



# SPRAT

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DEVOTED TO LOW POWER COMMUNICATION

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Spring 2019



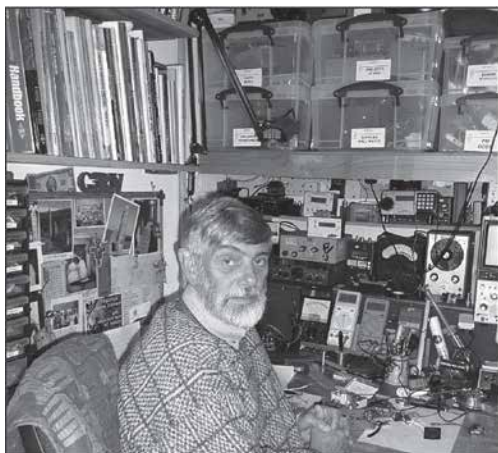
George G3RJV entertaining Graham G3MFJ and Colin G3VTT

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*This issue is packed full.*

**Editorial, Tropics & Awards, Balloon-supported antenna  
Operating in New Zealand, 20m Portable Antenna  
The Misunderstood T2FD Antenna, Direct Digital Synthesis  
Club Special Offers, Precision Voltage Reference,  
Multi-ratio Matching Transformer, Passive Repeaters,  
Communications & Contests, Valves & G5LOW Winter Sports,  
Pen Signal Injector, News Extra, Members' News, Rallies 2019  
Advertisements, Sales**

# JOURNAL OF THE G-QRP CLUB



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Thanks to all who sent in messages of support for George, G3RJV. Graham G3MFJ and Colin G3VTT, visited him recently and found him to be comfortable (see front cover). We also had reports that George enjoyed taking part in the Christmas carol service at the care home.

Thanks also to those who have made suggestions for improvements to Club services. Common themes are removing the need for physical QSL cards for our awards (looks likely), a means to look up if contacts are members (needs work to ensure GDPR compliance), and SPRAT in pdf form (definitely not happening). Interestingly, the pdf thing was also mentioned in the latest QRP Quarterly. Like QQ, if you want the latest SPRAT in pdf form you will need to wait for the DVD collection to catch up!

We have our 2018 Trophy winners listed on page 3. Congratulations to the winners. We hope they will attend the Club Convention in September for formal presentations of the trophies.

Mentioning the Convention, Peter Parker VK3YE, Has agreed to do a live talk via Skype, like we did with the Soldersmoke guys in 2018. There is also news of a new venue on page 40. There will be a Buildathon on the Saturday evening and a number of QRP-friendly speakers.

We now have a Club callsign **G5LOW**, and it is available for use by any authorised Club member. Details are on the website. Tex is designing a QSL card for those who want a physical card and Dave, GM3VTH, our QSL manager has agreed to send those out. G5LOW is now live on ClubLog and QSL.com. Colin G3VTT, activated G5LOW over the Winter Sports period and we would like to make more of it. Colin G3VTT, and Dom M1KTA both have more on activating the call on pages 26 and 27.

Finally, three cheers to Graham for some impressive Club Sales having sold; over 1000 Sudden kits, 2000 polyvaricons, 5000 crystals and over 60,000 toroids all sold over the last decade! Who says no-one builds radios anymore?

73 Steve, G0FUW  
[g0fuw@tiscali.co.uk](mailto:g0fuw@tiscali.co.uk)

# G-QRP Club Trophy Winners 2018

We have seven trophies which are normally awarded annually. Some are linked to SPRAT articles, others to QRP operating.

The SPRAT related awards are decided by the Club Committee and the Appointed Officers. The operating awards are adjudicated by Dom, M1KTA and approved by the Committee.

**Here are this year's winners:**

## **G2NJ Trophy**

Awarded for the best technical (non-antenna) article, or the greatest contribution to international QRP – **Fabio Bonucci, IK0IXI**, for his continued contribution to international QRP including at home in Italy, in SPRAT and through his work with QRP-ARCI.

## **Partridge Trophy**

Awarded for the best antenna article – **Andy Choraffa, G3PKW**, for ‘What is a matched aerial?’ in SPRAT 175

## **W1FB Trophy**

Awarded for the best simple article – **Peter Howard, G4UMB**, for three simple articles in SPRATS 174, 175 and 176.

## **Gordon Bennett Trophy**

Awarded for the best practical article – **Phil Stevens, G3SES**, for his series of simple test equipment articles in SPRATs 174 to 177.

## **G4DQP Trophy**

Awarded for the best log submitted for the Winter Sports – **Peter, G3XJS**

## **Chelmsley Trophy**

Awarded for the best log submitted for the full year – **J Carl Mason GW0VSW**

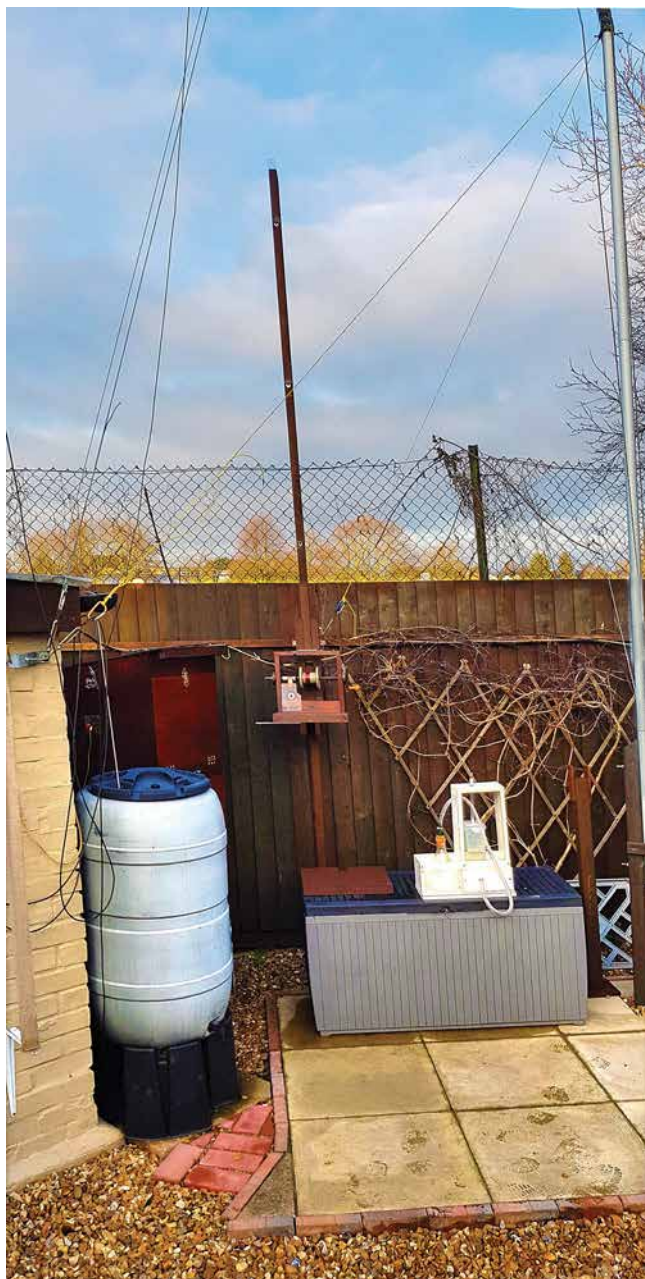
## **Suffolk Trophy**

Awarded for the best log submitted for operating on World QRP Day (17 June) – sadly no logs were received.

The committee have also made a recommendation for the RSGB's **G4STT Trophy** which they award for outstanding service to QRP. The RSGB will announce that at their AGM in April.

# A Balloon Supported Aerial

Chris G3XIZ, email: g3xizchris@gmail.com



## Rationale

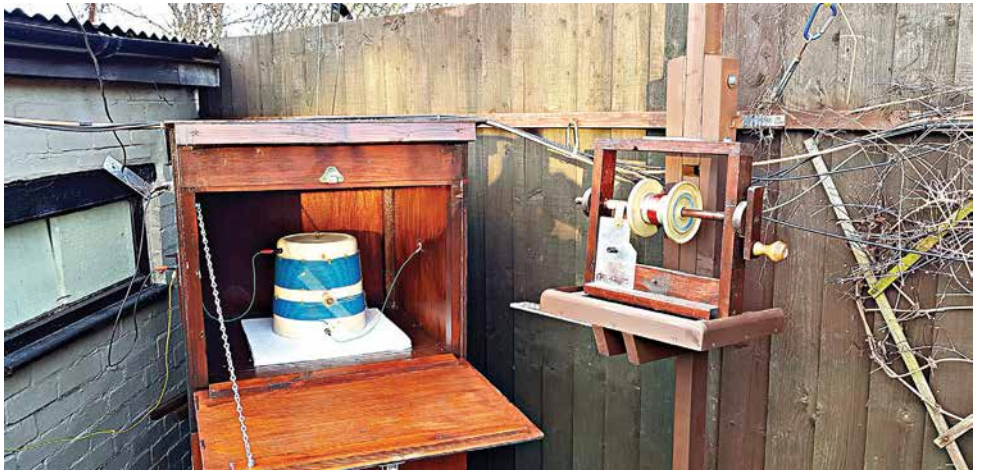
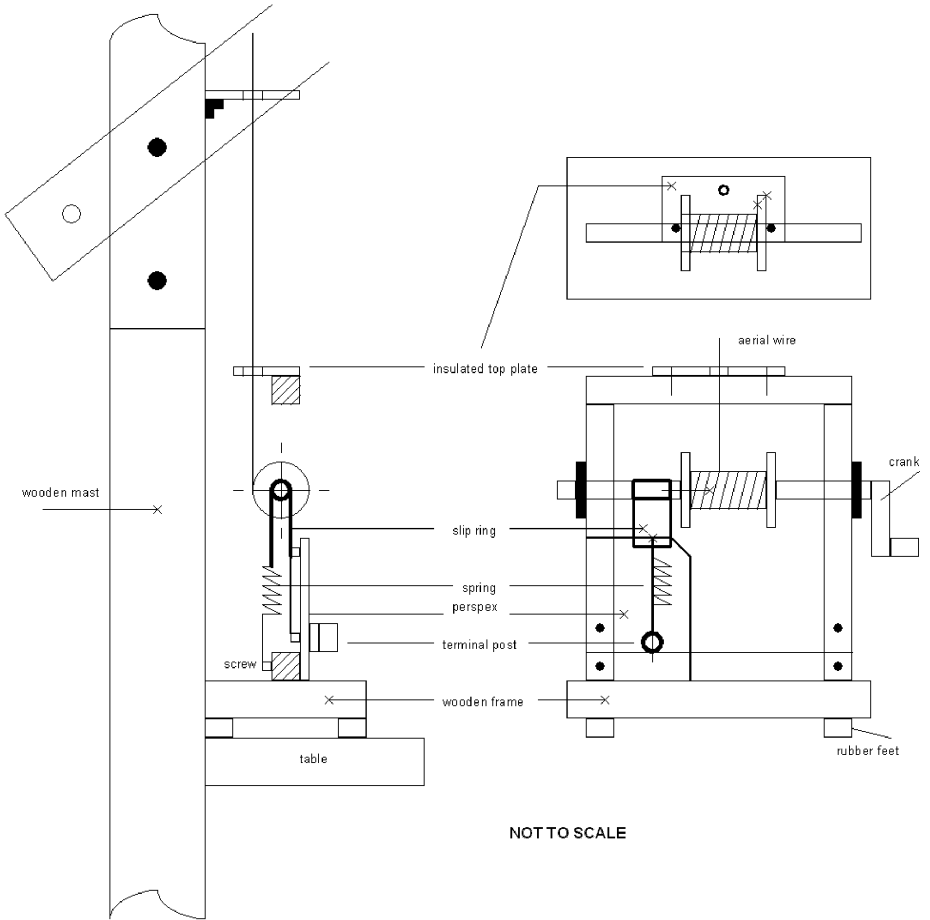
To maximise the potential of a QRP station a very good aerial is required. Unfortunately most of us are restricted for space, having only smallish gardens and with neighbouring houses in close proximity.

One solution is to go is vertically but a tall and sturdy mast may be unsightly (to some) and cause concern to neighbouring residents. So, what's really needed is an 'invisible' method of supporting the aerial. Supporting the vertical wire using a balloon is a good solution under favourable conditions as it will enable heights far in excess of most masts and has a very low visual impact.

Whilst experimenting on MF, LF and VLF I've used balloon supported aerials with some success and I shall outline a few pointers here for anyone considering trying this approach.

## Expectations

I only fly my balloon supported aerial when the wind is less than about 5mph as stronger winds cause the balloon(s) to fly too low. It may also wrap itself around some part of a neighbouring



property, which could cause some embarrassment at the very least.

There are only a few days per month on average with this wind level so it's advisable to monitor the weather forecast on line so as to be prepared.

### **Location**

It will help to sketch a rough plan of your property and those surrounding it together with trees and high fences. Even a slight wind will cause a tethered balloon to pull the aerial wire off vertical and you must be aware of the wind direction and where the aerial wire is likely to go. Should your energised wire touch a TV or FM broadcast aerial, it will probably not do the associated receiver much good !

### **Mast**

A balloon aerial may be tethered close to the ground but the use of a shortish, light, drop-down mast is recommended. The mast will raise the wire above most garden obstacles and help in keeping the wire clear of trees and fences. A small table fitted to the mast at a convenient height will support the winding mechanism. This table is angled slightly towards the mast; this lets rain water run off and also holds the top of the winding mechanism in contact with the mast.

### **Winding Mechanism**

I am no carpenter but making a serviceable winder was not difficult. A plastic reel containing the copper wire is tightly fitted to a wooden dowel spindle which itself is joined to a cranking handle (see drawing). A sleeve of copper or aluminium tube is fixed over the spindle and one end of the aerial wire is connected to this by means of a grub screw and washer.

