SPRAT

THE JOURNAL OF THE G-QRP CLUB

DEVOTED TO LOW POWER COMMUNICATION

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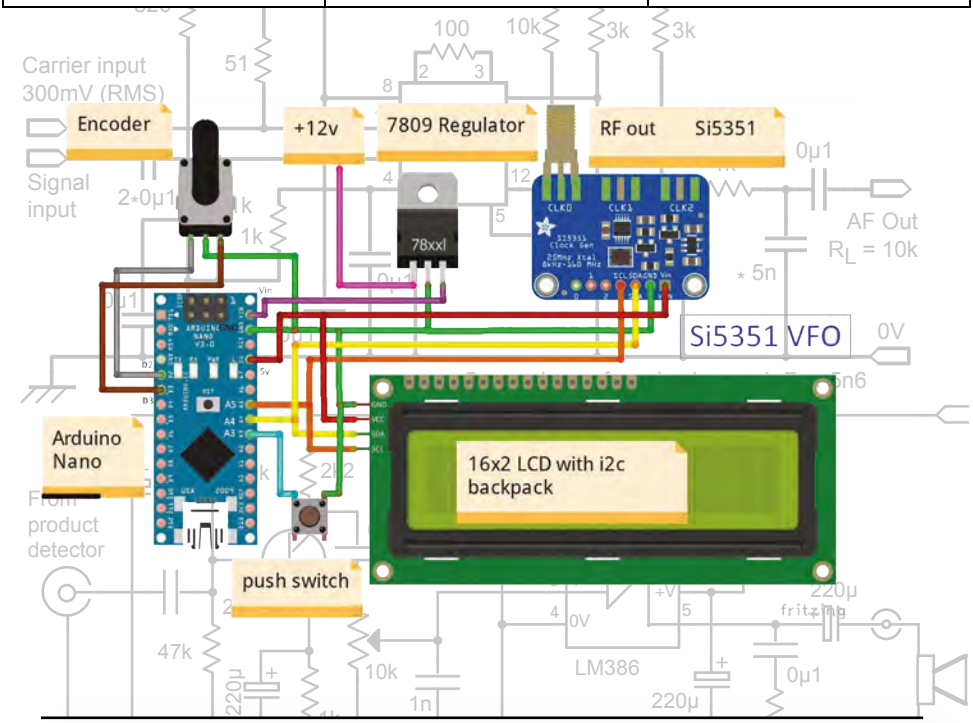

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JOURNAL OF THE G-QRP CLUB

Our founder George Dobbs G3RJV (SK)

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Editorial

Lots of good news to report this time around; later in *SPRAT* you will read about our Club Secretary's success in being awarded the G4STT Memorial Trophy. Congratulations to Club Member, **Stewart Bryant, G3YSX**, who was recently elected as the President of the Radio Society of Great Britain. Stewart has been a regular attender at Four Days in May and was at the very last Club Convention at Rishworth.

The Club is also fortunate to have **Jack Purdum, W8TEE**, as a member. Jack will no doubt be known to those who dabble in microcontroller projects as he has authored many books and articles on the subject. Jack has sent me a copy of his latest book '*Beginning C for Microcontrollers*'. I have had an earlier edition on my bookshelf for several years and this new one looks to be every bit as useful. Jack has a writing style that I find very easy to follow, and I am no computer geek. I hope to have a full book review for the next *SPRAT*.

SPRAT continues to attract lots of positive comment; we are fortunate to have so many superb articles being submitted, and to have Tex to bring them all together so well. We would like to ask that when authors include long web links that you shorten them by the following methods as it makes it easier for readers to type.

If it is to a YouTube video, then authors should use the provided "share" option, which provides a much shorter shareable link. For other internet links please use a service like Tinyurl.com. If you need help with such things, please contact our website manager **Tony, G4WIF**.

