplanet.com/projects/chirp/wiki/Home>

There's a bit more to do in using the ISS digipeater now it's on 70cm but it's quite straightforward and some people have reported that the signals are even stronger than on 2m. Do have a go and please let me know how you get on.

The 6m Band

Lyn Leach GW8JLY (Cardiff) writes, "There have been a few unusually late 'summer' Es events in the past few weeks. On October 1st I worked LA6OJ (JO38)

and on October 13th I worked some Italian stations in JN52. On October 15th I worked more Italian stations in JN35, JN45 and JN53 and 9A2PT in JN75. As far as I can remember this was the latest date ever for 'summer' Es. It won't be long now before the winter Es season commences".

Here at G4VXE, I caught a nice Es opening on October 26th, working T77C (JN63), TK5MH (JN41) and t8JIT (JN71) on a mix of CW and SSB followed by IK6BMU (JN72) on JT65A. Maybe this was an even later 'summer' event.

Jim Edgar GM4FVM (Eyemouth, Berwickshire) caught an Es opening on October 13th, working EA1VIL (IN70) and EA4BAS (IN80) before some aurora started, at which point he worked G4ELJ (IO91), G8GXP (IO93), OZ9KY (JO45) and GI4DOH (IO74). There was then a big Auroral Es opening, which Jim largely missed, owing to domestic duties, but he did manage to work SM2P (KP15). Jim writes, "The generally raised geomagnetic activity, with a K number over three for several days, induced more 6m Es. I worked EA3LX (JN11) on October 15th. Although there were brief periods of aurora associated with the enhanced conditions, it never came to a large event here".

The 4m Band

The only person to mention the 4m (70MHz) band this month is Jim GM4FVM who made some contacts during the aurora on October 13th, working GI4OWA (IO64) and GM4JJJ (IO86) followed later by ON7EQ (JO11). Jim says that meteor scatter (MS) conditions were not good during the month and it was hard going working regulars, OZ1JXY and SP9HWY. The Orionids shower showed very little improvement over normal conditions.

The 2m Band

It's always great to hear from a reader who hasn't been in touch before, especially when someone decides to try VHF activity for the first time. Martin Mills MOMLZ (Plymouth) wrote with his story, which I hope may inspire some of you to try something similar. Over to Martin.

"I passed my Foundation exam quite suddenly last May having visited Callington

Table 1 – Channels to program to handle Doppler shift.

Channel	Receive (MHz)	Transmit (MHz)
1	437.560	437.540
2	437.555	437.545
3	437.550	437.550
4	437.545	437.555
5	437.540	437.560

ARS one evening just to find out a bit more about getting a licence and ending up doing the practical test that very evening! I followed this with my Intermediate in November and my Full, through the Bath group, in July this year. I now operate as M0MLZ.

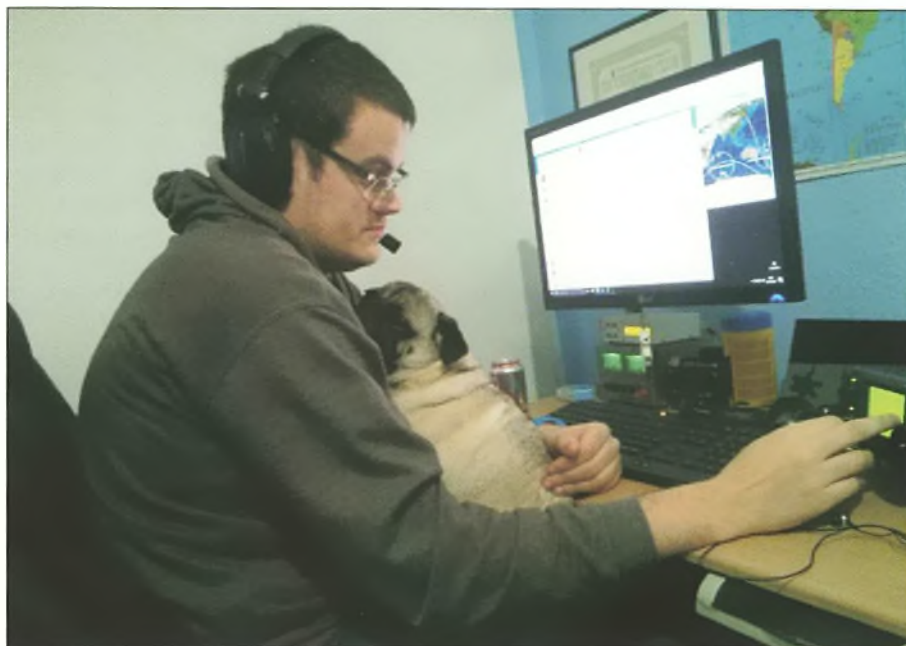
"In August I thought I'd have a go at my first ever contest and with some excitement I settled myself down for the 144MHz UKAC. Disappointingly, I only managed one contact from my QTH in Plymouth with a station 25 miles away in Cornwall but I was hooked and decided that for the following month I'd head to the top of a local hill and give it a real go.

"The first Tuesday of September arrived (unlike the HB9CV I'd ordered!) so I set up my station with a vertical X30-style white stick up Kit Hill (IO70UM) running 50W from my Yaesu FT-991 and had the most amazing evening, making 20 contacts. These included F6FGO (IN78), GJ3YHU (IN89), F9OE (JN18), GU6EFB (IN89) and EA1EBJ (IN73). I was thrilled to say the least but now realise there must have been quite a lift on because my entries from the same spot in October and November have not quite lived up to that although I did manage F6APE (IN97) during this week's contest.