A spring-loaded slip-ring is used to maintain a good electrical contact between the connecting terminal and the sleeve as the handle is rotated. The slip ring was made from a flimsy copper label such as are used for identifying garden plants.

The aerial wire (enamel covered 0.2 mm dia.) passes from the reel through a small hole in the winder's perspex top plate and thence through the holes in insulated plates fitted to the mast's side. The wooden parts of the winder were varnished and the spindle's bearings are kept lubricated with candle wax.

### **Balloons**

I use cheap balloons which I obtain from E-Bay for a few pence each. Originally I used to fill and tie five ten inch balloons together as this gave some redundancy in the event of one bursting. More recently I've chosen to use a single 18 inch balloon. Ensure that a short length of party ribbon (or string) is used between the aerial wire and the balloon as an RF spark could cause the balloon to burst.

### **Filling The Balloons**

I sometimes use helium gas which I obtain from E-bay but find this to be rather expensive. There were several videos on-line which showed a simple method of making hydrogen gas and that is what I now often do. Basically aluminium (cooking) foil is screwed up and dropped into a proper chemistry flask containing a rich solution of caustic soda.

The resulting hydrogen gas is cooled by being bubbled through a vat containing tap

water and from there it is piped into the balloon(s). The pressure is more than sufficient to inflate a balloon and a non-return valve is fitted so that the hydrogen cannot escape from the balloon and back into the cooling flask. There is a learning curve regarding how much foil and caustic soda are needed and this is achieved with practice.

### **Caution**

Clumsy and careless people should not handle hydrogen or caustic soda for obvious reasons. It is inadvisable to fill balloons in a poorly ventilated cupboard whilst smoking. The risk-averse among us should use helium gas, though I will say that it can become expensive over time.



*The winding mechanism, note the 'slip-ring' arrangement to connect the signal into the wire*

### **Launching**

Lower the drop-down mast and thread the aerial wire from the winder's reel sequentially through the mast's eyelets and then tie it to the insulating ribbon. Tie the other end of the ribbon to the inflated balloon, put the mast back in a vertical position and lock it in place. Connect a cable from the ATU to the winder's terminal post and then slowly unwind the aerial. Always keep an eye on the balloon and aerial wire to ensure that it is floating at a satisfactory angle and height and is unlikely to drift on to neighbouring TV aerials. Check it periodically, especially if the wind increases or changes direction. The aerial should stay aloft for several hours.

### **Tuning Up**

I count the number of rotations I make on the hand crank and thus can easily calculate the amount of wire which has been paid out. It is convenient to have a record of ATU settings tabulated against aerial length although there will be some variation of adjustment with changing aerial height.

### **My Results**

I tested a 50m balloon supported (nominally) vertical aerial against my 40m end fed inverted 'L' using MF and LF WSPR transmissions. The improvement was in the order of 12dB which is equivalent to a 16 fold power increase! Paying out more wire and achieving a nearer vertical angle should improve on even this impressive figure.

# More QRP Operation in New Zealand

Clive Smith, GM4FZH, Ravenstone House, Whithorn DG8 8DU  
gm4fzh@gm4fzh.co.uk

Well, we took the plunge again and went to New Zealand for our sixth time. It's a long way but broke the journey going in Thailand and visited the Bridge over the River Kwai (as the film called it) and on the way back stopped off at Bali in Indonesia. Airport security at Denpasar (Bali) was the only place to query what my Yaesu FT 817 was. The answer 'Ham Radio' seemed to do the trick.

I was a bit apprehensive about the stop-overs, as the countries involved have a strange policy towards radio transmitting equipment although, that is exactly what a mobile phone is! Take any spare batteries with you as hand luggage – my advice don't take LiPo batteries, I use NiMH.

The preparation for these radio sojourns was described in my last article some two years ago (Sprat 171 p22) so, this short article is really about operating and the contacts made. What one must realise is that the nearest neighbour to New Zealand is Australia some 2150 km (1330 miles) away across the Tasman Sea. So, unless you are inter ZL working (and those distances can be fairly long), it is a fair haul.

## The NZ official document states:-

*Terms, conditions and restrictions applying to visiting amateur operators*

- 1. Persons visiting New Zealand who hold a current amateur certificate of competency, authorisation or licence issued by another administration, may operate an amateur station in New Zealand for a period not exceeding 90 days, provided the certificate, authorisation or licence meets the requirements of Recommendation ITU-R M.1544 or CEPT T/R 61-01 or CEPT T/R 61-02 and is produced at the request of the chief executive.*
- 2. The visiting overseas operator must use the national callsign allocated by the other administration to the operator; in conjunction with the prefix or suffix "ZL", except where subsection (3) applies, which is to be separated from the national callsign by the character "/" (telegraphy), or the word "stroke" (telephony).*

This can be found at:

**<https://www.rsm.govt.nz/about-rsm/pdf-and-documents-library/spectrum-policy/official-information-notices-gazette/gurl-notices/amateur-radio-operators/amateur-radio-operators-gurl-2017.pdf>**

Normally when I called, I used ZL/GM4FZH as it indicates the country you are in but when talking locally on repeaters users seem to prefer GM4FZH/ZL. There is no requirement to use the area code. It also becomes quite a mouthful and operators usually came back with "what was that again"! Some countries (mainly non-English speaking) seem to struggle with the stroke or slash, I suspect this is because they are not used to reciprocal licensing arrangements.

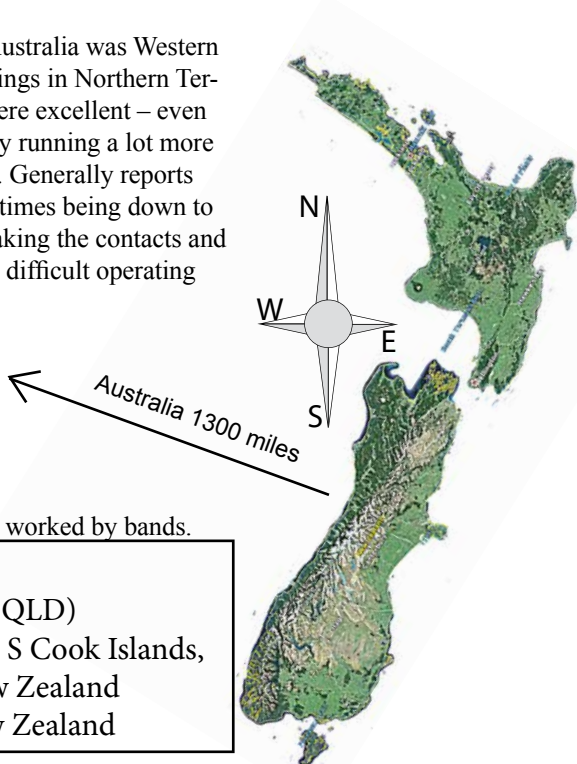


The bands I ended up working were 20m, 40m, 2m, 70cm and 6m – all on voice and 5W. The 2m was through local repeaters, the 70cm was the National System which is a series of linked UHF repeaters covering NZ – you may argue these are not QRP contacts but they were useful for local information. Overall I made 102 contacts, I could not work radio all the time as this was a holiday as well.

I used the FT 817 with mains power supply to have the 5W output. I would normally look for incoming signals of at least S6, as by experience this is what would give me a contact although if you can find a net running such as the ANZA Net (14.183MHz at 05:15z – 18:15 local in NZ) or the Rotary net, the net controller will assist with introductions and then you exchange call signs, reports etc yourself. Whilst on the ANZA net I did hear South Africa weakly but apparently that is a difficult path and certainly not for QRP.

The twenty metre band, was the main long distance band followed by 40m. The excitement was a few contacts on 6m sporadic with Australia. The sporadic E had been going for many days and I only hit the end of it. HF conditions were poorer than my last two operations in NZ and at times I felt I was struggling. Some of the inter ZL working seemed to have gone to 80m and my antenna does not cover that band - similar to UK conditions. I had one chat with a QRP constructor Charlie ZL2CTM, a YouTube video of him which included my contact was sent to me by Steve G0FUW – what a fluke I was on! I met up with two amateurs during the trip ZL2CHAR and ZL4SY.

The only state I did not work in Australia was Western Australia, I even managed Alice Springs in Northern Territory. Some of the signals reports were excellent – even one 59, with the other stations mainly running a lot more than 5W and some with huge beams. Generally reports were R4 or R5, signal strength sometimes being down to S1. Hams were very interested in making the contacts and putting themselves out sometimes in difficult operating conditions.



The table below shows the countries worked by bands.

<b>Band</b>	<b>Countries</b>
6m	Australia (NSW and QLD)
20m	Australia, Fiji, Japan, S Cook Islands, (Florida), Spain, New Zealand
40m	New Caledonia, New Zealand

# Twenty Metre Portable Antenna

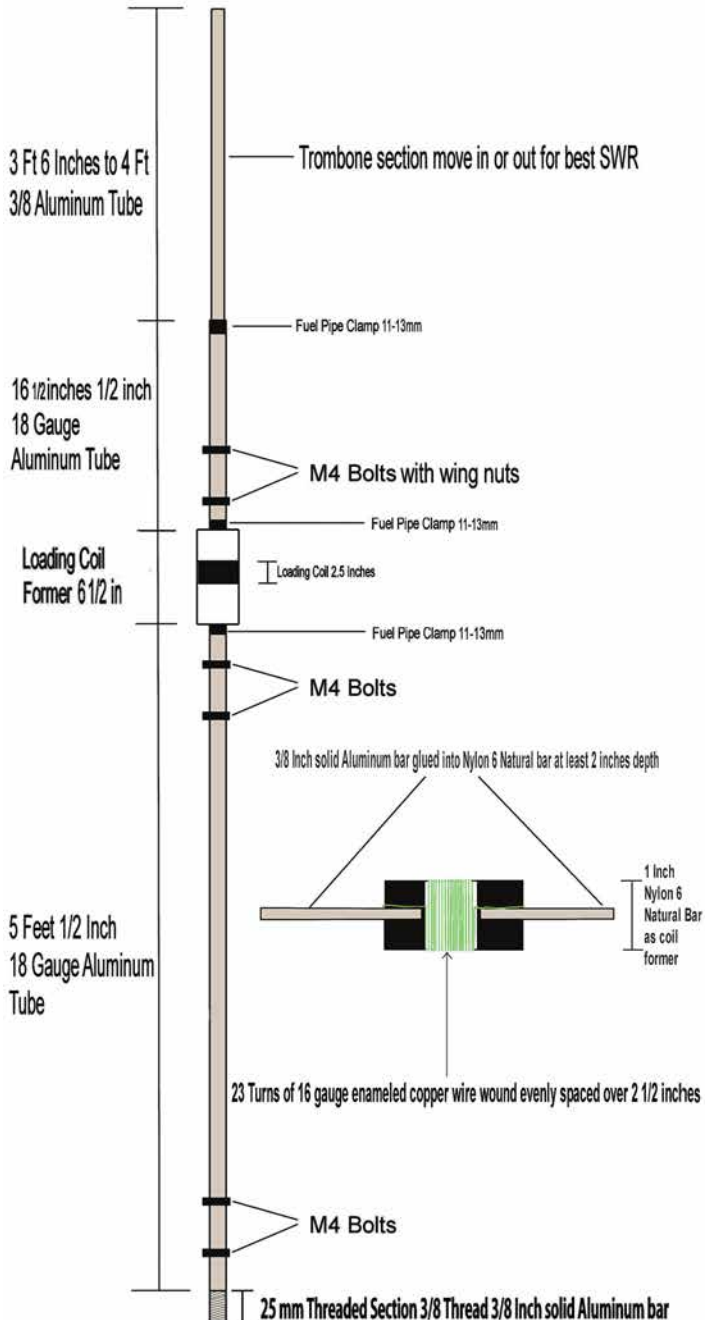
Paul MOPNN

It's a portable antenna but not that you would want to drive around with it on the roof of your car. It is far too heavy. I take no credit for this antenna it comes from the work of **AB4GX** (now **K4EAA**).

It's simply one half of the driven element of his 20m beam using the car/vans body as the ground plane. I have built three of his loaded 20m beams two out of aluminium and one out of copper wire and fibreglass poles. For what they are they work very well.

I enjoy making Antenna for HF/VHF/UHF this antenna was made using bits left over from other projects. I wanted something I could put up quickly and was physically small, unobtrusive and came apart for transport.

I have tried it on half a dozen cars of various sizes from Nissan Qashqai to a Fiat Punto and the SWR has been 1.5 across the 20m band.



## Materials

- 24 inches of 3/8 Aluminium bar.
- 7 feet of 1/2 inch 18 Gauge Aluminium tube.
- 4 feet of 3/8 Aluminium tube.
- 7 M4 Nuts washers, bolts or wing nuts.
- 6 1/2 inches of 1-inch Nylon 6 Natural bar.
- A good length of 16 Gauge enamelled copper wire.
- 3 Fuel pipe clamps 11-13mm (Not Jubilee Clips).
- 2 M4 ring crimp terminals.
- 4 Inches of 1 Inch heat shrink.
- Epoxy Glue.
- Liquid Electrical Tape.

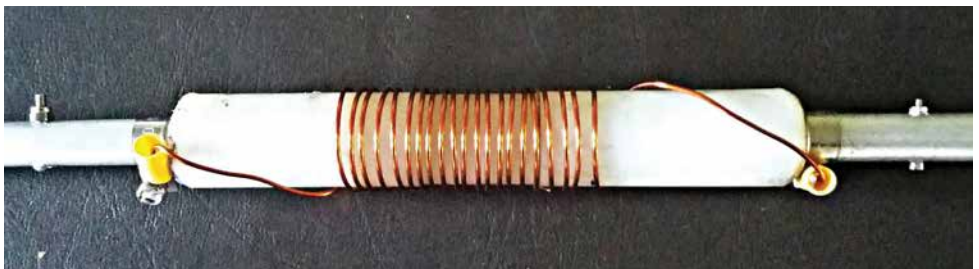
## Construction

Nothing about this antenna is complicated it's easy to make. Cut the 3/8 Aluminium bar into three 8-inch lengths. Cut a 3/8 24 UNC thread 25mm in length on one end of a 3/8 bar. Dies of this size can be picked up from China (ebay.com) for a couple of pounds.