And finally, due to the continuing growth in membership we are once again able to maintain subscriptions at their current level. I am often told that members would willingly pay more, but the Club finances remain in good health and we only ever aim to break even.

Steve Hartley, G0FUW
Chairman GQRP Club
g0fuw@gqrp.co.uk

G-QRP Convention 2021

Steve Hartley G0FUW

In April we ran a survey to gauge support for a physical Convention this year. The results showed that the vast majority are not yet willing to meet in person and would prefer another virtual Convention. The Committee thought long and hard about hosting a small gathering for those who would like to meet up but decided to leave it until 2022.

So, the G-QRP Club Convention 2021 will be a virtual event over the weekend of 5th and 6th of September. The Committee are now working on matching up the wish lists of topics and speakers to bring you another great QRP (remote) gathering.

Attendance for this year's virtual Convention will be free to all members. You will just need your membership number to gain access. If we do a virtual Buildathon that will be at a cost. Full details will follow.

Hush-hush….we are also in discussions about a QRP Convention elsewhere in the UK during 2022. More on that in due course.

Don Cameron G4STT Memorial Trophy

Club Secretary **Dick Pascoe, G0BPS** was awarded the G4STT Memorial Trophy at the RSGB AGM in April. This takes the form of a gold (coloured) NorCal 20 transceiver and is awarded each year to someone who has provided significant service to the QRP community.

Dick has been flying the QRP flag for many years and joined the Club in the mid-1980s. He has been a key part of the G-QRP Convention organising team at Rochdale and Rishworth and for the virtual Convention in 2020.

Dick has written books about QRP and has been a regular in the amateur radio press; *Practical Wireless*, *RadCom* and other amateur radio magazines. As one of the founders of **Kanga UK**, he ran a very successful QRP kit business that we are sure many members will have used over the years.

He's a past President, and current Board member, of the **QRP Amateur Radio Club International** (**QRP-ARCI**) showing that his QRP endeavours are not limited to the UK. All in all, a very worth winner of the G4STT memorial award; three cheers for Dick!

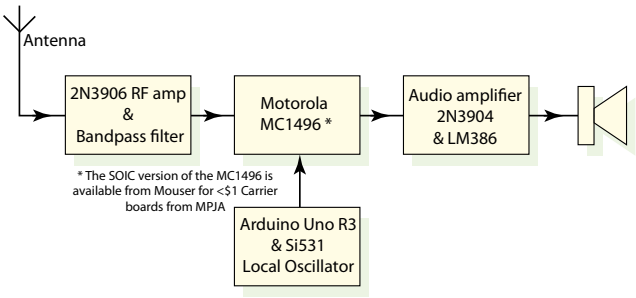
Details of past winners of the G4STT Trophy can be found on our website on the Trophies & Awards page. Dave, G3YMC, has a short history of the G4STT Trophy on his website:

www.davesergeant.com/qrp/qrp.htm

Direct Conversion Receiver Project

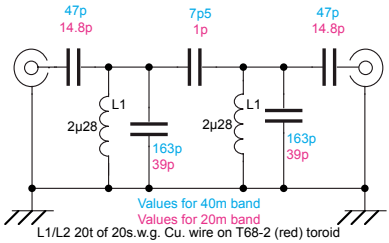
Pete Juliano, N6QW n6qwham@gmail

This Direct Conversion Receiver occurred accidentally. In Solder Smoke Podcast #224 (1), **Bill N2CQR** mentioned the fine work of **Paul Taylor VK3HN** who built a four-band rig based on a part of the project found in *Solid-State Design for the Radio Amateur*.



Luckily Paul found an assembly at a Radio Rally comprised of the IF Module (2X 40673 Dual Gate Mosfet's) and Transmit Mixer stage (MC1496, Double Balanced Mixer). (pp203-205).

Boom, time to rethink using the MC1496 IC, as a recent rummaging in the bins discovered a few units purchased long ago. Checking the Motorola Data Sheets, several sample circuits were presented.