"It has been enough, though, to encourage me to venture away from only HF and keep an eye on VHF too. This was rewarded last weekend when I noticed G4GVZ from Cheltenham on one of my local 70cm repeaters on Saturday afternoon. After a chat with him I had a tune around and found I was picking up the EI2MGR repeater in Cork. I then had a great evening with contacts that included EI3GGB (IO51), MW6EUK (IO83), M0TLX (IO94) EI8DY (IO62), EI9GGB (IO62) and EA11TV (IN52), all on FM through the Irish repeater".

Well done Martin! Nice contacts there and I'm quite sure you will go from strength to strength. Hopefully the HB9CV will arrive, or another small horizontal Yagi, because that will undoubtedly make quite a difference to having successful contacts on SSB. Being down in the southwest provides some great sea paths with some very interesting possibilities so I am sure there are many more DX contacts to look forward to.

Jef VanRaepenbusch ON8NT (Aalter) sends his usual interesting log with many stations worked from the UK. During the RSGB 2m UK Activity Contest on October 4th, Jef worked G0GDA (JO01), G8XVJ/P (IO93), 2E0NEY (IO81), M0BRA (IO91), G8CUL (IO91), G3MEH (IO91), G4CLA (IO92) and G4IRC (JO02). During the



Peter 2E0SQL's automated satellite station means that he can work DX even while 'assisted' by Monty the pug.

tropo on October 20/31st, Jef worked G7RAU (IO90), M1BXF (JO02) and M0CGL (JO03). Jef runs 25W to a 5-element Elk Yagi.

Simon Evans G6AHX (Twynning, Gloucestershire) enjoyed the tropo openings on October 29/30th, working F5ICN (JN03) at a distance of 993km. F5ICN was on the north side of the Pyrenees at around 400m ASL with a clear takeoff towards the UK. Simon also worked F1MOZ (IN93) and F6APE (IN97) as well as EA2XR (IN83) and EA2CSI (IN83). Simon took part in the UKAC on November 1st when his best DX was PA0WMX (JO21) at a distance of 564km.

Lyn GW8JLY writes with an interesting account of his activity. "On September 27th, I was very fortunate to make a 2m tropo contact with EA8TX (IL18). I have a very poor takeoff to the southwest and it's far from easy to make any QSOs in that direction, let alone a contact with EA8 at 2808km.

"Almost a month later, on October 29th, there was more tropo propagation. I made good QSOs with French stations in locators JN03, IN93, IN94, IN95 and Spanish stations in locators IN73 and IN83. The following day, the 30th, the band was open again to Spain and a few more EA stations were worked. During the evening the propagation had moved to the east from here and I made QSOs with German stations in JO31 and Dutch stations in JO21 and JO22. All signals were very strong in Cardiff.

"Recently Martin GM6VXB has been operating portable as GM6VXB/P and using MS from various oil support vessels and platforms in the North Sea. I completed MS QSOs with him in the rare 'wet' locators

IO98, JO07 and JO17. I am very grateful for Martin's efforts to activate these rare locators."

Jim GM4FVM writes, "I do not have a good takeoff to the south so the tropo conditions did not favour me much. I can get out to the southwest and I did manage to work EI4KH via the Cork repeater on 2m FM at a distance of over 600km from here, followed by G10BDX (IO74), both on October 30th. Conditions were up again the following day when I worked OZ1BEF (JO46) and OZ5NJ (JO45), also via tropo".

The 70cm Band

Jef ON8NT worked G4CLA (IO92) and G4RUL/P (JO00) during the RSGB 432MHz UKAC on October 11th and then G0JJG (JO02) during the tropo event on October 31st.

Tom Hackett M0ABA (Shoeburyness), operating as MX0CNS during the October 70cm EME contest, had some fun although he did not find conditions helpful to making contacts with his low power and small antennas. HB9Q was seen with good signals early on but then conditions went downhill fast. Even with poor conditions and just a 2-element Yagi (yes, two elements!), it was still possible to get some decodes from the PI9CAM super station.

Simon G6AHX worked F5ICN (JN03) during the late October opening.

Satellites

Jef ON8NT reports a good number of contacts through SO-50 and AO-85. Via SO-50, he worked 2E0SQL (IO91), DL70NRW (JO31), PE1NIL (JO21), G0ABI (IO80), LX6/DO2SYD/P (JN29) and EA4AYW (IN70) and via AO-85 he worked

PE1DH (JO31), F4EJW (IN78), DB2TK (JO50), EA7AHA (IM76), 2E0SQL (IO91), G0TKZ (JO02) and PA3RVG (JO21).

Kev Hewitt M0GTD (Southend) monitored the ARISS contact between OR4ISS on the space station and IQ3FL at Istituto Comprensivo 'Marco da Melo' in Mel, Italy. At 0847UTC on November 4th, the pass was almost directly overhead with good signals. Kev used a Yaesu VX-3 and a 2-element Yagi made from two Poundstore rabbit ears television antennas.

Mark Marment CT1FJC (Algarve) has had a good month, logging 144 contacts through satellites with some really nice ones. Mark writes, "I worked KG5CCI (EM34) through AO-7 at a distance of 7274km. We hope to make it via FO-29 as well when orbits permit. The AO-7 QSO is my best DX distance so far. It was a very low elevation pass at both ends and there was only a short time to complete the QSO. However, I was heard by W5PFG (EM21) at 7679km, who also sent me an e-mail and report. When his trees have lost their leaves, allowing a lower horizon and we have a suitable orbit, we will give it a try. I was also very pleased to work KO4MA (EL88) at 8821km through FO-29 as well as WP4T (FK68) on the same pass.