Cut the 1/2 18 Gauge aluminium tube to 5 feet in length. Slide the 3/8 threaded bar inside the 1/2 inch 18 Gauge 5 feet aluminium tube. Clamp up in a vice centre punch and drill three 4mm holes one at 2 inches one at 4 inches the other at six inches make sure the threaded bit is sticking out. A pillar drill makes this easy. I find it easier to drill the first hole out put a nut and bolt in and drill out the other's at least they will line up then.

## Next the loading section.

A hole needs to be drilled at least 2 inches deep into the middle at both ends of the Nylon 6 bar. Using a lathe would be the easiest way to do this or a pillar drill. I did it with



a hand drill and the result was fine. The hole needs to be 9.5mm or 10mm wide. Glue the other two 8-inch lengths of 3/8 solid bar into the drilled out ends of the Nylon 6 bar. I used Gorilla Epoxy glue. Leave overnight to set.

Slide one end of the loading coil former into the other end of 5-foot 1/2 18 Gauge aluminium tube clamp and drill two 4mm holes one at 3 inches and one at six inches. Make sure they line up with the holes at the bottom it just looks better. Cut a length of 1/2 inch 18 Gauge Aluminium tube to 16 1/2 inches slide this over the other end of the bar 3/8-inch bar of the coil former clamp and drill two 4mm holes one at 3 inches and one at six inches again make sure the holes line up it looks better.

Disassemble the loading coil and lightly clamp the bar end of the loading coil in the vice. Measure 2 inches from one end and use electrical tape to mark the start of the loading coil then measure two inches from the other side to mark the end of the coil with electrical tape. There should be a 2 1/2 -inch gap between the taped sides. This is where the coil needs to wound.

### **Winding the Coil**

Using the 16 Gauge enamelled copper wire wind 23 turns around the 1-inch Nylon 6 bar across the 2 1/2 inch gap and space the turns out evenly. Tape up the load coil so the coil does not unravel. Burn off or file the end of the enamelled copper wire and crimp then solder the A4 ring crimp terminals.

Reassemble the loading coil section but before bolting up slide the 11-13mm fuel clamps over the 1/2 18 Gauge aluminium tube take the small bolt out of the fuel clamp slide the A4 ring crimp terminal on to it and do it back up in till firm do this to both ends of the loading coil.

Lightly clamp 1/2 inch 18 gauge 16 1/2 inch length in the vice and cut about 1 1/2 down the length at the top with a hacksaw this is to hold the 3/8 trombone section with another 11-13mm fuel clamp. Using an Antenna Analyser (SWR meter) with the antenna mounted on the car I use a 6-inch Mag mount slide the top section in or out for the best SWR.

Finally, once it's all working and you are happy with the SWR. Heatshrink the loading coil and use liquid electrical tape on the A4 crimp ring terminals. How well does it work? I've worked the USA sat on the drive with 5 watts SSB and using 200mw from an Ultimate3 running WSPR spotted Worldwide.

### **Further Experimentations.**

A shorter top section will allow the antenna to work on 17 Meters. Adding more turns to the loading coil and physically lengthening the Nylon 6 bar adding taps and banana plugs. Will make it a multi-band antenna. Using as a shortened vertical with the appropriate length and number of ground planes. Making another element and using as a vee dipole. Putting a join in the 5ft section to reduce length for ease of storage and transport.

Original article 'Monoband Yagi for 20m' 73, *Amateur Radio Today* April 1992 AB4GX (now K4EAA).

<https://www.nonstopystems.com/radio/pdf-ant/article-yagi-20m-alu.pdf>

# The Misunderstood T2FD Antenna

John VE3IPS

I have been reading a lot lately on the Terminated Tilted Folded Dipole antenna (T2FD). This idea started back in 1949 (An Experimental All-Band Nondirectional Transmitting Antenna” by Gil L. Countryman, W1RBK, (W3HH), QST, June 1949, page 54.) and is also the result of much research.

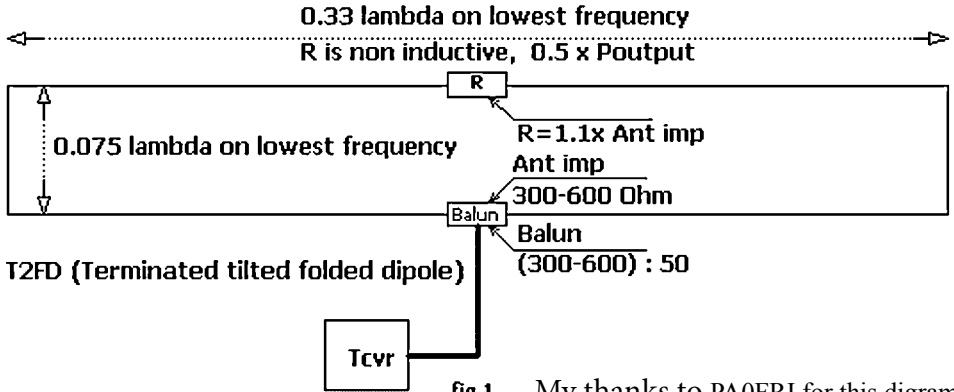
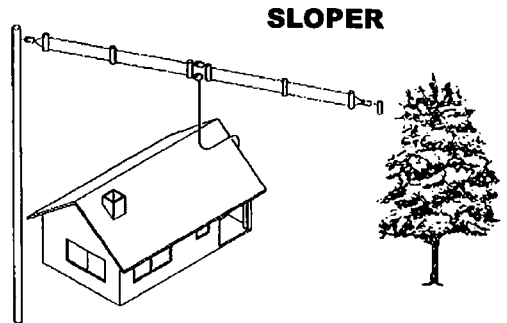


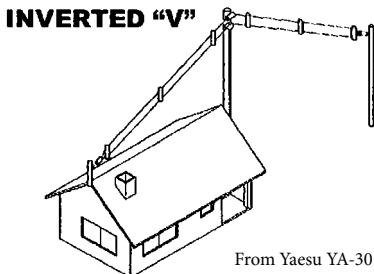
fig 1 My thanks to PA0FRI for this digram

The biggest complaint is that power is lost in the resistive element, it is several dB down to a dipole but its wide range and low noise capability may just be a suitable broadband antenna for the low power enthusiast. Also, it seems the Signal Corps was using this antenna in WW2 (maybe Vietnam as well) with 10 watt man pack radios. So now I decided to build this out as a platform for experimentation.

This antenna has been originally thought of being in a sloping configuration with a height of at least 32 feet at one end and 6 feet at the other end with a



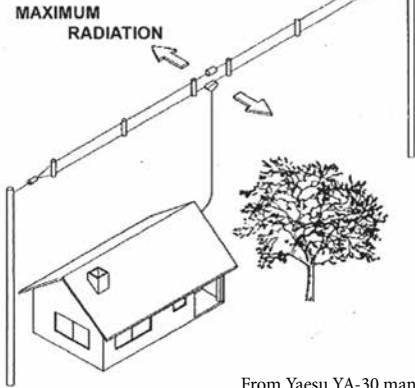
From Yaesu YA-30 manual



From Yaesu YA-30 manual

30 degree tilt. This makes it a bit of a challenge to install. I considered mounting it in an inverted V configuration because it's a folded dipole type of design so why not?. I also have seen various military antenna suppliers showing it in a horizontal, sloping or inverted V configuration. Let us try all three for fun and experimentation.

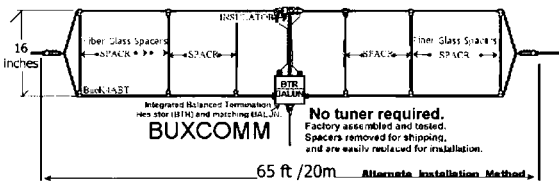
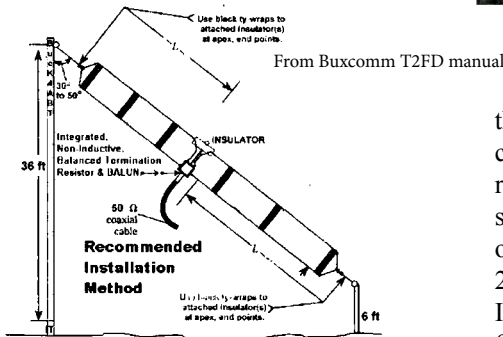
## FLAT TOP



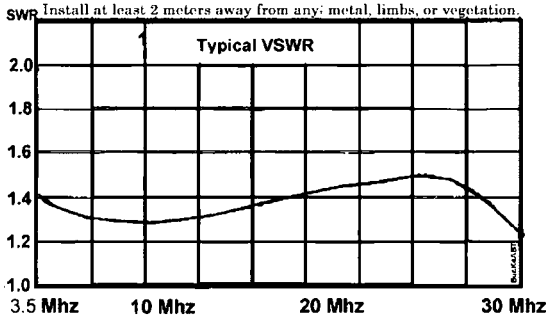
From Yaesu YA-30 manual



*My Inverted V looks nice*



Typical VSWR when using 9:1 BALUN and 450 ohm BTR.  
Install at least 2 meters away from any: metal, limbs, or vegetation.



There are three design issues, the resistive element, the center component and the end pieces. The resistive element was actually very simple. This design calls for a 390 ohm resistor. I used 10 3900 ohm 2w carbon resistors in parallel. Thus I have a 20 watt element that will be fine for QRP and could support 50-60 watts of CW key down if needed. Some designs are showing resistors form 390-600 Ohms depending on the feed line or balun usage.

The center component led to an aluminum bar and the end pieces turned out to be fiberglass tent pole masts (I thought PVC tubing would not be rigid enough). The next challenge is how to connect it to the radio and some designs require a 9:1 balun for impedance matching. However, I was thinking that if it's a folded dipole then I should be able to feed it with 300 ohm twin lead as per the original design. Since, I had



*A dowel helps to wrap it up*



*Box Connections*



*Fits in a 26" tent pole bag*



*Better view of the Top Clip on element*

35 feet handy I chose to try it out. I used my trusty EmTech balanced line tuner and was able to get low SWR from 5 Mhz and 7 Mhz using a 60 foot antenna.

The other design element is that spacing between the two elements and for the 40m version it is 18 inches and 34 inches for the 80m version. I chose to just go with 18 inches as that's the tubing I had on hand. I doubt this is critical but experimentation will show if its workable.

You can also make a 47 foot version for 40m or a 90 foot version for 80m usage. I chose to make my antenna modular so that I can change out components as needed.

I am working on a version using the 9:1 balun so I can try that out as well and let the built in antenna tuner on the radio do the matching for now. The modularity of my design allows me to bolt in a new box that will contain the balun.

So my modularity is comprised of 2 basic ideas. A center antenna component that will contain the 390 Ohm resistor pack and also the feedline connection. I chose to mount the boxes on an aluminum bar for rigidity as I plan to install this in an inverted V configuration or hang it from a 20 foot mast and run it horizontally. I will try some NVIS activity to see if this is workable at a 10 foot height. The second idea is to use small Nite-Eze carabiners and be able to connect in the shorter or longer wire elements for experimentation. I could also bolt in a wire dipole element on each side of the center component box and try a 2 element beam on 40m as a bonus or just run an end fed or regular dipole. Mr Cebik W4RNL published a Modeling document if anyone is interested I can send it out as a PDF.

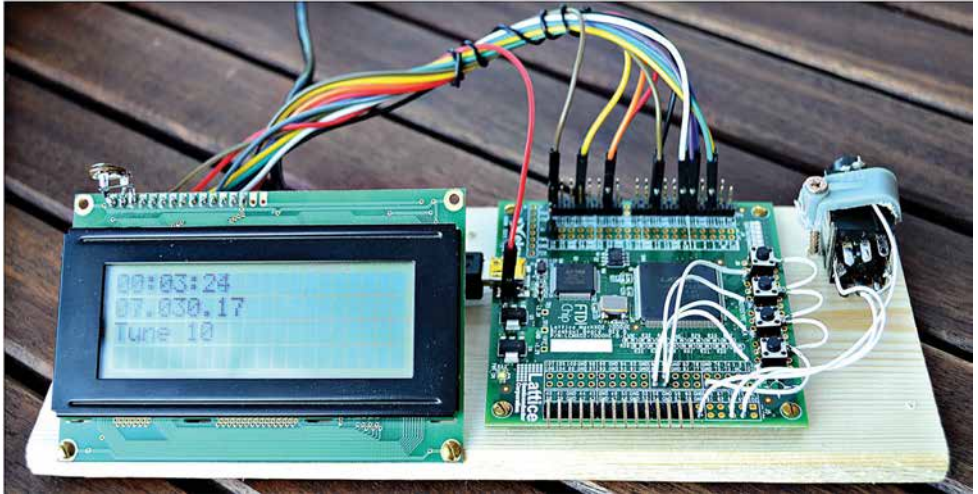
Check out Tony's PDF on the 3 wire version and his portable T2FD version and other HF Link ideas

[http://hfink.com/antenna/Build\\_a\\_T3FD\\_Antenna\\_by\\_Tony\\_Rycko\\_KA2UFO.pdf](http://hfink.com/antenna/Build_a_T3FD_Antenna_by_Tony_Rycko_KA2UFO.pdf)

I have had good success with 20 watts on 40m and 60m making local regional contacts and the noise level is lower making this antenna design worth building.

# Direct Digital Synthesis

Dr. Graham Butler, M0BDS, [graham.m0bds@gmail.com](mailto:graham.m0bds@gmail.com)



## Introduction

Direct Digital Synthesis (DDS) is a purely digital technique used to create an accurate and agile frequency source. It performs the same function as a Phase Locked Loop (PLL) synthesiser but without the need for additional analogue components. Until recently, this has been a particularly difficult task for the hobbyist since microcontrollers are not fast enough to directly synthesise radio frequencies.