To get a feel as to how good is the MC1496, my plan was to build the Product Detector stage. This would serve two purposes, first being to test the suitability of such a circuit - and second as a device tester for the units I had.

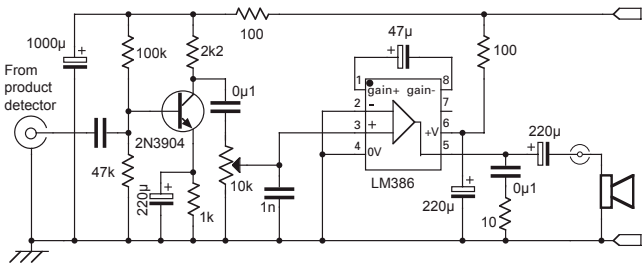
To sharpen the incoming signals, I added a Band Pass Filter.

On the output side is the audio amplifier with a 2N3904 driving an LM386-3.

For the LO I used an Arduino driving one clock on a Si5351 PLL. You could use an AD9850 as you only need one clock or even a Si570.

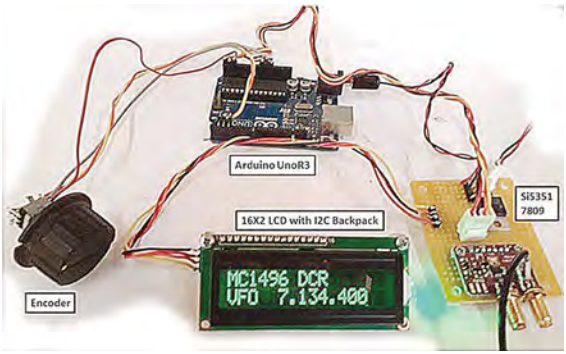
It was a jaw dropping experience to listen to this receiver! (2)

The Si5351 makes it super stable and frequency agile. Many 1970/1980's commercial rigs, used the MC1496 in the design. Presented below are the schematics of the various modules of the receiver.



New Stock of MC1496s can be found a Mouser (About 80Cents/unit.) The MC1496 DCR is built on single side copper vector board which provides an excellent ground plane and ease of construction.

All wiring of point–point

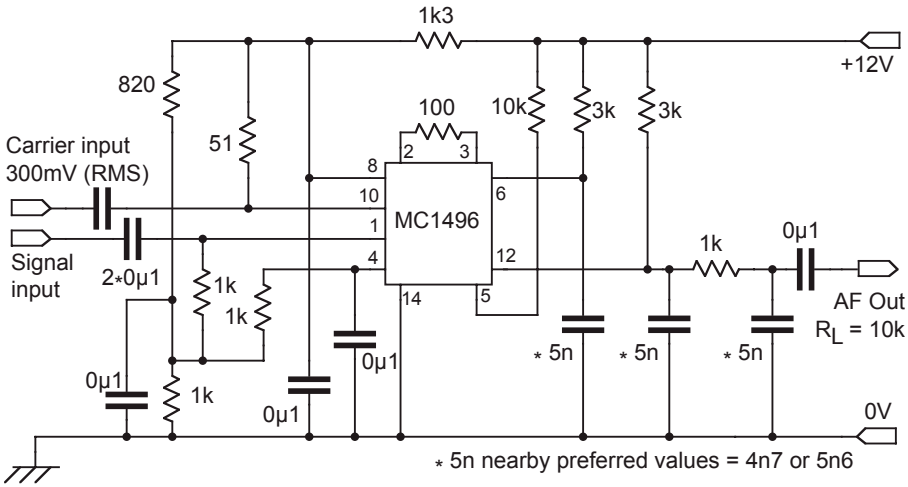


connections are done on the underside. The board is 4.5inches long by about 1.75inches wide and includes the MC1496 and the audio stage.