"Before long, I hope to get the satellite antennas up on the roof of the apartment block alongside the 6m beam. This should give me a lower horizon angle, which is currently about 2° because of large apartment blocks on higher ground some distance from me. With the antennas at present on a tripod on a west facing terrace, I lose more than 180° of rotation, restricting the orbits I can use.

"I have been able to make a few QSOs through SO-50 using the Doppler shift in frequency on the downlink on passes as they move away from me, to remove the

huge known TS-2000 birdie on 436MHz".

Patrick WD9EWK (Phoenix) writes, "In mid-October, I drove to the San Francisco Bay Area for the Pacificon Convention, the ARRL's Pacific Division event. This was the first time I have been to this Convention and I helped the volunteers who normally represent AMSAT at this one. Along with the booth, I was able to do some demonstrations of satellite operating outside the Convention hotel. For these, I operated as W1AW/6, which was also being used by the special event station on the HF bands. W1AW/6 was heard through the SO-50 and FO-29 satellites, working stations across the continental USA and Canada.

"Before and after the Convention, I operated as I drove to and from San Francisco. I made a quick trip one evening to Santa Cruz – a coastal city south of the San Francisco Bay Area – to activate the rarely heard grids CM86 and CM96. After the Convention, I visited a few National Park Service sites around San Francisco, including the Fort Point National Monument at the south end of the Golden Gate Bridge. From Fort Point, I worked SO-50 and FO-29 passes in a heavy downpour, enough to make this an official activation for the ARRL's National Parks on the Air activity. For the Pacificon trip, I activated ten grids across California, along with a total of five National Park Service sites, all via satellite. I drove over 1800 miles over five days, including a couple of hundred miles in and around San Francisco for sightseeing and operating.

"A few days after returning from San Francisco, I drove to the Organ Pipe Cactus National Monument, near the USA/Mexico border in southern Arizona. This national monument also sits in another rarely heard grid, DM31. I worked several passes from grid DM31 as well as DM32

within the national monument and drove down to the border fence. Unlike in past years, I wasn't able to walk up to the border fence but I could see the signs and large Mexican flag just across the fence. Operating from the Organ Pipe monument made this the sixth National Park Service site I operated from during the month of October".

Graham Jones G3VKV (Cheltenham) operated through FO-29 on October 12th, for a low transatlantic pass south to north of 8° (minutes) with a maximum 2.8° elevation. Graham had seven contacts, starting with KG5CCI in Arkansas, VA3KSF in Ontario, K4FEG in Tennessee, NS3L in Pennsylvania, N9IP in Indiana, VE6CCM in Calgary, Alberta and, to finish off, WC7V in Montana although we lost contact as the satellite went over the horizon. Working one station on a pass like that can be satisfying but seven is very impressive indeed!

Microwaves

A new 47GHz beacon on 47.088940GHz, callsign GB3CC, located on Cleeve Hill, Gloucestershire (IO81XW81) was activated on November 4th by the Gloucestershire Repeater Group. It is on the same site as the 10GHz beacon and runs 10mW to a slotted waveguide antenna, which is 4m above ground level and 330m above sea level. Any reception reports will be very welcome.

Merry Christmas!

That's it for this month. Thank you to everyone who has written this year and to all readers and their families, wherever you may be. I wish you a very happy time over the holiday period. I look forward to reporting more of your VHF/UHF news during 2017.



A rather wet Golden Gate Bridge provided the backdrop for one of Patrick WD9EWK's operating locations recently.



Plan your rally visits with our comprehensive list of forthcoming events.

PW Publishing Ltd. will be at shows marked* – come along to our stand for great deals on subscriptions to *Practical Wireless* and *RadioUser*. Club Secretaries and Event Organisers – please send us details of your event if you would like it to be mentioned here.

DECEMBER

December 8th (Thursday)

The SBARC Winter Table Top Sale

The South Bristol Amateur Radio Club Winter Table Top Sale will be held at the Novers Park Community Centre, which is at the rear of 122 to 124 Novers Park Road, Filwood, Bristol BS4 1RN. It's described as: "A chance to clear some items from the shack and pick up new items or fill that wish list. Please bring equipment, cash and your bartering skills." The event is associated with a regular Club night, which starts at 7.30pm and is open to all, not just Club members. The sale will take place between 8.00pm and 9.00pm – no trading before 8.00pm. www.sbarc.co.uk

December 17th and 18th (Saturday/Sunday)

Vintage Radio Weekend

Vintage radio enthusiasts are invited to participate in an on the air Vintage Radio Weekend on December 17th and 18th. This activity is open to everyone who has a classic transmitter or receiver, or who is interested in owning one. Activities can be on any band and mode, and at any time. All participants can download a free self-service VRW Award Certificate. For more information, please see the Phoenix Amateur Radio Club website. www.phoenixarc.org.uk

2017

JANUARY

January 15th

The Red Rose Winter Rally

The Red Rose Winter Rally (organised by the West Manchester Radio Club) will be held at Lowton Civic Centre, 23 Hesketh Meadow Lane, Warrington, Cheshire WA3 2AH (just off the A580 East Lancs Road). The doors will open at 11.00am and there will be free car parking, trade stands, a low-cost Bring & Buy, special interest groups, an RSGB bookstall and a café area. The venue is all on one level, with facilities for the disabled.