With the advent of inexpensive FPGA (Field Programmable Gate Array) boards, the task has just got a whole lot easier.

Before entering into the world of binary arithmetic and (simple) mathematics, here is an everyday illustration that demonstrates how DDS works. Consider a jug that is standing inside a wide bowl. At regular intervals, a precise amount of water is poured into the jug. If the jug overflows then it is carefully emptied and the “overflow” water, now sitting in the bowl, is poured back into the jug.

This process repeats continuously. Note that the overflow rate represents the output frequency, which is proportional to the amount of water added.

Let the jug hold 1 litre of water and the amount added be 123 ml. Assume that pouring occurs exactly once every minute. On average, overflow will occur at a rate of  $123/1000$  overflows per minute (or 7.38 overflows per hour).

A small change to the amount added (say 124ml) will make a corresponding change to the overflow



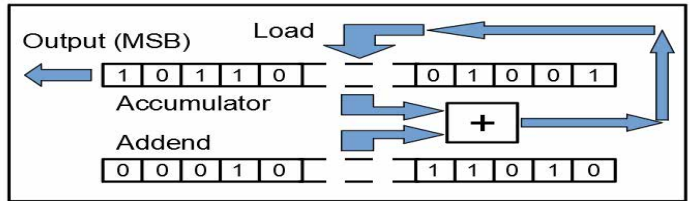


rate. It is now 124/1000 per minute (or 7.44 overflows per hour).

## Implementation

An FPGA is the ideal device to implement this procedure. My DDS scheme uses a 24-bit binary counter as the accumulator (jug). Every clock cycle, a 24-bit binary number is added (the poured amount) to this accumulator. Binary arithmetic automatically takes care of the overflow mechanism (the bowl). I use a 50MHz clock and take the frequency output from the most significant bit of the accumulator. The graphic below illustrates the hardware implementation:

Here the addend is the quantity added at each clock cycle and is directly proportional to the required output frequency. The output frequency is:



$$F_{out} = 50 \times 106 \times Addend / 224 = 2.98023224 \times Addend$$

This provides a resolution of about 3Hz, which is more than adequate. Since the required frequency is likely to be set and displayed in units of 10Hz, a “multiply by”  $10/2.98023224 = 3.35544320$  is needed. A multi-cycle “shift and add” circuit can readily perform this operation.

## Practical Considerations

In theory, any output signal below the Nyquist Frequency (half the clock rate) can be generated. In practice, however, it should be limited to about a third of the clock rate to minimise phase noise. This equates to about 16MHz. For HF bands above 20 metres, the best approach is to generate one third of the required frequency and “pick off” the third harmonic with the output filter.

A suitable output filter is needed since the generated waveform is a square wave. Either a bandpass filter or a traditional harmonic filter will suffice. When used to drive a class-E power amplifier, however, the square wave output can be fed directly to the (switching) power transistor. In this case, all filtering must be done between the power amplifier and the antenna tuning unit (ATU).

## A Working System

Full details of the working system are beyond the scope of this article. However, additional details may appear in future articles, if time and space permit. To make a user-friendly DDS system, it is necessary to have a display to show the operating frequency and to present a simple menu system.

A set of push buttons allow the user to navigate the menus and alter the settings. Since a working DDS system only uses about 10% of the FPGA’s available space, it would be helpful to include additional features such as a side-tone generator, iambic keyer, envelope shaper and receiver incremental tuning (RIT). My current system (a work in progress) is shown in the heading photograph.

## Finally

Hopefully, this article has whetted your appetite enough to look into the use of DDS and the application of FPGAs for amateur radio purposes. If you would like further information, please do not hesitate to contact me using the above email address. You may also find the following web links particularly informative.

[https://en.wikipedia.org/wiki/Direct\\_digital\\_synthesis](https://en.wikipedia.org/wiki/Direct_digital_synthesis)

<https://en.wikipedia.org/wiki/VHDL>

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

<http://www.latticesemi.com/Products/DevelopmentBoardsAndKits/MachXO2Break-outBoard.aspx>

The Lattice FPGA board and the various associated components can be obtained from Digi-Key Electronics.

## Special offers

**Graham Firth - G-QRP Club Sales - sales@gqrp.co.uk**

Recently, we have been sent – with previous permission - all sorts of ‘surplus to requirements’ parts that I think some of our members would love to have. I must say at the beginning, that these are for use, not for putting on your shelf ‘just in case’, and not to be immediately sold on any of the selling platforms. We are hoping that this will stimulate more home brew! This stuff is cheap, and for members only, and we would like an indication of what you plan to do with them. Also, I do not want any more except by pre-arrangement and with my full agreement.

All parts are £2 each. Postage is £1.20 for all orders. I prefer a contact by email, as we only have one or two of most of the parts, and I will probably have to use my club hat! If you really can’t do email, then call me on 0113 267 1070, but don’t expect my wife to know anything about them!!!

Please do not send money until I have told you that an item has your name on it.

ICs -	SL612C; SL622C; SL630C; SL640C; SL641C; SL1640C; SL6440C; SL6270C; SL6700C; SL1430C.
Mixers -	MCL SBL-1; MCL SRA-1; HPF 505
Ceramic filter -	Murata CFM 455
Crystal filters -	IQD 10XF-90F2.4L (9.0MHZ); TAMA TF90H600 (9.0MHZ); NIKKO MX 10M22D (10.7MHZ) (includes 2 x +/- CI xtals)
Mech. filter -	MF-455-10AZ121

# Precision voltage reference

Phil Stevens (philg3ses@gmail.com)

Like many other radio experimentalists I have quite a few digital multimeters which are many years old. All instruments have a gradual decrease in accuracy as they age and cheap instruments can have a poor initial accuracy. In the professional world test equipment has to be regularly checked for accuracy, usually by an external calibration house. This service is far too expensive for the radio amateur.

The most used facility on a DMM is to measure DC voltages, so I decided to construct my own calibrator using a REF01HP 10.0V precision voltage reference because I had been donated with a large number of these devices some years ago. The circuit was designed to give three fixed outputs of 10, 1 and 0.1V and also a precision variable output from 0 to 10V.

The data sheet for the REF01HP states that the maximum error is  $\pm 50$  mV ( $\pm 0.5\%$ ) but it is possible to trim out any error if one has a precision standard DVM. I have a Solartron 7055 microprocessor precision instrument and measured the prototype error as  $< 0.25\%$ . Therefore I have yet to add a null circuit considering this accuracy adequate for amateur radio.

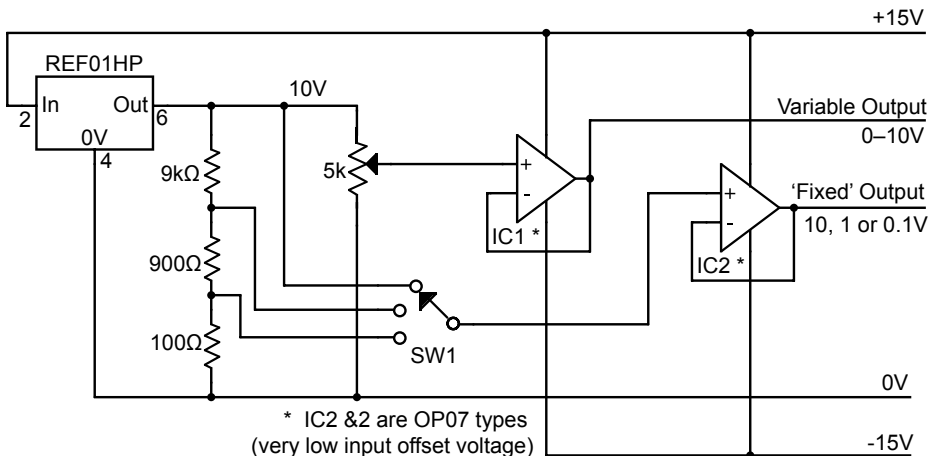
To prevent any loading on the reference by low resistance loads two voltage follower stages were added. These use OP-07 very low offset integrated circuits. The circuit can be easily modified or simplified according to ones needs.

Components: The fixed resistors have a tolerance of 0.1% and were salvaged items from scrap instruments. The 5k ohm potentiometer is a precision device with its precision dial also from my junk box.

The OP-07 buffers could be replaced by lower tolerance devices which could have their input offset errors trimmed out. There are many more modern voltage devices available than the REF01HP, but I could provide some REF01HP devices free to GQRP members. Do not use a Zener diode as the reference as they have poor accuracy and temperature stability.

A regulated  $\pm 15$  V supply is needed to provide about 50 mA

Please feel free to contact me if you wish to comment or have any queries.



# Switched Multi-Ratio Broadband Matching Transformer

Mike G3JKX

You may find it a great idea to build this useful gadget if your AMU or your rig's built-in AAMU is having difficulty matching odd lengths of aerial wire.

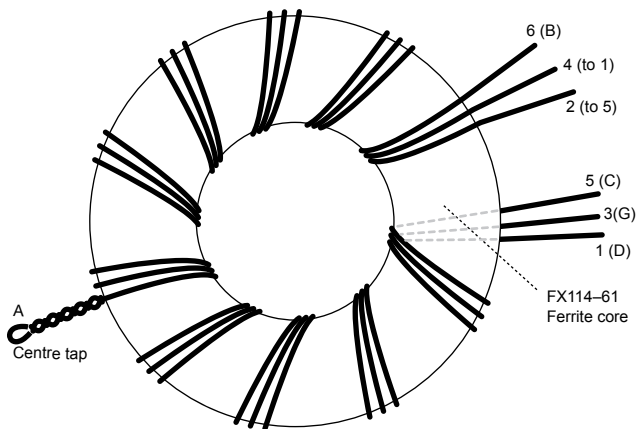
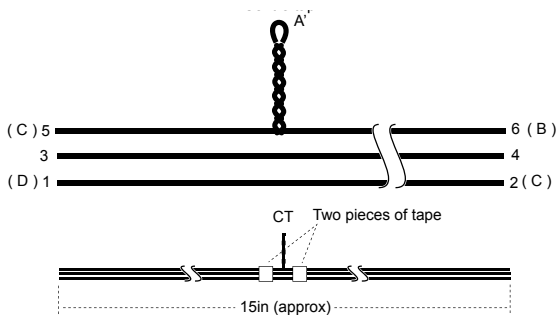
## Parts required.

- One FX114-61 Ferrite Ring (1.14in diameter, type 61 ferrite),
- 4 x 15inch lengths of 16SWG enamelled or insulated wire.
- A 2 pole, 6 way rotary switch, with knob.(or 4 plugs and 14 sockets)
- Two chassis mounted co-axial sockets of your choice and a suitable box.

## Assembly

Take one length of wire and make a centre tap. Parallel this upped wire with two other wires. Tape each side of the centre tap to hold all three wires together.

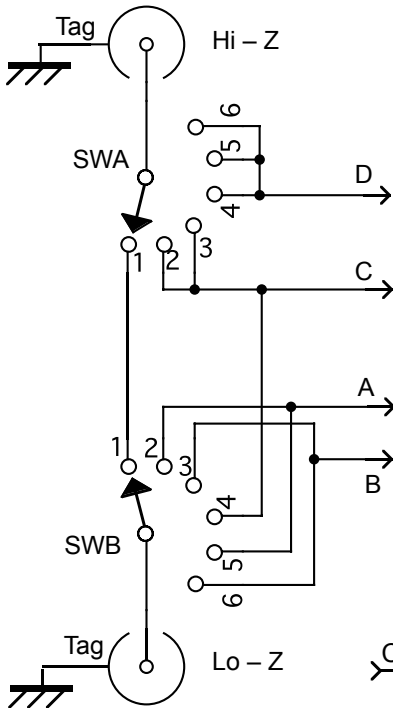
Wind onto the toroid five turns\* of all three wires close together from the centre tap and five turns (or six if you wound six on the first group) on the other side of the centre tap, in the same sense of course. Going through the hole counts as a turn. Mark all 6 coil ends as per diagram.



*\* remember that each time the wires are passed through the centre of the toroid counts as a 'turn'.*

Check with an ohm-meter that wire 5 goes to 6 & A. Referring to the switch diagram on the next page.

Solder together tags 4, 5 & 6 on switch A wafer and between tags 2 & 3 to switch B wafer tag 4.



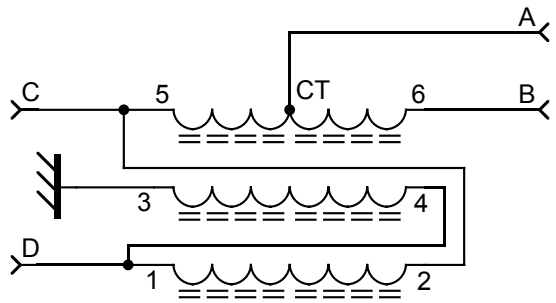
Solder Pin 1 on both wafers together. Also switch B wafer pins 3 to 6 and 2 to 5. Join transformer wires 5 to 2, then join end 1 to 4.

Connect remaining transformer wires to the correct tags on the appropriate switch wafers.

Mount the two coaxial sockets and connect to the appropriate switch rotors.

If you're not going to use a metal box, connect a braided earth between the Hi and Low Z socket mounting bolts.

Connect wire 3 to this or chassis. Ensure all soldered connections are good!