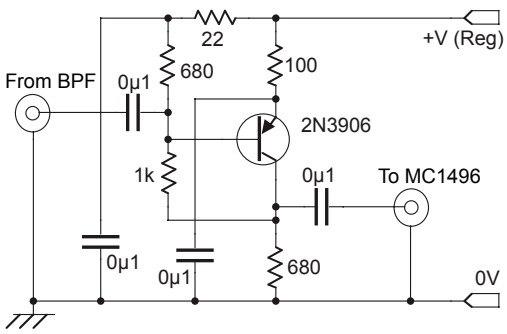
Next is the Motorola Application note for the Product Detector. (Just a few components).

There are other Product Detector circuits; but this one uses a single supply whereas others use a differential supply.

Ahead of the MC1496 I built a simple RF Amplifier Stage using a 2N3906. The RF amplifier stage was a lift found in EMRFD Fig 6.110 using just the 2N3906 *pnp* side of the amp. Somehow, I have always bypassed the idea of using *pnp* transistors in my designs. No more, as they are a viable candidate, and perform well.



The supply for the *pnp* should be no more than 8V from a three terminal 78L08 regulator.



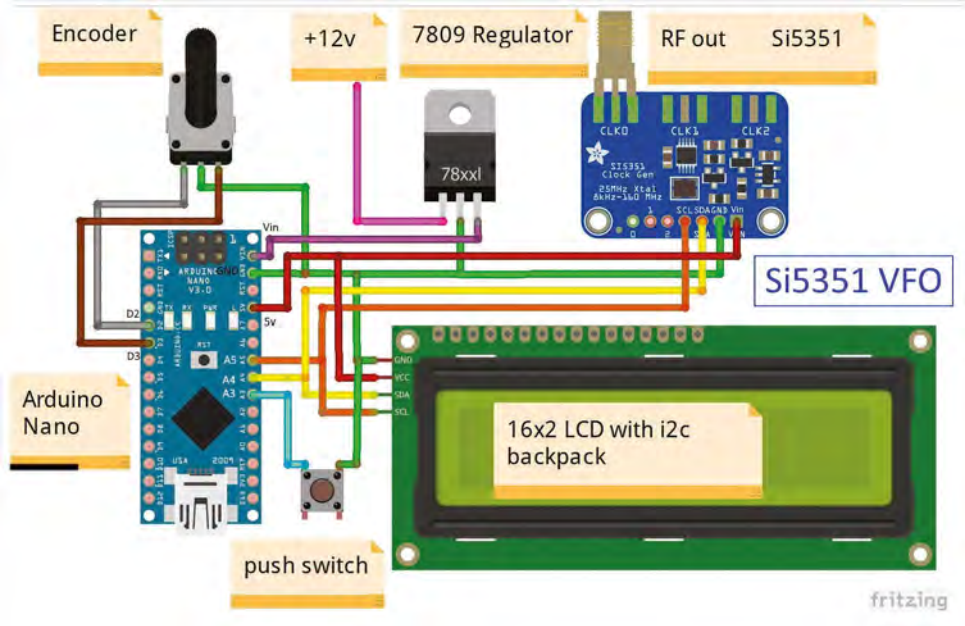
To make the MC1496 function one needs to supply a Local Oscillator (LO) signal to feed Pin #10 of the device. There are many ways to do that; but for those who would like a simple Arduino / Si5351 based LO this is “your ticket to ride”. Time to dump those dinosaur LC VFOs!

The project components are - an Arduino (Uno, Nano or Pro-mini), the Si5351 breakout board availa-

ble from many sources, an Encoder with a momentary Push Switch, (shown separate for simplicity on the drawing) the 16x2 LCD fitted with the I2C backpack and lastly a 9A/1A regulator. For those new to the I2C, it is a common buss where many devices can be connected to that buss. The Si5351 and Liquid Crystal Display wiring are simply paralleled. Code in the Arduino provides an I2C address for the LCD.