John (Rally Manager)

Tel: 07870 161953

http://wmrc.org.uk/lowton_winter.htm

January 29th

The Horncastle Winter Rally

The Horncastle Winter Amateur Radio Rally will be held at Horncastle Youth Centre, Cagthorpe, Horncastle, Lincolnshire LN9 6DZ. The doors will open at 10.00am and admission will cost £2.00. There will be free parking, trade stands, a prize draw and refreshments will be available (including hot drinks and the now famous Horncastle bacon butties). The event will be all on one level and the venue has toilets for the disabled, wheelchair access and is suitable for both wheel and electric motor chairs. For more information, call the number below – if no answer, please leave a message and you will be called back. Tony G3ZPU
Tel: 01507 527835
E-mail: tony.nightingale@yahoo.co.uk

FEBRUARY

February 5th

The Canvey Radio and Electronics Rally

The South Essex Amateur Radio Society will be hosting the 32nd Canvey Radio and Electronics Rally at The Paddocks Community Centre, Long Road, Canvey Island, Essex SS8 0JA (the southern end of A130). The doors will open at 10.30am and there will be free parking, trade stands, freshly made refreshments (Mark's famous bacon baguettes) and facilities for the disabled. Traders will have access to the venue from 8.30am.

Vic Rogers G6BHE

Tel: 07957 461694

E-mail: nvr1945@btinternet.com
www.southessex-ars.co.uk

February 10th, 11th and 12th (Friday/Sunday)

The Orlando HamCation

The 71st Orlando HamCation will be held at the Central Florida Fairgrounds and Expo Park, 4603 West Colonial Drive, Orlando, Florida 32808. The doors will be open from 9.00am to 6.00pm on Friday, 9.00am to 5.00pm on Saturday and 9.00am to 2.00pm on Sunday. Admission for all three days will cost US\$15.00 (for tickets purchased at the gate) or

US\$13.00 (if purchased in advance).

There will be talk-in, free car parking, trade stands, a flea market, a car boot sale, forums, special interest groups, family attractions and a prize draw. www.hamcation.com

February 11th (Saturday)

The Ballymena ARC Rally

The Ballymena Amateur Radio Club Rally will be held at Ahoghill Community Centre, 80 Cullybackey Road, Ahoghill, Ballymena, Co. Antrim BT42 1LA.

Hugh Kernohan G10JEV (Secretary)

Tel: 02825 871481

E-mail: hkernohan@aol.com

<http://g13fff.synthasite.com>

February 12th

The Harwell Radio & Electronics Rally

The Harwell Amateur Radio Society will be holding a Radio and Electronics Rally at Didcot Leisure Centre, Mereland Road, Didcot, Oxfordshire OX11 8AY. The doors will open at 10.00am and admission will cost £3.00 (children under 12 free). There will be talk-in on 145.550MHz using G3PIA, free parking nearby (disabled parking next to Leisure Centre), trade stands, special interest groups and an RSGB bookstall. Refreshments will be available all day.

Ann, G8NVI

E-mail: ann.stevens@btinternet.com

<http://g3pia.org.uk>

February 19th

AudioJumble

AudioJumble – "The UK's largest second-hand and vintage hi-fi event" – will be held at The Angel Leisure Centre, Angel Lane, Tonbridge, Kent TN9 1SF. Items on sale will include vintage and modern hi-fi, valve amplifiers, transistor amplifiers, speakers, turntables, tuners, tape recorders, CD players, records, components, books and vintage radios.

www.audiojumble.co.uk

February 19th

The RadioActive Fair

The RadioActive Fair, promoted by the Mid Cheshire Amateur Radio Society, will be held at Nantwich Civic Hall,

4 Market Street, Nantwich, Cheshire CW5 5DG. The doors will open at 10.30am. There will be free parking, trade stands, a Bring & Buy, an RSGB bookstall, catering and facilities for the disabled.

Stuart M0WTX (Fair Manager)

Tel: 07880 732534

www.radioactivefair.co.uk

February 26th

The BRATS Rainham Radio Rally

The Bredhurst Receiving and Transmitting Society Rainham Radio Rally will be held at Rainham School for Girls, Derwent Way, Rainham, Kent ME8 0BX. The doors will open at 10.00am and admission will cost £2.50. There will be talk-in on 145.550MHz using GB4RRR. Free parking, trade stands and light refreshments will be available.

E-mail: Trev@wig1.co.uk

www.brats-qth.org

February 26th

The Pencoed ARC Table Top Sale

The Pencoed Amateur Radio Club Table Top Sale will be held at Pencoed Rugby Football Club, The Verlands, Felindre Road, Pencoed CF35 5PB. The doors will open at 9.30am and admission will cost £2.00. In addition to the trade stands, there will be hot food (morning and lunch time). Hot and cold drinks (non-alcoholic until lunch time) will be available from the bar. Sellers will have access to the venue from 8.00am and tables (which will be available on a first come, first served basis) will cost £10.00 each.