**Warning; NEVER rotate the switch with RF power applied. An option would be to use four banana plugs, joined in pairs, with fourteen sockets instead of a rotary switch.**

50Ω i/p to Low Z socket			50Ω i/p into High Z socket	
Position	Turns Ratio	output impedance	Turns ratio	output impedance
1.	1 : 1	50Ω	1 : 1	50Ω (Straight through)
2.	1 : 1.44	104Ω	1.44 : 1	24.10Ω
3.	1 : 2.25	253Ω	2.25 : 1	9.88Ω
4.	1 : 4.0	800Ω	4.0 : 1	3.13Ω
5.	1 : 5.75	1653Ω	5.75 : 1	1.51Ω
6.	1 : 9.0	4050Ω	9.0 : 1	0.62Ω

# VHF Manager's Report

## Passive Repeaters

John G8SEQ QTHR john@g8seq.com

This article was inspired by a talk recently given to Coventry ARS by member **Iain G7III**. It reminded me of some conversations I had with Phil G4CFG and a QRP club member who's name I can no longer remember (It was over twenty years ago!). However, the question asked was: how to get a VHF signal out of the Yorkshire dale that he lived in, so I suggested a passive repeater.

### What is a passive repeater?

Basically it is two antennas connected back-to-back. Usually each antenna would be a high gain type such as a Yagi or dish antenna. The technique is best suited to VHF, UHF & SHF.

### What can they be used for?

They can be used to get around or over an obstructed path.

### Advantages:

Passive repeaters do not require a power source. They don't require a licence or NoV either. They can be used simultaneously by multiple users (using different channels/frequencies). They can be used with ANY mode of modulation and will re-radiate mixed modes simultaneously. They do not suffer cross-modulation, unless faulty or poorly constructed\*. They can also be used to change the polarization of the incoming and outgoing signals. They do not suffer from de-sensing, so can easily be used in full duplex mode (though a pair of repeaters say one on 2m & one on 70 cm is required).

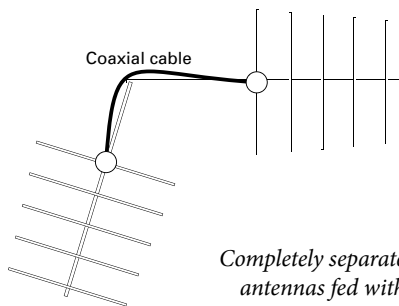
\*If an accidental diode ("rusty bolt") is included in the antenna then there is a possibility of cross-modulation.

### Their disadvantages:

The re-radiated signal is nowhere as strong as a signal re-transmitted from a conventional repeater. In fact the signal re-radiated/received will be directly related to the original transmit power of the user. You need access & permission to a site near the obstructed path which can be 'seen' by both stations trying to use the pair.

### How to make one.

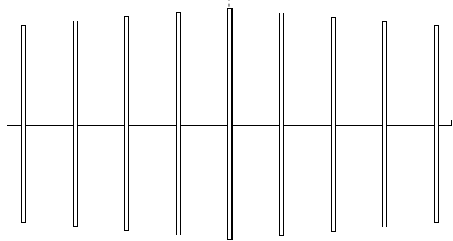
Simply erect a pair of antennas at a location which can be seen by both Trx A and Trx B. Join the driven elements with a short piece of coaxial cable.



*Completely separate antennas fed with coaxial cable, can 'see' round corners*

Point one antenna at Trx A and the other at Trx B. This can be used to get your signal over a hill on a straight path or around an obstruction on a dog-leg path.

### Common driven element



*A back to back arrangement of yagi antennas, can also share a common 'feed' element*

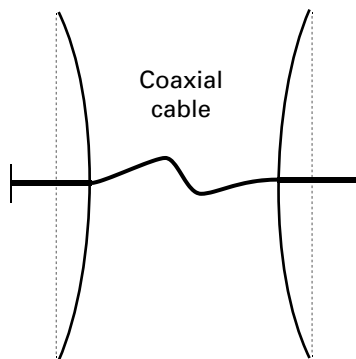
An alternative construction, is to use a bidirectional Yagi ie a Yagi with no reflector but two sets of directors in front and behind the driven element. No co-ax necessary, thus reducing feeder losses. This is best suited to getting over a hill/building in a straight line but a dog-leg could be accommodated by using an asymmetrical bidirectional antenna ie one side with many elements and the other side having only a few, thus giving a wide beamwidth on one side enabling a dog-leg path to be worked.

Of course dish antennas need to be connected by co-ax or waveguide.

The improvement in performance will be a reduction in path loss equal to the combined gains of each antenna. For example two Yagis of 10dB gain will reduce the effective path loss by 20dB giving at least three and a half S points increase.

### Does it work?

YES! Iain, G7III did some experiments using HB9CV antennas for 2m and 70 cm. He placed his passive repeater on Riddian Bridge which enable signals to be worked from The Dilke PH to Lime Pits, a short but obstructed path. These locations are on or near the Daw End branch of the Birmingham Canal Network.



I've also done some tests of my own. I have been accidentally using a passive repeater for years. By pointing my 2m beam antenna at an active repeater 5 miles away in Leamington, I can use my low power hand held to access the repeater from anywhere in the house with any polarization. My beam is a 9x9 crossed Tonna which is phased for circular polarization.

Using the repeater as a beacon, as I turn the beam I can watch the S-meter rise and fall as the signal from the repeater goes through peaks and nulls on my beam antenna.

I've also tried hiding behind a metal central heating radio and turning the power down on the hand held so the repeater doesn't 'see' the direct signal from the handheld.

**De John G8SEQ**

# Communications and Contests

Dom Baines, M1KTA, 34 Bury Road, Stapleford, Cambridge.  
CB22 5BP m1kta@ggrp.co.uk

## G QRP Club Winter Sports

The G QRP Club Winter Sports is one of the most popular QRP operating events. Each year between Boxing Day (December 26th) and New Year's Day (January 1st) the club invites any operators to join in a QRP "QSO Party" using 5 watts of RF output or less. The operating takes place on and around the International QRP Calling Frequencies.

These are :

CW: 1836, 3560, 7030, 10116, 14060, 18096, 21060, 24906, 28060 and 60m 5262KHz  
SSB: 3690, 7090, 14285, 21285, 18130, 24950, 28360kHz

Well done everyone who took part. Everyone said conditions were awful and the 'money band' appeared to be 40m for nearly everyone. Quite a few of you managed 30m and 160m as well. Once again thanks to all for all of the entries especially some DX.



G4ARI

**Robert, PA9RZ** sent me a lovely note including the comment. "A miracle has happened..... I found some time for operating during the W/S" I loved the photo of 7 keys used with the various rigs.

**Val, RW3AI** sent me a log of "contests during this period"

**Tim G4ARI**, included a note saying he was returning to WS for first time in years and operated with a collection of homebrew radios.

**David G4HMC** Winter Sports has been the best I can remember for many years, probably as far back as the 1980s. There was plenty of activity and good to excellent conditions, particularly on Boxing Day.

**Phil G3SES** said. Despite poor conditions, with deep QSB, I was able to make a few a few relaxed contacts. All were 'proper' QSOs and included a fair amount of content.

**Tom DM4EA** lots of fun and it's what I understood a hobby should be ;-)

**Dom M1KTA** (self) I note that Mike EW1CY was running 200mW on 20m. Looking at websdr I did note he appeared consistently on the band with a good signal.



There were a few comments that some DX operators really tried to make a QSO and really persevered. I

have not performed a complete DXCC breakdown and log count but it is pretty safe to say conditions made any QSOs on 15m or 10m a rarity.

Several members do appear in a few logs but I didn't see an entry? There was big move to LF with most focusing on 40m and 80m with a fair few of you choosing to use 60m.

Colin G3VTT was operating as G5LOW on a few days and he appeared in logs. Santa OF9X appeared a few times most days usually on 20m so there appeared to be opening to the East in the afternoon of the 27th. The Holy Land special event station 4X19HNY also appeared a few times on 28th.

A few DL members also appeared operating in HB0 and HB9 portable. I note a few managed SOTA operations as well. Brr must have been cold.

Once again there was quite a bit of 2m and 70cm activity in the middle of the period. Perhaps I should ask if members might be interested in satellite operations during the period?

For antennas used, the end fed half wave was used most followed by dipoles and the G5RV horizontal antenna.



Space prevents lot of extra comments but so glad everyone enjoyed taking part this year. Anyway this is a hard one to judge and it is not just about the largest number of QSO but the entrant that really does deserve the G4DQP Trophy this year was Peter G3XJS as he was keen to make QRP/QRP QSOs on

all bands from 160m to 20m, which he managed to do, although it was not as easy as in previous years.

### **Chelmsley Trophy**

Wonderful range of entries the winner this year was Carl Mason GW0VSWGQRP 9581. 50 DXCC on CW (wth 12 of those also on SSB) in current conditions quite a respectable result for only the period from October

### **RSGB Spectrum Forum**

There were lots of discssions about 60m and there are some foot note comments added to the latest RSGB band plans

*[https://rsgb.services/public/bandplans/docs/rsgb\\_band\\_plan\\_2019.pdf](https://rsgb.services/public/bandplans/docs/rsgb_band_plan_2019.pdf)*

## **Communications & Contests Extra**

**Dom Baines, M1KTA, 34 Bury Road, Stapleford, CAMBRIDGE. CB22 5BP**

**m1kta@gqrp.co.uk**

# **G5LOW**

The club, courtesy of Steve G0FUW our chairman, has secured a callsign that can be used by arrangement with him, see XX for details of how to apply to use it. I would especially encourage those that might be in any on the RSL about the UK to request to use it if you are taking part in any event or contest (qrp category of course).

**Remember you have to be a full licencee to use it.**

There are lots of qrp category contests right through the year and lots of lovely silverware at the RSGB convention. Plenty of /P contests might suit a team of multiple operators. In addition to the call the RSL prefix operator also applies so you could have GX5LOW. It is my understanding that it would be possible for G5LOW to be used concurrently from all the different UK RSL at the same time which might make it rather interesting with GM5LOW, GW5LOW, GJ5LOW.

For those that know it ARRL CQWW WPX might make you rather sought after with a rare prefix. The RSGB CW FD would be an ideal option as well.

It will not be just for contest use, perhaps some might want to use it for activity days such as the International QRP in June, or perhaps a local event?

Maybe there might be a G5LOW QSO through Es'Hail2 soon?

# Valve QRP Day 2018 & G5LOW Winter Sports

Colin Turner G3VTT 182 Station Road Rainham Kent ME8 7PR  
G3vtt@aol.com

My thanks to all of you who operated in the November Valve QRP session and in the Winter Sports with your old time valve equipment. I had a rewarding experience operating G5LOW, our new club call, in December and I put the homebrew transmitters to good use working 40 contacts in 9 countries in tough conditions on 80m, 40m and 60m. I heard a large number of excellent CW QSOs going on giving sensible reports, swapping information, asking questions and getting answers not to mention passing greetings at Christmas and New Year. Those members heard with QRP should be rightly and justifiably proud of maintaining the old ideals of amateur radio.

**Bill G4GHB** has had his fair share of problems in getting on the air recently and he tells me of his troubles: “Hi Colin, another valve day and more problems yet again! I worked on 5.262 MHz with no problem then in the afternoon my 61BT valve transmitter wouldn’t work. The valve lit up and there was HT present but no voltage at the key. There was however 38 volts on the valve. The tip of the jack plug had come unscrewed! (I’ve had the same trouble with those Far Eastern plugs!). I tightened it up and was ready to go again with 1.6 Watts out. I tried to call G4ZXN but was beaten to it by G4WCP, then G3KOJ, G4XRV, GW3UEP, perhaps not quite in this order, my list is a bit jumbled up, so I then decided to go to the pub!73, Bill, G4GHB.”

**Adrian G4GDR** used his BC348 and 6L6 combination to work four other stations with vintage QRP equipment in November. From “Hi Colin, I had a good time over the weekend making eight QSO’s using a mix of 19 set’s MK II & III on 80 and 60m. All were valve to valve contacts with G3s TYB, VTT, XIZ, G4XRV and ZXN and two non-valve G3ZPF & ON4LFO. All stations had very good signals. I have started to homebrew an article from Sprat Issue 7 page 6, the W9SCH one valve transceiver, and I will be using it in the Spring event! 72 for now Ian. G4GIR.” I’ve included your notes in this issue Ian – many thanks.

I met **Richard G0GLZ** at the Rochdale Rally last year and had a good long chat about valve equipment. He writes in to say, ‘It was good to talk to you at the Rochdale Rally the other day. I was the bloke who bought a few things from your stall! We chatted about the recent valve QRP day. I worked a total of five stations during the weekend using valve gear. Sadly, no one was using AM! There was some significant activity on



*Codar–coral chez Richard G0GLZ*

eighty metres on the Saturday and in the evening it was the Club Calls contest when Top-band was ablaze with SSB and CW contest signals for a few hours. I put a call out on AM before the contest start but found no takers! I have attached a photograph of the 'Codar Corral' at chez G0GLZ. Best wishes and keep up the good work. 73 Richard'

From **Derek G3NKS** who always supports these events. "Unfortunately didn't get much time to play radio – a very busy weekend. Just 7 QSOs in total, all but one on the Saturday and all but one using a valve TX, the one exception was the DK on 80m on the Sunday. On 80m: M0HAZ, G3XIZ, G3VTT, G4BLI and DK7OB. On 40m: G3UD and F6BWO. My setup on 80m - CO/PA (2 x 6V6) running 5W, 40m - Single 6V6 running 3W. RX is a Drake R4C. The aerial is a G5RV at 15ft. Good fun and many thanks Colin. I'm looking forward to the next one. 73, Derek G3NKS"

**G3YVF** has a new TRF receiver. Well, two and a half contacts...the half got away, I knew he was there calling me but I couldn't make a go of it as he was too weak. I used the huge 'heavy metal' job, the Marconi 361 (a four valve TRF,) on 60m for the receiver and a homebrew CO/PA transmitter and I worked you and G3DXZ. I tried 1843 KHz using the ATP4 valve transmitter, CO/PA and the Eddystone All World Two receiver. In all a lovely combination but on the times I was there I didn't work any others.

Here is a picture of the two stations as they are in regular use. A further note is that I have used the CO/PA and 361 on MHz over the last few months and so far have worked 32 stations with the best DX being EI6DN, GM3NHQ and GI4C-ZW. On my silly little end fed wire that really is DX! The Marconi 361 TRF receiver really good fun to use and I cannot put it down. I would also add that



*An impressive collection of valved equipment*

Eddystone has hit the target with the All World Two with an SP2 as detector and it really is a wonderful TRF receiver....Paraset builders take note!!!! No wonder the Secret Listeners in WW2 liked it and it is instantly resettable too.