To keep this project simple there are only two controls with the main tuning control being one of them and the second is a selection of the step tuning rate all on the encoder device. Having to start somewhere the bootup frequency is 7.2MHz which is the 40m band. However, the tuning range is from 160m through 10m so may be used as a general purpose signal source. One of the step tuning rate options is 100kHz so it is fairly easy to zip through to other ham bands.

The MC1496 DCR is a stepping stone to a far more complex undertaking and the Arduino and Si5351 are required to implement the follow-on project. There is a website supporting the MC1496 adventures and additional information on the Arduino/Si5351 is also resident there.



Send me an email for the Arduino sketch information.

References:

(1) *Soldersmoke.blogspot.com*
(2) *www.youtube.com/watch?v=stBR_B57DNY*
(3) *http://www.n6qw.com/MC1496.html*

Email to: *n6qwham@gmail.com*

NanoVNA in the Box

Timo Kiiski, OH1TH/OH5TA

This version is in some way handier, but the storage needs more space.

The most significant shortcoming of the NanoVNA - especially concerning its mechanical strength - is the lack of enclosure. The open structure of the VNA may be subject to a wide variety of damage. The damage, though small in financial terms, may leave you without a meter for an unnecessarily long time…

One possibility is to take advantage of various mobile phone cases. In that way, I resolved the problem at first. However, I came to the conclusion that even at the expense of the additional size of the device, it is best to fully enclose it fully. Since the attachments between the case / VNA are now also padded, I think the VNA will be able to withstand even drops and bumps pretty well. But it hasn't been tried – yet!

I found Hammond plastic cases, type 1591-G, made in Canada were suitable. It seemed appropriate, perhaps a little too big for the purpose. Anyway, for structural reasons, it is not advisable to use too small a housing.

Hammond cases are well-known, but the case was disappointing in terms of material. The plastic is pretty low quality, albeit "sufficiently" sturdy for the purpose. Care should be taken not to break the material accidentally. A metal enclosure is recommended, but no such suitable was available in my remote place.

I am not going to give the sizing of the enclosure, because everyone will probably use different enclosures. A few tips. The enclosure can be rather shallow, not much more than the thickness of the VNA. Make sure that the SMA connectors are not stressed.

One recommended possibility would be to use the case with its own more robust connectors to which the VNA connects. A hole of sufficient size (finger-fitting) shall be made for operation and power buttons. In my box design, the power button and others are quite deep in the case (i.e. very well protected), but still easily accessible.

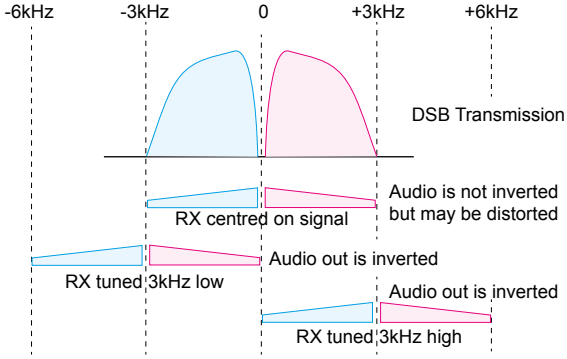
Original boxed NanoVNA compared with the newer NanoVNA model H (lower).

Audio inversion for DSB on a DC Rx

Peter Parker VK3YE email: parkerp@internode.on.net

Tuning DSB suppressed carrier transmissions on a direct conversion receiver, such as those found in simple DSB transceivers, can be tricky. Especially if there's a little drift at either end. This issue, along with relatively low usage and often weak signals, makes reported DSB – DSB contacts rare.

The problem, like many things with simple direct conversion receivers, comes down to the audio image, with an equal response on both sides of the local oscillator. Normal ways around it include an upgrade to either a more elaborate phasing type DC receiver or (more commonly) a superhet. However there is another way around the problem, and that's audio frequency inversion. I first read about this when researching 1950s DSB history. The suppressed carrier DSB enabled a voice signal without the troublesome AM interference generating carrier. Its bandwidth though twice that of SSB it's extremely easy to generate, often requiring a minor conversion of a push-pull power RF amplifier stage to become a high level balanced modulator.