Madeline Roberts (Table Booking)

Tel: 01639 767056 or 07738 375775

February 26th

The Wyong Field Day

The Central Coast Amateur Radio Club will be celebrating its 60th anniversary with a Field Day at Wyong Racecourse, Howarth Street, Wyong NSW 2259, Australia. The gates will open at 8.30am and admission will cost AUS\$10.00. There will be ample car parking, ATMs on-site, trade stands, a large flea market, lecture programme, licence assessments and an air-conditioned licensed area.

www.ccarc.org.au/wp/ccarc-field-day

PL 259 Assembly

Dear Don,
PW has just arrived so thank you for including my suggestion in the Websites section. Also, **Terry Bailey G6CRF/G0CRF/KW4NQ** has truly earned his Star Letter. I was a GPO apprentice even more years (half a century) ago and I concur that he is right. I've been using his method of assembling PL259s for years and never had a fault develop. Good work, well done.

Bob Houlston G4PVB
St Albans, Herts

Dear Don,
I found that the Star Letter in the December Issue rather disturbing. This is something that I think you should have researched before printing. The writer advocates that the connection of the braid to the plug body is done by folding the braid over the cable and screwing the plug onto the body. This is totally wrong. I am sure that you are going to get a lot of backlash regarding this (the 259 is one of my pet hates). See the manufacturer's instructions in the attached datasheet.

www.mouser.com/ds/2/18/274-711853.pdf

From those instructions:

Step 1: Slide coupling ring onto cable. Cut end of cable even and strip jacket, braid and dielectric to dimensions shown in table. All cuts are to be sharp and square. Do not nick braid, dielectric or centre conductor. Tin exposed centre conductor and braid, avoiding excessive heat.

Step 2: Screw the plug subassembly on to the cable. Solder assembly to braid through solder holes, making a good bond between braid and shell. Solder conductor to contact. Do not use excessive heat.

The ARRL Handbook, the

RSGB Handbook and every other similar publication that I have come across show the connection of the 259 in line with the above instructions.

"If you can pull the connector off you then you are pulling too hard". Seriously? If it comes off, then it's not put on correctly. At the very least the centre conductor solder joint should not fail.

The varying cable jacket sizes and well as the differences between the plug designs make it extremely unlikely that a solid and long lasting connection will be made. Aside from that, twisting the connector on over the braid will cut many strands off the braid. There are other issues in doing this regarding the matching but because the matching of 259 is dubious at the best of times, this is a bit of a moot point. The screwing onto the cable jacket is used to provide a mechanical connection only, not the electrical connection for the braid.

The only common connector that will be encountered by most people that sometimes uses a screw-on type of connection are some forms of F connector used in the Satellite TV arena and even there most are crimped. That particular cable does have a solid copper jacket too, as well as it being for low power (signal) use.

The 259 is a dreadful connector and a long-standing joke in professional circles is that it's marginal for DC use, let alone RF. It is difficult to install correctly and a 15W or 25W iron is not good enough. I have an old Henry 60W iron with a very large bit, a lump of copper about 50 x 25 x 15mm, which just about does the job of soldering the braid connection. I also find that a bit of preparatory work, tinning the area around the solder holes first, helps a lot. Use 60/40 tin lead solder. It's still easily available and perfectly legal for non-commercial use. If you use

Repeaters and CTCSS

Dear Don,
I think **Dave Perry G4YVM** (Letters, November) hit the nail on the head when he spoke about CTCSS repeater access being a step too far. I was recently in Cheshire armed with a small VHF/UHF CTCSS-enabled handheld and I found myself tuning round the repeater frequencies hearing nothing at all. I was very tempted to put out a call but not knowing the required CTCSS frequencies, combined with the complexities of programming them into the handheld, put me off completely. If the local repeaters had only required a toneburst, I would have been active but instead I turned the radio off.

Martin Waller G0PJO
Suffolk

Dear Don,
I have been aware for some years now, like most amateurs, that both 2m and 70cm have been quiet bands as far as FM are concerned.

To me the letters from both **David Perry G4YVM** and **Ben Nock G4BXD** have hit the nail right on the head. Why do we need to have CTCSS these days on FM repeaters? The bands are not busy and the days of having to be able to find a vacant channel are long past. The change to CTCSS and also to 12.5kHz channel spacing were needed at one time but are they essential in 2016?

There is very little daytime use of the channels and this applies to weekends as well as weekdays. Where I live in Herts/NW London there are perhaps five or six simplex channels at most in use during the evenings.

Furthermore, if you visit other parts of the country, it becomes necessary to research and programme in to your radio's memory likely repeaters with their CTCSS tones, whereas once upon a time all you needed was a 1750Hz tone and you could be sure of being able to use repeaters anywhere in the UK.

My son lived in Bristol and has now moved to Gloucester, which means programming in a different set of repeaters. My daughter is moving from round the corner to Oldham so that means yet more repeaters to be researched and programmed in. What a faff when all you want to do is to speak to anyone who happens to be around and monitoring their local repeater.

No wonder the bands are quiet.

Stephen Slater G0PQB (Chairman, Edgware & District Radio Society.)
Borehamwood, Herts.

lead free solder, it is much more difficult to ensure a good joint.

Better still, you can get now purchase compression fitting 259 plugs from many stockists. These eliminate most of the problems. However the basic issues of the plug still exist. The 259 is a somewhat temperamental

design, not all plugs are the same (annoyingly, different threads between the socket and plug exist), it's not waterproof and so on. It is cheap and it is common, which are its only plus points, if you can call them that. 90% of the problems I investigate concerning antennas and suchlike boil down

Signal Levels and Noise

Dear Don,

Roger G3XBM's comments about QRP in the Letters section (December) prompted me to pen a response.