For anyone wanting to try a TRF then look no further than the circuit of the Eddystone All World Two. I am rock bound as I grind all my own crystals but I do wish any one calling CQ on 60m would tune either side as many times I answer a CQ but they don't realise I am nearby answering their CQ call. Please put the RIT on wide and use it! So a score of 2 1/2 for me this time but next time I will try harder! 73 Geoff."

## The Winter Sports 2018/19 report from G3XIZ reads

“I was QRV on all Winter Sports days and as usual dusted off some of my old home built gear. Activity was much better than last year but I was tormented by an intermittent sparking type of QRM so my apologies to any who called me but didn’t get a response. Despite the local QRM I had 26 2-way QRP QSOs with 22 separate stations on 4 bands: 160, 80, 60 and 40m. All contacts were made using CW except for one A.M QSO on top band with G4GIR who was running his vintage WW2 19 set. I worked the club’s special call G5LOW (Colin G3VTT) twice, both times on 80m. My recently built 40m TRX did good service netting 10 of the contacts and my valve TRX with its regen receiver netted 13, including a station from Ukraine on top band.”

Down the road in Sittingbourne from G5LOW is **John G3TYB**, who wrote: “Hello Colin, my report on the recent valve weekend, I worked twelve stations and had a total of seventeen QSO’s. Of those four were on 60m, one on 160m and the remainder on 80m. 40m was particularly unproductive because of a contest. Equipment used was my CO/PA Transmitter with Regen Rx, and latterly a homebrew valve receiver and transmitter. Most importantly this boasted a VFO from which I productively chirped and drifted my way across 80m. Power was 5 watts max and the antenna was a 160 ft. top doublet (useless for top band!) Of the twelve stations five were using valve equipment.” Thanks John, I thought the signal was pretty good!

**Nigel G0EBQ** wrote: “Hi Colin, Unfortunately I wasn’t able to get on till late on Saturday so it sounds like I missed all the best bits. I did work DL0SKCC (yes the call is correct) and then a nice two way QRP QSO with member Tim G4ARI. I didn’t hear any valve stations though. The rig was the Skeleton transmitter and space charge receiver. Thanks for the advice about using a coupling winding to the antenna, G3YVF had also suggested it, I did try it but for some reason it didn’t work! I must have done something silly and will try it again but that does mean that I will have to unsolder everything first so it’s a case of finding a minute! All the modifications and improvements that you mentioned in your last piece were entirely down to G3YVF and not me at all and I’m very grateful to him. Thanks for your always interesting column and keep the flag flying! 72s Nigel G0EBQ 3375”

**G3XIZ** also wrote about the November Valve QRP day. “Hello Colin OM, I had enjoyable Valve Weekend contacting fellow valve enthusiasts. Activity was quite good as were band conditions and my local QRM was low for a change. The valve transceiver was brought down from its home in the loft and dusted off and then I indulged in my habit of ‘improving’ the circuitry before putting it on the air. Over the weekend I had 28 QSOs with 19 separate stations, using the 160, 80 and 60 metre bands. In total 18 of my contacts were with ‘valve’ stations, those being: G3DXZ, G3NKS, G3TYB, GW3UEP, G3VTT, G4FGJ, G4GIR, G4XRV and G4ZXN.

“You’ll notice that G4FGJ is a new addition to the list and Gordon managed to get his prototype valve transmitter operational just in time to give me a QSO on both Top Band and 80m. Before putting my transceiver away I made a rugged, varnished wooden box in which to house it. My carpentry skills are not great but it certainly is fit for purpose. 72/73 G3XIZ”

**Kare YU7UA** sent in to say: “Hi Colin, during the Valve Day activity I worked from the workplace which is the TV/FM tower at Fruska gora nr. Novi Sad JN95WD, 516m ASL. I used an old Telefunken SEM78 valve transceiver an ex spy radio covering 3-8MHz

CW/AM, made in about 1955. The receiver is 5 tubes EF89, 3x ECH-81 and an OA-2, and the transmitter is an EL803 VFO, 2x EL84 PA, 1x ECH81 and 2x EL84 AM modulator and another OA-2 regulator. The power is little over QRP level, 15W, sorry. Frequencies are quartz controlled (or VFO with drift on transmit. The receiver is VFO controlled, manual switching between RX-TX, and the antenna is a W3DZZ at about 4 to 6m. The results are as follows on the first day 3 QSOs on 80m with ON, SP, HA, and the next day 7 QSOs on 80m with I, SM, HB9, G, DL, PA. It was very satisfying to use this old radio, 72 from Kare YU7AE G-QRP nr. 11798. Finally Gerald G3MCK writes and told me he had only 5 contacts due to poor conditions but one of them was LI9CG who was using a Paraset. He was using his all valve receiver and a co/pa with 5 watts. Gerald continues to do very well on the bands with low power and he has only simple low vee dipoles for 80m and 40m plus a roof dipole adjustable for 30m and 20m. I've provided these reports to encourage you all to get on the air.

### Restoring Old Radio Knobs

"Hi Colin, My Racal RA17L is now repaired. A resistor and an RF choke in the 2nd VFO had both burnt out. What a big job to get at it! I replaced them and it still didn't work after reassembling it then I found a coax wire was loose in its plug which came away when I tugged it.

"So I resoldered it and it works fine! With this broadband QRM here since December 2017 I'm now trying a homebrew magnetic loop away from the phone wires and angled for minimum QRM.

"I actually heard an ON station on 10 MHz after years of noise and giving up 10 MHz I think 5 MHz and 7 MHz are useable now after almost giving up radio but then using Hack Green SDR online as my receiver.

"Anyway, here's a tip members might not know about to put new life into dials and knobs if they are etched. Clean first with Cif cleaner and an old toothbrush then a white wax crayon rubbed into the lettering and rubbing off with a soft cloth brings it out.

Then you should rub the excess wax away with a soft cloth, that makes it look new again. I remember my Dad doing this on something about 50 years ago.

"The flash has brought out the lettering on the brown ones in the before picture, they were quite faint.



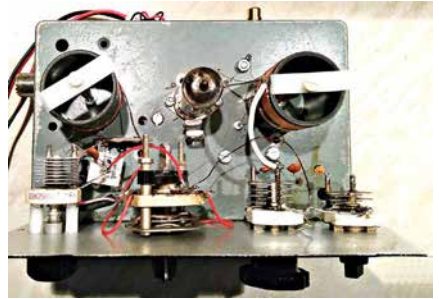
*Before treatment  
and - after a little TLC*



## The W9SCH Transceiver Experiences by G4GIR

Having previously used valve commercial gear such as 19 Sets, AT5 and an AR88 receiver I felt I needed to make something SIMPLE and CHEAP for use in the QRP valve weekends. A search of the SPRAT CD threw up various designs however my attention was drawn to SPRAT 7 pages 5 through 7 a 'One Tube station by W9SCH'.

"With the requirements of SIMPLE and CHEAP, I decided to use whatever was on hand! One small problem though, I had no valves or valve bases except a few spare 19 Set valves. A very good friend of mine, G4AQS, I hoped would be able to help with the missing items! Sure enough one B9A and a 12AU7 were gratefully received. The next job was to collate the rest of the components. One very old second hand Eddystone die-cast box for the chassis, a scrap piece of aluminium sheet for the front panel, 1.5" diameter black drain pipe for the coil formers and some scrap veneered 3 ply (stained and varnished) for the case, giving it that retro look! The remainder of the components were all available from years of hoarding. For those that don't have the CD or original article, the circuit is a double triode, one half acting as a crystal oscillator PA and the other half as a regenerative detector. The circuit worked first time although some modifications were made such as a smaller value tuning capacitor used to limit the receive range from 3.5 to 3.7MHz, making it easier to find and keep the received station tuned in. A 10k 10 turn



pot was used for the regeneration control after adjusting the series fixed resistor value. An audio transformer to isolate the HT (250 – 300 Volts) from the headphones was also fitted. When used with a variable audio peak notch filter the receiver is very good. The transmitter with 300 V delivers 2 Watts RF output. The aerial in use is an Inverted L, 40' vertical, 100' horizontal and to date 38 QSO's with DL, F, G, ON and PA have been made with the majority worked during Winter Sports using power levels of 250 mW to 2 W. I am looking forward to working many more with this simple but effective and enjoyable rig. If anyone has constructed or intends construct it I would be interested in hearing of your experiences. 72 Ian G4GIR"



Thanks to Ian for this input on his project. Finally in response to feedback from the constructors and operators of the Valve QRP gang I am proposing we add two more operating events for Valve QRP Days. The next weekend is April 20th and 21st and in November it is the 9th and 10th. I would also suggest we operate over the weekend of July 6th and 7th and support the DL 'Original QRP' contest (!) and again during the Winter Sports next December. I have booked G5LOW for a number of these dates and hope to work many of you in the sessions. I really must make another little transmitter you know.

72 Colin G3VTT/G5LOW

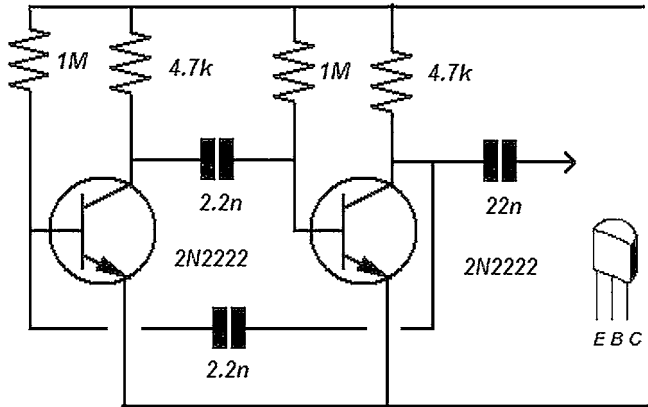
# Ball-point Injector

Peter G4UMB email: pahowd@gmail.com

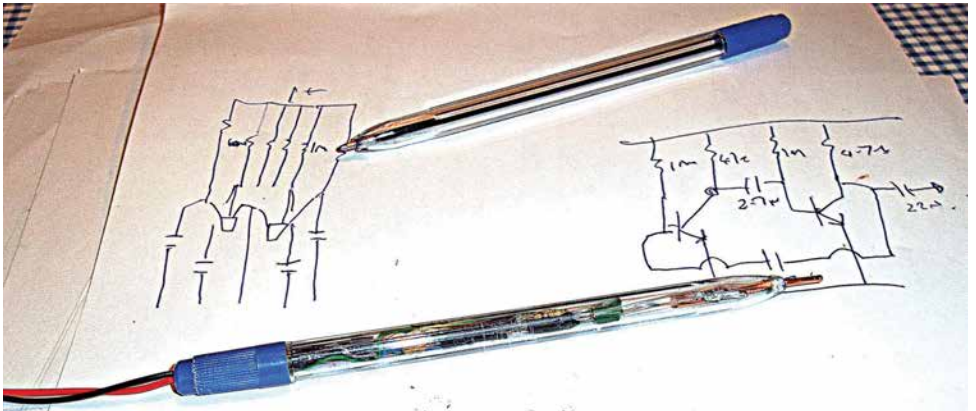
I bought a pack of 10 ball point pens from a pound shop and set myself a challenge to convert one into a signal injector.

I claim no real originality for the circuit shown alongside, as it has been presented many times in various publications in the past. All it really consists of is a simple 'Flip-Flop' square wave oscillator that runs at an audio frequency, but has harmonics that can reach well up at least the low VHF range.

The difficulty was to fit the circuit inside the very narrow body of the pen. However by assembling the parts in line and connecting them with sleeved connections ugly style I just managed to squeeze it in using regular components. The only problem now is I am sometimes picking it up to write with it!



*Pen Size Signal Injector*





# Membership News Extra!

Tony G4WIF, PO Box 298, Dartford Kent. DA1 9DQ

Before the usual Spring information, an announcement and an opportunity for someone to become part of the GQRP team. After 13 years I would like to retire from my membership secretary post. I will be continuing as Internet Manager - looking after the club website and other related issues. All the background involvement that you don't normally see will continue too. So I won't be gone, just taking more time with the soldering iron.

For all kinds of practical reasons the new Membership Secretary will need to be UK based. You will also need to be comfortable using the internet and computers.

At the time of writing I will have processed the bulk of 2019 membership renewals - so as we move into the summer we can start you off slowly. Interested members should contact me and I can tell you more about the role. email me at

*[g4wif@gqrp.co.uk](mailto:g4wif@gqrp.co.uk)*

## **Your last Sprat?**

This will be your last Sprat if your wrapper label says "membership expired" or "underpaid". Please check your wrapper and contact me (or your overseas representative) if this applies to you. Please do not assume if that if you are a UK standing order payer that it can't be you.

If I could not identify your payment then your membership has lapsed. Please everyone, check the wrapper now.

If underpayment applies to you, there will no further Sprats until you send the balance.

If you sent me cash in any currency other than UK pounds then your payment will not count. As stated in the Winter Sprat, Euros and Dollars are not acceptable – we can't spend them here in the UK. If you want to risk cash then please go to your own bank and get UK money.

## **Providing information with your payment.**

Astonishingly our overseas reps and myself receive payments with no information about the member paying. We have no special gifts of prescience so please take the trouble to include your name, callsign, membership number and address. An email address is very helpful if we need to contact you about the payment.

## **Privacy.**

This is to remind you that the club holds a database of all our member's names, callsigns and addresses. It is implicit that every time that you renew your subscription, you are giving us active consent to record this activity in the club database. We only use your data to confirm your membership to send you Sprat, QSL cards, or fill your order in the club component store.