DSB's problem was that not all receivers of the time had a narrow crystal filter. Receiver broadness made DSB reception harder than SSB, especially if you were not able to vary the BFO's frequency much. And frequency stability was even more important for DSB reception than SSB reception.

History would demonstrate that this was a temporary problem with most amateurs going from (often homebrew) AM rigs to commercial SSB gear without a period on DSB. And even if you were on DSB, the improved equipment of SSB stations made your signal easier to resolve.

Ingenious method

However it wasn't long before an ingenious workaround for the problem was created and described by **W4PGI** in 1964. He found that if you inverted the audio on a DSB transmission you would be able to tune the signal in easier even if your receiver was unselective. This is because you would centre the BFO on the edge rather than the middle of the signal.

That was possible because the inverted audio would place the low frequency parts of the audio at the edges of the signal and the high frequency parts on the inside. If there was interference on one side then you could tune 6 kHz away to the other side which might be clearer. This is a similar approach to that possible when listening to CW signals on a direct conversion receiver.

Read W4PGI's *CQ Magazine* article (and others on DSB techniques) on W4JKL's site here:

https://www.qsl.net/w4jkl/glowbugs/DSB.html

W4PGI's approach was to invert the audio at the transmitting end but you can also do it at the receiving end. That's possible by detuning your direct conversion receiver by 3kHz off to either

side (up or down – it doesn't matter). The audio coming out will be inverted so you will need another audio inverter to make it intelligible. You could build an inverter using a 3 kHz audio oscillator and a double balanced mixer (essential). This approach was used in other fields of electronics like telephone voice scrambling or electronic music.

More attractive

Or, a more attractive option for most amateurs, is to use equipment you probably already have. This requires an SSB transmitter (frequency unimportant) fed into a dummy load and a nearby SSB receiver. If the transmitter is set to USB and the receiver set to LSB with the frequency adjusted 3 kHz higher then you have yourself an audio inverter.

Inverted audio from the off-tuned direct conversion receiver can be fed through this arrangement to restore it to something intelligible. The diagrams explain this better. A video demonstrating this (with crude speaker-microphone audio coupling) is on my YouTube channel at:

https://www.youtube.com/watch?v=cp4K31sFGog

Treasurer's report year ended March 2021

Graham G3MFJ email: g3mfj@gqrp.co.uk

I am pleased to report that we have not made a loss this year, and this is the first full year since we lost George, so things are looking good. We still have a full colour Sprat with 44 pages (4 more than we used to have), and the current subscription is still covering all our costs despite Royal Mail trying to upset us with postal increases.

Interestingly, Brexit has done us a little good in that we are no longer charged VAT on the postage to the EU, thus a part of our Sprat costs has actually reduced. Again, we must thank our Editor, Tex, as he is making a big difference to our costs by doing what we used to have to pay our printer to do. So, the report is that the club's finances are in a very healthy state, as can be seen by the fact that we are still charging members £6 annual subs, and have done since 1995!

Overseas subs are the same plus what the extra postage for airmail delivery costs us. I do not see any reason for any increases for the next few years, and your committee is proud of this. Last year we actually showed a loss of some £6000, caused by us covering part of the costs of members attending George's funeral and the cost of the extra Sprat. However, that was more than covered when we brought some accumulated US$ membership income into the UK, as was recommended by our financial advisor. This year, I can report a small surplus (as a non-profit making concern, we can't have a profit), and this year our surplus is just over £4,000.

Again, we have sufficient money in reserve to cover us for at least one year, should some disaster befall us. So, we are fine, and I do not see any increase in subscriptions on the horizon for a few years yet. However, to keep things tidy, we still will not allow renewals for more than one year at a time. Your committee would like to use some of our money to encourage youngsters into the hobby, so this is one of our continuing projects for the immediate future..