Like Roger I'm very lucky to live in a rather RF quiet location here in north Northumberland. In the past I have enjoyed QRP operations on both SSB and CW. However, I am beginning to notice that an increasing number of UK stations are now suffering 'Contest Syndrome' with QSO exchanges resembling, "You're 599 Old Man, please repeat your callsign phonetically".

Increasingly, stations with which I am in QSO are giving me 59+ reports yet constantly ask for repeats of information. In many circumstances I am told that while indeed my signals are 59+, I am barely above the other station's local noise level of S9. It seems that to complete a QSO in certain situations with a station living in a very noisy location, you must resort to running higher power in order to overcome their local noise level.

Without a doubt this noise problem is growing exponentially as our lives seem to become more and more dependant on various electronic gizmos producing high levels of RF pollution. Increasingly, some of my friends now have to rely on the various WebSDRs to even take part in HF QSOs.

So in answer to Roger's letter about using low power, while I sympathise with his views, I believe QRP is rapidly being killed off for many amateurs living in urban environments by higher and higher levels of electronic smog. And, of course, QRP CW is not an option for everyone.

Paul Unwin G4HDS

Rochester, Northumberland

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

to this connector. I have pulled connectors off the cable with two fingers because the solder joints have not been solid. In any situation this is not good. In the case of an installation running 100W+ of RF, it's a potential equipment killer.

In the case of commercial equipment, the prices are high. We pay anything from a few hundred to several thousand pounds for such equipment, yet it generally comes fitted with 259/239 type connectors. I'm strongly of the opinion that it's high time that manufacturers ditched this particular connector and used the vastly superior N type. Yes, they are more expensive but they last decades and compared to the cost of an expensive rig, they are well worth the extra cost. The fact that they are easier to fit for most people is another factor in their favour.

Andy Eskelson G0POY
Barking, Essex

Dear Don,
I read with interest the Star Letter in December's *PW* regarding soldering. I smiled at the comment that the Post Office take on a good connection was a wire wrap with copper wire on a mild steel post not requiring soldering.

In the early 1980s, I worked on one of the very first commercial voice over data systems made by Time and Space Processing, the TSP100 and the Military Tempest version TSP1000. These units interfaced a telephone switchboard to a modem to allow analogue voice to be transmitted over a data network, giving a secure voice connection at the sky-high rate of 9600bps! The TSP had a four wire audio input/output interface that in most cases had to be connected to a two wire telephone circuit that was used for both voice and signalling (loop disconnect). To interface to the telephone two-wire circuit, we used a hybrid transformer

interface that was balanced. I had many problems with the two-wire interface due to the impedance of the circuit changing. The most common cause of this was poor connections at the wire wrap terminations at the switchboard. The cure was to solder as many connections as possible and try to have a small number of dedicated extensions for use on the switchboard.

I remember being flown over to the New York end of a system that was having major problems. I asked to see the frame of the Centrex where the audio circuits from the TSP were connected and, lo and behold, they were wire wrapped. It should be said that most adjacent wire wraps were soldered and on the frame was a 48V soldering iron hanging there just waiting to be put to use. I asked the Codex technician whether he would get the Ma Bell (telephone company) technician to solder the wire wraps. He said he couldn't because it was crossing the line! It was just about lunchtime so we all (Ma Bell technician included) headed off to the canteen. I made an excuse to go to the bathroom, nipped back to the frame room and soldered the wire wraps. After a nice lunch we went back to set up the hybrid interface on the TSP and, would you believe it, problem solved.

Copper and mild steel have different expansion rates and even in the switchboard or switchroom there would be variations in temperature sufficient to cause a change in the resistance of the connection but soldering the connection made sure the resistance stayed the same.

On the subject of RF connectors, I worked as an RF communications engineer for 40 years and we used compression gland connectors, be they PL239, N type, SNC or BNC made by either Amphenol or Andrews. I still only use this type of connector. They are worth the extra money

but as Terry says, you must take the strain off the cable and when using outside, tape with self-amalgamating tape. You should then have no worries and fewer blown finals.

Leonard Baddeley G8LXI
Cornwall

Dear Don,

Terry Bailey G6CRF's letter brought back memories of my old days with the GPO. I had the same lecture in 1957 that the mechanical joint was only held in place by the solder at the tip. This was back in the days when it was 1.5 turns around the two-slot tag on all the distribution frames.

Unfortunately, many forgot the solder altogether at smaller locations. These joints caused many intermittent problems and a purge was organised to solder up all dry joints found. The only really successful dry method was either wire wraps on square sharp edged pins designed for the purpose or the Krone IDC terminations common today.

Regarding PL259s, I rarely soldered the braid other than when a reducer was fitted and then only to the adapter, not the main body. To pad out undersized cable, I use plumbers' PTFE tape or Hellerman sleeves (though I haven't tried to buy these recently).

Moving on to more modern plugs (1940-1950ish), N and the later BNC developed jointly by both Neill and Concelman of C connector fame. A GPO method of soldering the centre pin was to introduce a short piece of solder into the hole for the centre core. The prepared wire was introduced to the pin while a dry soldering iron was applied. As the solder melted, the cable was gently pushed home. If a small bead of solder appeared at the side hole in the pin, then a good joint was guaranteed. Continue to heat for a further second and capillary action will suck this bead back into the hole. I have terminated a few thousand over the years.

In this game a couple of suitably modified wooden spring

cloth pegs glued to a piece of wood will make a useful vice and won't suck heat out of the job in hand. Perhaps I might also mention that a pair of sharp scissors kept for the job is the easiest way if trimming the braid and work over a box to catch the bits.