We only share your data with the printers who mail you your Sprat. If you are unhappy with us holding this information about you, then clearly you cannot, for all practical purposes, be a member of the G-QRP Club and if you contact us we will gladly refund your unused membership fees and delete your data.

# MEMBERS' NEWS

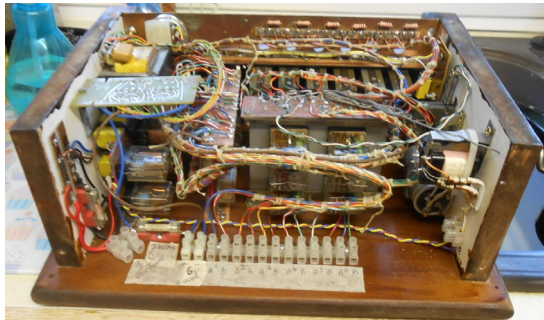
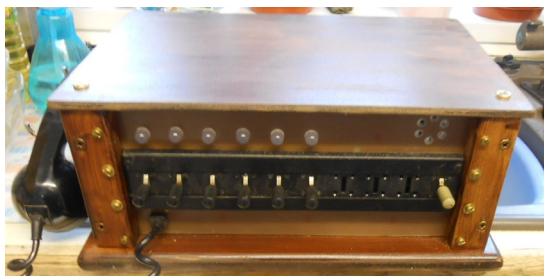
by Chris Page, G4BUE

E-mail: [chris@g4bue.com](mailto:chris@g4bue.com)  
[gc4bue@gmail.com](mailto:gc4bue@gmail.com)



At least one member's email to me bounced! I don't know why, but if anyone has the same problem, copy the email to my other address <[gc4bue@gmail.com](mailto:gc4bue@gmail.com)>, yes gc4bue (gmail needs six characters). I noticed with some amazement that the NASA New Horizons probe that visited Ultima Thule in the Kuiper Belt at the beginning of January, communicates with Earth stations using 15W at a distance of over four billion miles!

**KA9P** has just joined the club and cannot believe it took him 50 years to discover *SPRAT!* Scott has just built the miniR2 receiver and multiband Universal QRP Transmitter (pictured right) and will use it in 2019 to celebrate 50 years of trying for homebrew QRP DXCC and WAS. He says, "Both units are built in discarded 12 inch wide 3u card racks, with everything modularised for experimenting and upgrading. Our standard 4x6 inch PCB stock fits the card cage slots well, with just a single nibble removed along the length of the stock, so most everything is built Manhattan style and slid into the rack. The Sotabeams digital audio filter is a great piece of kit to use with the miniR2, and apart from not having AGC, the pair makes for great listening. I got to use the kit for six hours in the CQWW CW Contest and worked 44 countries, so I'm off to a great start".



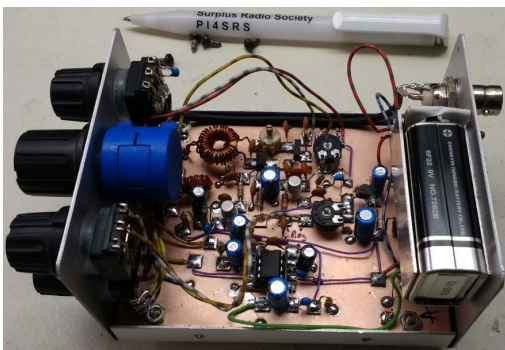
**GM4VKI** says he, **GM3WIL** and **G3MFJ** will be at the Northern Rally in Blackpool in April, followed by Braehead on 16 June and then Crianlarich and Gala. Roy diverted from radio at the request of the South Tynedale Railway to construct a 'Railway Concentrator' for the new signal box at Slaggyford, consisting of a six isolated line switchboard of the 1940 vintage (pictured left). Construction took him over two months and he thanks **GMØKZX** for his considerable donation of parts. **M1KTA** will be QRV 8/16 March as **C6AKT** from Eleuthera again (NA-001). Dom plans 80, 40, 20, 15 and 10 CW, including the BERU contest. **DDØVR** has received his Fiji licence. **3D2VR**, for his upcoming 1/30 September Pacific Ocean tour. Heli hopes to soon receive his licences for 34

Samoa (5W) and Tonga (A3). **KE1B** and **W6NN** will be QRV 22/27 April as **FO/KE1B** from Moorea (OC-046), and 27 April/2 May from Bora Bora (OC-067), running QRP with a KX2 and Buddistick on their hotel balcony. Rich and Anna will be mostly on 20m FT8 and other bands and modes depending on conditions. Talking of FT8, a comment from **G3YMC**, “Not sure how others are coping with the current lousy conditions but while they continue I am taking a break from the hobby. Some have moved to FT8, but that doesn’t interest me, however it seems to have effectively killed CW activity outside contests and DXpeditions with little opportunity for the sort of casual QSOs we QRPers enjoy”.

**G4UDG**’s ‘winter warmer’ this year was to the small village of Loutsas on the east coast of Athens, and although a family holiday, he was QRV as **SV8/G4UDG** with his KX-2 and Palm pico key (pictured right). An EFHW wire for 20m was erected in a dog-leg inverted vee fashion suspended by Chris’s 23 feet fishing pole, and as they were on a second floor apartment, the actual height was about 40 feet. A counterpoise wire on the balcony floor enabled the ATU to be adjusted for a 1:1 match, and a CQ on 14060 with 3W resulted in a reply from **DM3TN** using 5W. Over the next two weeks Chris made 75 QSOs with 28 DXCC, 33 on two-way QRP, including 800mW two-way with **DL6ZB** and 1W two-way with **F5NZY**. Best DX was RW9AS at 2130 miles.



Inspired by *SPRAT* and *Members’ News*, **PH2LB** decided to spend an hour every day home-brewing. Lex’s first project was the 40m WBR regen RX, published in the August 2001 *QST*, that he built Manhattan style (middle right). He says, “The not so loud audio stage was updated by the audio amplifier taken from the **AA7EE** 31m WBR schematic, and a HPF was added because of some overdrive from local AM radio pirates. It has been modified with an extra switch to add more capacity to get extra coverage and now covers 40m and the 41m broadcast band. More details on his website at <<http://www.ph2lb.nl/blog/index.php?page=40m-wbr-receiver>>.



Pictured above in his shack in South Wales is **GWØVSW**, who got back to operating HF QRP in October. Despite Carl’s QTH being sheltered on three sides by hills, he has made around 300 CW QSOs on seven bands, 160-17m, including 60m where he logged seven countries in his first day on the band using 5W and an inverted **G5RV**. He recently purchased a WonderLoop antenna that he says worked surprisingly well on 20m, working CT, DL, HA, I, LY, LZ, OE, OK, S5 and YU with an 817 and 5W. He even made an SSB contact with Z6, so not too bad for a small six foot wire loop on the bench, he says.

Below right is **GØAYD**'s shack showing his two **G3WPO** TCVRs, "working 100% and bought from a well known auction site, and still giving sterling service after renovation". Dave says one is called the Omega, produced in *Ham Radio Today* as a kit in 1983, 10W all bands full QSK with, "Awsome CW filters and a brilliant receiver", and the other is the Micron, a CW only 15W TCVR covering 80, 40, 30, 20, 15 and 10m. The other radios are three ubitx eight-band TCVRs, one with a colour touch screen and the others with a blue LCD display, all three running K8 CEC firmware. The picture above shows Dave's matching ATU for one of the ubitx radios which incorporates a T match ATU, plus a 2m FM TCVR, and which has the only mic in his shack! The cases came from Malaya via *eBay*. He asks anyone who has an Omega or Micron that is not working to contact him.



Sadly, **G4EHT** has failing eyesight and it now takes him ages to do construction. Despite that Bill has built AM 3W TXs and superhet RXs for 80 and 160m (pictured right), and has had excellent reports when working VMARS members using AM around 3516kHz. **G3XIZ** has been improving the stability of his 80m TRX's VFO which wasn't too good. Chris plumbed it into an antique data logger to record its change in frequency with temperature, and thus has been able to affect some improvement using a thermistor/varicap arrangement. He is still using the data logger and tapped into the RX's AGC and plotted his local QRM to see at what times it was most severe, and thus try to deduce the source. His new 160m TRX project is collecting dust as he spent a lot of time rewiring and 'improving' the old unit. Chris says it performs so much better now that the motivation to get a new TRX working has evaporated. He has just made a QRP L-match ATU using switched T50-2 toroids and says it works well, and is now half way through making a T-match ATU. When finished it should allow him to use the lower frequency bands from his /A shack.



In 2018 **F5NZY** made 4000 QSOs with either 1W or 5W with his KX3 and FT817nd. Steph says, "I still have a kW amplifier (Expert 1K-FA) and although the maximum power in

France is 500W, I have not used it for months. For my QRP activities in the countryside or in the woods, I bought a 8.4Ah LifePo4, lithium battery and a 35W solar panel”. **N2CQR** writes, “While the rest of the world seems going SDR, I am sticking with HDR (H for hardware) and have recently doubled down on the luddism by moving back into magnetostriction. **N6QW** sent me a 455 kc mechanical filter (from 1967!) which now provides excellent selectivity in my HRO-inspired 40m RX”.

**2E0NTV** got his Foundation Licence in February and his Intermediate in October and finds the G-QRP Club ‘very inspiring’ because his real passion is homebrewing. Nick has



just built the Michigan Mighty Mite for 7015 kHz, his first TX construction, followed by a LPF (pictured above), “to attenuate the numerous harmonics that the Mite produces, using **G3RJV**’s excellent *A Short Guide to Harmonic Filters for QRP Transmitter Output*, plus **G4COE**’s very useful *Torroid Induction Chart* (both GQRP data sheets on the website) to calculate the number of turns for my inductors and capacitor values. I used red T50-2 toroids and regular ceramic caps. The whole thing went into a small tin with a female BNC connector on each end. The filter turned out really well and I was very impressed with the way it cleaned up my signal so effectively”.

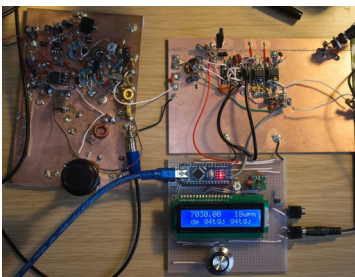


After a nine year absence from radio, **GØBON** got the urge to get on the air again and has been busy over the winter with various projects (pictured above). The aluminium pole in the middle of his garden was replaced with an extendable 33 feet mast from Sotabeams, and the 4:1 comudipole balun feed to the doublet was replaced with twin co-ax feed into a newly built balanced Z-match based on **VK5BR**’s design. Ivan says, “On the bench a few modifications to my HB 2N2-40+ were required on the VFO, as the supply voltage dipped on key down causing the frequency to shift. This was cured by replacing a zener diode with a voltage regulator. My Norcal 20 needed tuning up slightly and an IC chip in my Walford Brent TXCVR replacing. Have had great fun working stations again, mostly European but it’s been tough with the poor band conditions. Hopefully by the time of this *SPRAT* issue I will be busy building the OCX TCXR for 80m”. **ON4BCA** returned to radio after 25 years with a QSO on 28 December. Patrick is QRV on 40m with a FT891 at 5W and an indoor magnetic loop MLA-M construction from **OK2ER**. He says, “Due to the small 26 inch loop, results are not exactly fascinating, about 12 DXCC so far. Planning is to get an outdoor antenna this year, most likely a 51 inch magnetic loop”.

**GM4CXP** was QRV 5/19 January as **EA8/GM4CXP** from his hotel room with his FT817ND and Moonraker Whizz Whip plus Whizz Loops versions 1 and 2, but due to a S8 minimum

noise level, wasn't able to work anything! However, he was astonished to find through his Tecsun PL-365 RX with an 18 inch whip, he was able to pull CW stations through on 20 and 17m late am until mid-afternoon daily in an outside bar! Being registered blind, Del says he now needs help with anything he wants to do. Long gone are the days of homebrew, hence his use of commercial equipment. His surprise QSO of this period was **PA7WP** via tropo on 18 November on 2m FT8 at approximately 435 miles using his tri-band SQBM1000P vertical at 14 feet AGL. He writes, "Another surprise - I am gobsmacked to find I can make QSOs on 160m with my 'lowdown' 80/40m inverted vee on FT8 tuned by a Palstar AT4K ATU".

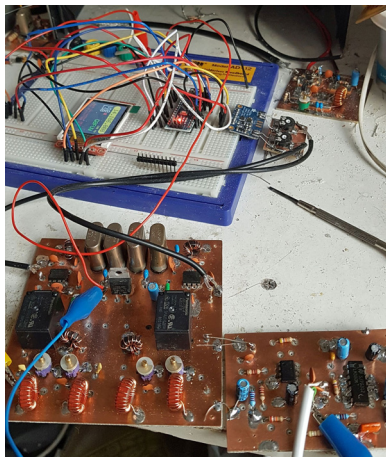
My apologies to **G4TGJ** and **G4FGJ** for getting their callsigns wrong in the last *Members' News* (*SPRAT* 177, page 35). The picture was **G4TGJ**'s 40m TCVR, not **G4FGJ**'s. Since then **G4TGJ** was QRV for a SOTA activation of Cracoe Fell (G/NP-032) using his FT817ND and the 40m version of his EFHW (pictured above right). Richard made 15 CW QSOs on one with another summit station, **HB9BIN/P**. The antenna also works on 20m where he had five CW QSOs, including **N4EX** and **N1AW**. He has abandoned his Sudden based project and started an Arduino based TCVR using the SI5351A oscillator surface mount chip. The RX uses the Tayloe detector (as used in the QCX) with a FT3253 analogue multiplexer chip. Richard says, "The picture [above left] shows the Aduino Nano clone, SI5351A on its adapter board and an LCD display on stripboard with the RF section on copper clad board above it. The RX is already working really well on 40m but, as it is DC, receives both the wanted signal and its image. Adding the phasing and filtering is the next part of the project. In the picture you can see my original Sudden based board on the left, the only part now being used in the new RX is the LPF. I am also using the crystal oscillator as a test signal".