Year to:	
March 2017	£1011
March 2018	£281
March 2019	£504
March 2020	£7400
March 2021	£4414

The loss/surplus figures for the past few years are above:

A Phase Modulator for 2m FM

Gert de Gooijer GQRP-11286. Email: pa3crc@peopleskills.nl

It is always the same: I cannot get decent FM signal with a quartz controlled oscillator. Can you? Everyone out there 'pulls' their crystal oscillators with a varactors in series with their crystalsthat they have available, and it works! But each time I try do this, I get very, very bad audio quality and almost no deviation. No matter what I try, Arrrghhh!

I've got a bunch of old 12MHz crystals, intended for use in the Kenwood '2200 and '7200 sets from back in the seventies and now I wanted to make a small 2m set for use with the local repeater with those crystals. An output of around 100mW should be ample. So simple?

But with these crystals, it is always the same, again and again, not enough deviation and terrible audio, Grrr...

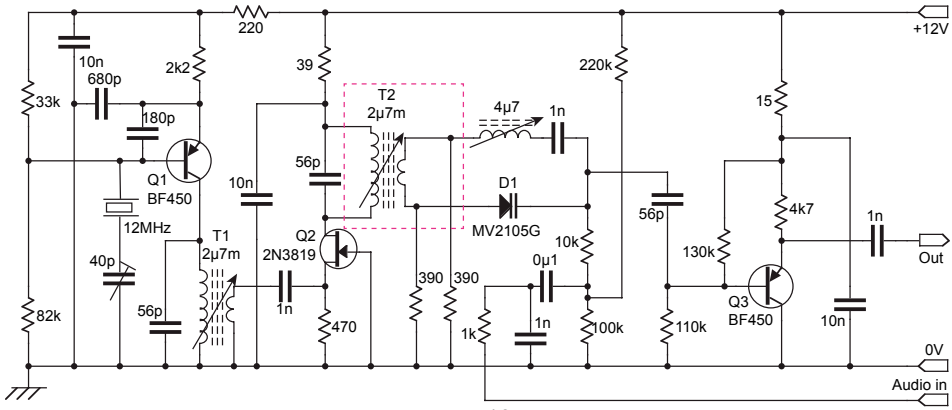
Phase Modulation

Professionals do not 'pull' crystals. When you look at the professional literature using crystals, they all speak about Phase Modulation. Amateurs always use direct FM, pulling crystals, you never read of one using PM. But well, they know the trick pulling crystals, and I don't. So perhaps better pretend to be professional and use a phase modulator. I searched the internet. But I had no 'hits' with results for schematics for practical phase modulators.

So then just looking at all-pass audio filters used in phasing method SSB generators. These all-pass filters shift phase while passing all frequencies. "Flangers", a device used as an audio effect in guitar music, also use the same kind of idea. Then changed it for 12MHz instead of audio frequencies. Also changed the R into an L for more phase shift (the 4.7µH one) and the C into a varactor (6-100pF eBay perhaps?) and made the rest around those components. And guess what… it works!

The Circuit

I've got 12MHz crystals, but I assume the whole setup also also work with 6, 8 or 18MHz crystals when changing some values of L and C. The first BF450 Q1, acts as a 12MHz oscillator, the second (Q3 at the output) as an emitter follower to present a high impedance to the actual



modulator and preventing loading it too much. These are *pnp* types because they were to hand. The 2N3819 FET Q2, is a buffer between the 12MHz crystal oscillator and the modulator and is perhaps not needed, but I did not remove it to try operation without it.

If you're keen to try bypassing the FET buffer, you could then try to connect the modulator directly to the secondary winding of T1. Leaving out the stage with the FET would save you a Toko can, a transistor and some other components.