Still with the GPO, the article by **Tex Swann** rattled the few remaining grey cells regarding the Negative Impedance Amplifier used on two-wire line circuits to reduce loss.

Many circuits of about 20 miles in length relied solely on 'loading' to reduce loss. This entailed fitting inductors at intervals in series with the line, producing, in effect, a lowpass filter with the line providing the capacitor, the most usual arrangement being 88mH spaced at 1.136 mils, this giving a cut off frequency of 3.4kHz (amateurs may recollect the value when making FSK teleprinter terminal units).

Back to the amplifier. This had to couple to the line at exactly a half section of the filter, making building out necessary, involving capacitors and sometimes additional inductors. This achieved, the amplifier or negative impedance converter could be installed. I can only go into the basic principles here but imagine a simple attenuator consisting of three resistors, two in series and one in parallel, T fashion. This, when inserted in a line, will attenuate signals equally well in both directions at the same time. Now substitute Z for R and make the values negative. We have

Linear Amplifiers

Dear Don,

My November copy arrived today. I was interested in **Steve Ireland VK6VZ's** piece on amplifiers. I'm a fan of his for many years. His *Quad for a few Quid* is terrific.

However, I'd like to add two-pennyworth. With the previous 400W limit in South Africa, I used a Kenwood TL-922 and later added an Elecraft KPA500 that I assembled from a kit. Not coming from the vaive days of amateur radio, I felt the KPA500 was a good addition. That line was not mentioned in the article.

Eventually, the TL-922 became erratic so I looked around for a replacement. Just at this time our power limit was increased to 1kW so you can see the dilemma.

Finally, I was lucky enough to obtain a SPE Expert 1.3 from Martin Lynch. Tony contacted me to say they had a small shipment. It arrived with no hitches at Customs (a sore point in ZS) and it went on air out of the box.

The operating temperature here in Robertson reaches close to 40°C on many days and the SPE and the KPA500 are next to the open door. They're on all day without any temperature problems. The SPE loads along with 10W input from one of the TS-480s. When I checked the drive it was actually 7.5W and the amplifier is putting out close to a kilowatt!

I had a problem with the KPA500. When I contacted the manufacturers, they diagnosed the fault (after I did some tests) and sent me the parts.

The big problem in ZS is that few people do SMD soldering. It took some time to find a competent solderer but reassembly was easy and it fired up with no problems. This is one of the advantages of going with a manufacturer that has a good reputation for support. Yes, it's not a kilowatt output. If I need extra power on the WARC bands, I can always use the SPE.

Tom Morgan G0CAJ ZS1AFS (Look for ZT1T over the Christmas period)
Robertson, South Africa

Editor's comment: Thanks Tom (and good to see you again at Newark this year). We reviewed the KPA500 a couple of years back and I own one myself. For some years now this amplifier has been a great choice, comfortably achieving the UK power limit on 160 through 6m and being light enough to take on expeditions – we had four of them on our recent ZL7G Chatham Islands operation. The Expert amplifiers are, indeed, very popular too. Modern amplifiers with high gain allow, as you say, the use of low power drivers and at ZL7G we also had two Juma PA1000 amplifiers (new to the market from Finland), several kilograms lighter than the KPA500, requiring less drive power and able to produce up to 1kW output. It was interesting to use the Juma driven by an Elecraft KX3 – this could make an excellent lightweight expedition combination in future. The reason high gain HF amplifiers have tended to be scarce in the past is because US regulations limit amplifier gain, so 100W drive power has become the norm.

created a strange device where the terminations are both input and output. It was not the most stable of systems but I have seen such routes work for 25 years without problems.

When I was checking figures in the office, I noticed paperwork for a new route describing the losses as 'best possible', the problem being that the amplifier was really acting as an attenuator.

Gus Malcolm G8DEC
Bromsgrove

Editor's comment: When I published last month's Star Letter, I hadn't anticipated the flurry of correspondence it would generate! I know that the PL259, SO239 series of connectors are a sore point with many amateurs although I would suggest, despite at least one of the foregoing comments, that they have withstood the test of time because most radio amateurs are familiar with them and, frankly, they are perfectly adequate for amateur power levels

at HF, provided they are properly terminated (and half the trick is to get the correct connectors for the cable you are using – the better vendors will stock a suitable range of solder and compression types). My thanks for all your input on the subject.

Please note: The opinions expressed in any letter published in PW are those of the named correspondent whose letter has been published and they don't necessarily reflect the opinions of the editorial staff or PW Publishing Ltd. Editor

J. BIRKETT.

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Full	Licensing	3	C
Foundation	Technical Basics	4	D
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Full	Technical Basics	6	A
Foundation	Transmitters & Receivers	7	C
Intermediate	Transmitters & Receivers	8	B
Full	Transmitters & Receivers	9	B
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Intermediate	Feeders & Antennas	11	A
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Intermediate	EMC	17	A
Full	EMC	18	B
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It is not difficult to see why equipment reviews have always been popular and it is not surprising to see why *RadCom* equipment reviews by Peter Hart are considered by many as the 'best' amateur radio equipment reviews available. *Hart Reviews - The Best of RadCom Equipment Reviews* is a great book for everyone interested in amateur radio equipment in the real world.