Just before Christmas, **G4JQT** built a 60m AM copy of the Codar AT5 (right). "Not quite QRP, with an RF output of about 7W, but it's been great fun", says Ian. With his doublet antenna he has made AM contacts all over the country and says, "60m really is excellent for inter-G working. I've written the project up for the VMARS magazine *Signal* where I hope it will be published later in the year. I am also messing with a Pixie II for 60m. This is a remarkably popular QRP CW TCVR (given its performance!) and is widely available on *eBay* for just a few pounds. I'm looking to incorporate a Super VXO for 5262kHz, and slightly better RX filtering, and sensitivity - if that's possible. **LA3ZA** has written extensively about various Pixie mods, <[LA3ZA.blogspot.com](http://LA3ZA.blogspot.com)>.

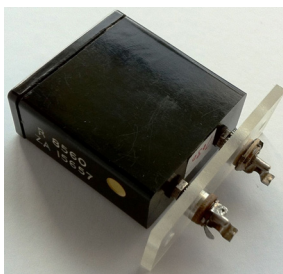


Pictured right is **GØFUW**'s attempt at the Sudden SSB TCVR by **N6QW**. Steve says, "I have a bucket load of old TV crystals and have used them in various 4.433MHz SSB filters. Pete was helpful in rigging the matching transformers, which were originally for the Club SSB filter. The RX is inhaling RF but I have yet to hook up the TX side". **G3ZOH** recently bought an excellent RSGB guide by **GØKYA** on how to use the free MMANA-GAL antenna modelling software. Brian says, "It has opened up a whole new area of interest. The book makes it very easy to get started but is very addictive! It's already proved useful for modelling matching networks to optimise my Pro-Whip vertical antenna. If you are interested in antenna modelling but do not want a steep learning curve, this is a great way to get started".



**GØKJK** recently moved from Cheshire to a Yorkshire retirement complex, where at times the RFI is really bad, and built a TX on a piece of wood off-cut using Bowood Electronics' excellent tag-strips and G-Club crystals. Just after 1900z on Christmas Eve, Keith joined the pile-up of mainly North American QRO stations trying to QSO special event Christmas station **ØF9X** in Lapland. He says, "For 20 minutes I was easily elbowed out of the way, but then came 'GØKJK 599 MX GL' (the 599 being somewhat suspect, of course!) to which I replied in kind, and easily completed the QSO. As we QRPers so well know, persistence often pays! What members might find interesting, and even encouraging, is that I was using a straight key, a mere 1.5W RF and an end-fed indoor antenna draped up the shack wall and over the curtain rail, cut to an exact length of a tiny 8ft 3ins, representing an eighth of a wavelength on 20m, the band in use. It tunes sharply to resonance using an ATU wound on a T68-2 toroid with five turns primary and 15 turns secondary, and a 60pf or so variable capacitor, (see Club Sales polyvaricons). As our Club Motto so well puts it, over such as this 1300 mile path 'It is vain to do with more what can be done with less'. So, if you have really low power and less than an excellent antenna, don't give up! You never know where your flea-power signal might get you!".

**GØUCP** shows us a way to make a holder for WWII crystals. John says the small, chassis mounting headphone jacks, with a springy silver-plated contact, will just take and hold one leg of a crystal quite firmly. If you mount two of them one inch apart on a bit of perspex, the whole assembly can be bolted to a chassis with just two slightly larger holes underneath for clearance and insulation.



Thanks to all the contributors of this column. Please let me know how your winter goes for the Summer 2019 edition of *SPRAT*; what you have been building, who you have been working, and any other information about QRP, by 12 May. Also, interesting pictures, please don't be shy in letting members see what you have been building and/or where you have been operating from, your antennas, who you have been meeting, and even a shack picture to let other members know what you and your equipment look like. Let me know if you intend operating from somewhere other than home during the summer and autumn months, so I can let members know to listen out for you.

## Rallies the club is attending

**Graham G3MFJ**

This is the list of rallies we are attending as we go to press. If you know of any for the next issues of Sprat, please let me know:

Yeovil ARC - Sunday April 7<sup>th</sup> - Digby Hall, Sherborne  
NARSA - Sunday 28<sup>th</sup> April - Norbreck Castle Hotel, Blackpool  
Dayton – 4 days in May – 16, 17 & 18<sup>th</sup> May  
Rochdale Rally – Saturday 15<sup>th</sup> June – Caldershaw Road, Rochdale  
Scottish Braehead ASRA Rally – Sunday 16<sup>th</sup> June – Braehead Shopping Centre  
Junction 28 Rally - Sunday June 28<sup>th</sup> - Alfreton Leisure Centre  
Red Rose - Sunday 14<sup>th</sup> July - St Joseph's Hall, Leigh  
Chippenham & District Rally – Sunday 28<sup>th</sup> July – Kington Langley

My wife has decided that we need to visit our daughter in Ohio in May, so I will be attending FDIM and will have a table there for new members and renewals. There will not be a club booth at the actual Hamvention. Any NA members can ask me to bring anything, but I will not be taking the full club sales stock. Club Sales will be closed for the whole of May. Order now if you think that you will want anything then.

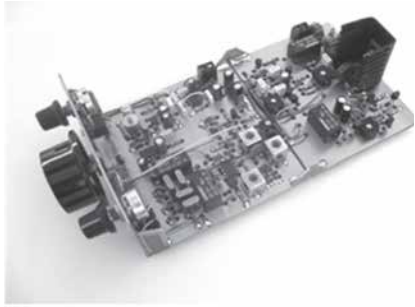
We know of this other rally, but the club isn't planning to be there:  
Durham & District Society - Sunday 26<sup>th</sup> May at Bowburn Community Centre

### **Advance warning**

The G-QRP Club Convention in conjunction with the Telford Club Hamfest will be on Saturday 1<sup>st</sup> September at a new location – Harper Adams University (TF10 8NB) mainly due to car parking problems at the old site. There will be better facilities – and light! We will have the usual lectures during the day, and there will be the usual buildathon the previous evening (31<sup>st</sup> August) in the hotel. More information later and take a look at [www.telfordhamfest.org.uk](http://www.telfordhamfest.org.uk). Please put the dates in your diary.







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# GQR Club Sales

Graham Firth, G3MFJ, 13 Wynmore Drive, Bramhope, LEEDS. LS16 9DQ

Antenna Handbook – 2 <sup>nd</sup> edition – members price £6.00 plus post	} £2.00 (UK) or £5.50 EU
Radio Projects volumes 1, 2, 3 & 4 – by Drew Diamond – members price - £6 each book + post}	} or £8.00 DX <u>per book</u>
6 pole 9MHz SSB crystal filter (2.2kHz) £12 plus post (max of one)	} £3.50 (UK); or
Polyvaricon capacitors – 2 gang (A = 8 to 140pF + O = 6 to 60pF) c/w shaft extension & mtg screws - £1.75 each	} £3.80p (EU); or
– 2 gang – (both 8 to 285pF) c/w shaft extension & mounting screws - £1.75 each	} £4.50p (DX)
A Pair of LSB/USB carrier crystals HC49U wires - [9MHz ± 1.5kHz] £4 pair	} All components
HC49U (wire) crystals for all CW calling freqs – 1.836, 3,560*, 7.015, 7.028, 7.030* 7.040, 7.045	} plus postage
7.122, 10.106, 10.116*, 14,060*, 18.086, 21.060, 24.906 & 28.060 all are £2 each	} (ANY quantity)
HC49U crystals- 1.8432, 3.5, 5.262, 5.355, 7.0, 10.006, 10.111, 11.5, 14.0, 22.0, 29.0MHz – 50p each }	
HC49U crystals – 2.00, 3.00, 3.20, 3.579, 3.58, 3.60, 3.6864, 4.0, 4.096, 4.1943, 4.433, 4.5MHz	} £1.20p (UK), or
5.00, 6.00, 7.2, 7.6, 8.0, 9.0, 10.0, 10.70, 11.0, 12.0, 13.50, 15.0, 16.0, 18.0, 20.0, 24.0, 25.0MHz	} £3.50p (EU) or
26.0, 27.0, 28.0, 28.224, 30.0, 32.0, 33, 40, 48MHz – all 35p each (Some of these are low profile)	} £4.00 (DX)
Ceramic resonators – 455, 480kHz, 2.0, 3.58, 3.68, 4.00, 7.37, 14.32 & 20.00MHz – 50p ea.	}
Diodes - Shottky signal diode – 1N5711- 20p each; 1N4148 GP Si – 10 for 10p	} Post free
Varicap diodes - MVAM109 – 40pF @ 9v, 500pF @ 1v. 50p each	} if ordered
– BB204 – twin diodes, common cathode, 15pF @ 20v, 50pF @ 1v 50p	} with heavier
SA602AN - £1.50 (note – I may supply NE or SA, 602 or 612 as available. SA612AD – SMD SOIC-8 £1.40	} things
MC1350 - £2.00 These are getting in short supply now so max of 2 per member	} like binders.
LM386N-1 - 4 to 15v, 300mW, 8pin DIL - £0.45, LM386M-1 SMD SOIC-8 – 35p	} toroids,
TDA7052A - 4.5 to 18v, 1W 8pin DIL low noise & DC volume control – £0.60 each	} polyvaricons,
TDA2003 - 10w audio amp – 5 pin £0.25 each	} or filters
TDA2822 - 1.8 to 5v stereo amp – can be bridged. 0.5W Audio amp 8pin DIL – £0.20 each	} Use just
TA-7642 Radio IC – direct equivalent of MK484 ( & ZN414) – 75p each	} that postage
2SC536 transistors (npn) fT – 100MHz, hFE-320, VCBO +40V - 5 for 50p	}
MPSH10 transistors (npn) fT – 650MHz, hFE 60, VCBO 25V - 10p each, 10 for 80p	} If parts are
2N3904 transistors (npn) fT – 300MHz, hFE-150, VCBO +40V - 10 for 50p	} ordered
2N3906 transistors (pnp) fT – 250MHz, hFE-150, VCBO -40V - 10 for 50p	} with books
BC517 Darlington (npn) fT – 200MHz, hFE-30,000, VCBO +40V - 13p each, 10 for £1.10	} or DVDs
FETs - IRF510 – 50p; 2N3819 - 24p; 2N7000 - 10p; BS170 – 8p - all each	} add this
BF981 – dual gate MOSFET – 40p each	} postage
Pad cutter - 2mm shaft: 7mm o/s, 5mm i/s diam, gives a 5mm pad with 1mm gap £6.00	} as books
10K 10mm coils – 0.6uH, 1u2H, 1u7L, 2u6L, 5u3L, 11u0L, 45u0L, 90u0L, 125uL – all 80p each	} or DVDs
Magnet Wire – 18SWG – 2 metres – 60p; 20 & 22 SWG – 3 metres - 60p;	} do not
24, 25 & 27SWG – 4 metres - 40p; 30, 33 & 35SWG – 5 metres - 30p.	} travel well
Bifilar wire – 2 strands - red & green bonded together. Solderable enamel.	} with parts.
21SWG (0.8mm dia) – 2metres - £1; 26SWG (0.45mm dia) – 3metres – 70p	}
Litz wire – double silk covered multi-strand wire 7/0.04mm -12p, 14/0.04mm. 25p. Both for 3 metres.	}
All our wire is solderable enamel insulated. Max of 3 sizes per member per order	}
QRP heatsinks - TO92 – 30p; TO39/TO5 – 40p; TO18/TO72 – 60p (pics in Sprat 148)	}
Axial lead inductors (they look like fat ¼W resistors) these are low current	}
3.3, 4.7, 6.8, 10, 15, 18, 22, 33, 39, 47, 56, 100, 150, 220, 470 and 1000 - all uH, all 20p each.	}
Toroid Cores – priced per pack of 5 – max of 2 packs of each per member	}
T25-2 – 50p, T25-6 – 60p, T30-2 – 70p; T30-6 – 80p; T37-2 – 80p; T37-6 – 80p; T50-1 – £1.00; T50-2 – 90p;	} Postage for
T50-6 – £1.10; T50-7 – £1.20; T50-10 – £1.20; T68-2 – £1.80; T68-6 – £2.40; T130-6** - £2.40ea. FT37-43 – 90p	} toroids include
FT50-43 – £1.20; FT37-61 – £1.20; FT50-61 – £2.40; Ferrite beads – FB43-101 (3.5mm dia x 3.2mm long,	} postage for all
1.2mm dia hole) – 40p for 5: BN43-2402 – £1.20; BN43-202 - £2.00; BN43-302 - £2.00; BN61-202 - £2.40.	} small parts
All toroids are plus postage – up to 5 packs = £1.20 (UK), £3.50 (EU), £4.50 (DX). Each additional 5 packs, please add 50%	
** Except ** item – these are heavy and each counts as a pack (ask for quote if you want more than 2 of the large toroids)	
MeSquares & MePads * - £6.50 each plus post (UK & EU as parts for up to 4) : will DX please order direct from Rex)	
STIX board * – 3" x 1", 80 x 0.15 square pads plus 2 x SOIC pads. £3.75 each. Will post with parts for no extra postage.	
* these items from Rex's stock are pictured on the website.	
Limerick Sudden kits RX & TX both single band (160 through 20m); ATU (80 through 10m) £40.00 each plus post UK - £3.50, EU - £5.40, DX - £8.00	
Sprat-on-DVD – 1 to 172. Only £5 each to members plus postage, UK - £1, EU - £3, DX - £4.00	
Sprat Binders – nylon string type – Black with club logo on spine -16 issues per binder – new stock - £6.00 each plus postage	
(one: UK - £2.00, EU – £4.00, DX - £5.00. More - add £1.10, £1.50, £2.50 each)	
Cheques (UK) and payable to G-QRP Club. MINIMUM ORDER for cheque or PayPal payments is £5	
You can also pay by BACS. The numbers you will need to do that are - sort: 01-07-44 and a/c: 54738210	
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