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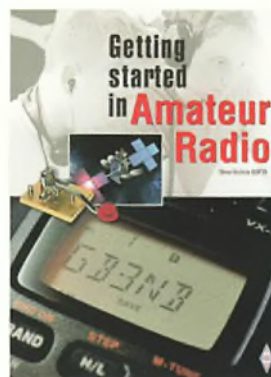
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If you are planning to buy or sell any amateur radio equipment you should not be without *The Rig Guide*. The book begins with tips for buyers and a guide to selling and tracing. There is a handy guide to sell rig on ebay and even tips on how to avoid getting lured with stolen gear. *The Rig Guide* contains a list of the abbreviations used in the descriptions and an explanation of them all. Amateurs trust RSGB reviews and a full list of *RadCom* reviews since 1990 is included and when a piece of equipment was reviewed by *RadCom* it is highlighted on the listing.

The Rig Guide isn't limited to popular commercial amateur radio transceivers but also covers receivers, scanners and linear amplifiers too. You'll find extensive lists of past models from Acom to Yeasu, with over 20 manufacturers listed in-between, including Icom, Ten Tec, Kenwood, etc. We're not just talking about current models either and you will even find details on the many Chinese manufacturers. DSP isn't forgotten either with a dedicated section on the equipment available. Overall, *The Rig Guide* contains details of around 400 of pieces of amateur radio equipment covering HF, VHF & UHF. Each item is described in an easy to understand listing that covers its main features, band coverage etc. with a photograph of the equipment.

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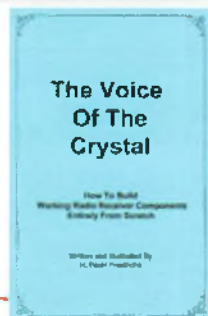
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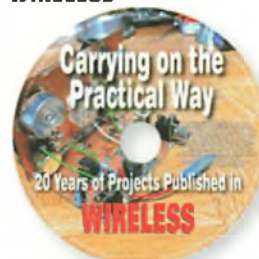
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Receiver Protection Unit – Part 1

Keith Rawlings G4MIU considers receiver protection and describes his design for a homebrew receiver protection unit

Scanning Scene Bill Robertson takes a look at monitoring local and wide area pager messaging and relays a reader's thoughts on the Whistler TRX-2 mobile/desktop digital scanner

Decode Mike Richards brings you up to date on the latest Raspbian release and a Linux vulnerability. He then looks at the reception of HF facsimile transmissions and configuring Fldigi

Military Matters Pat Carty reports on his recent visit to Scotland to observe a major international maritime exercise and his visit to the site of what will become the Scottish Submarine Centre

Sky High Godfrey Manning responds to questions submitted by two readers and, in the process, explains flight procedures so that the jargon used by pilots over the radio becomes understandable

DXTV & Satellite News Keith Hamer and Garry Smith report on some good Sporadic-E and tropospheric conditions in September and uncover some BBC nostalgia

Maritime Matters Robert Connolly looks at the early days of marine distress signals and how they were adopted by the international community

Feedback

Airband News David Smith brings you up to date on developments at Luton and then considers European wake vortex re-categorisation

News & Products

LM&S Broadcast Matters Chrissy Brand selects the best from the broadcast bands and fellow RadioUser readers also recommend some easy catches and hard to hear signals

NDB DXing Robert Connolly brings you details of a multimode decoder for Mac-based devices, muses on the potential origin of a mystery signal and rounds off with his suggestion for a possible stocking filler

RF Development Board – Part 4 Roger Thomas explains how to build a direct conversion receiver that can be used to monitor signals on medium wave

Book Review David Harris looks at Marconi: The Man Who Networked the World by Marc Raboy

Radio Websites Chrissy Brand and RadioUser readers choose a selection of diverse websites past and present, listen to radio stations in Alaska and New Zealand, check out the latest gadgets and watch television online from Croatia and Minnesota

Radio Events

Off the Record Oscar muses on an advert with a catchy tune, revisits a radio-related episode of The Goodies and then rounds off with his thoughts on propagation and current activity on the medium wave band

Comms from Europe Simon Parker discusses updates and modifications to transceivers that were new in 2016. He looks at the new PMR channels now in use in some EU countries and predicts what's in store for 2017

RadioUser Index 2016

Software Spot This month, QSP73 Services is offering a 'seasonal special' compilation that includes all the main featured software offered with the January to November 2016 collections (excluding large text files and the Mods and Manuals collection) together with programs for predicting propagation conditions, satellite tracking and pager decoding for Windows

Glossary

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Carrying on the Practical Way

Matthew Nassau M0NIX has an Arduino project to use your Morse key as an input device for your home computer.

PW 70MHz Contest Results

Colin Redwood G6MXL has the results of September's PW 70MHz Contest. Find out how you got on.

A Homebrew Screwdriver Antenna (Part 2)

David Beard G8FMX completes the Screwdriver antenna project, including calibration and testing.

In the Shop

Harry Leeming G3LLL has more sage advice on topics that range from static electricity, through impedance to earthing.

Valve & Vintage

Ben Nock G4BXD receives an interesting donation to the Museum as well as rediscovering a lifeboat set and yet another wavemeter from the Museum's darkest recesses.

There are all your other regular columns too, including *The Morse Mode*, *HF Highlights*, *World of VHF*, *What Next*, *Data Modes*, *Buying Second-hand* and *Technical for the Terrified*.

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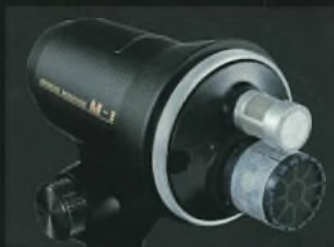
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