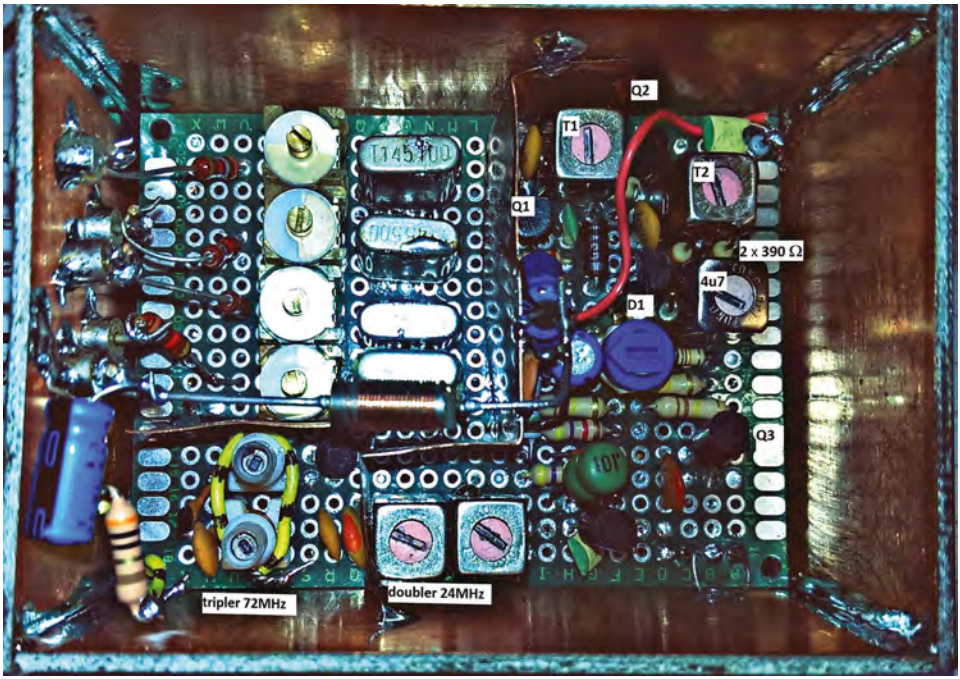
The actual modulator is very simple: just the passive components you find inside the ddotted-line box in the schematic. T1 and T2 are 7mm Toko IF cans for 10.7MHz. Each primary winding is around 2.7uH with the original fitted parallel-C removed, which normally sits underneath the can. You can easily do that with a small screw driver, just 'ruin' the ceramic C, thus leaving an open connection. Then parallel the primary winding with 56pF to resonate the 'can' to around 12MHz.

Transformer T1 in the collector of the oscillator influences the precise frequency and should be set at the basic crystal frequency. Then try to vary it a little, at the same time monitoring the modulation with a 2m receiver, receiving the harmonics.

The L and the C in the modulator need to be fed 180° out of phase so, T2 just needs to be peaked, it acts as a balun. Perhaps a balun on a FT37-43 will also do the same job. The 4.7µH coil was an unmarked 'can' and influences the modulation depth and quality. Also of importance is the DC voltage on the varactor (here initially set by the 100k and 220k voltage divider)

The final version was built on 'perf' board shown below, but the prototype using 'ugly style' during try-out also worked.

Just put some volts of audio into the audio input and there you go! After multiplication for getting in the 2m-band, there was plenty of frequency deviation.



Teensy WSPR Transmitter

Kevin Wheatley, M0KHZ, kevin.m0khz@gmail.com

In a previous article I introduced the Simple VFO and associated hardware, this article introduces WSPR TX capabilities to the same platform with no modifications to the hardware, just a download of new software to gain a new instrument in the shack.

Developing this software introduced a number of challenges and I failed to find any 'Google' clues for implementing WSPR on the Teensy microprocessor so my learning curve was steep. *(In the texts below, "//" denotes that the rest of the program line is a comment only -Ed.)*

IntervalTimer

The first challenge was to ensure correct timing for the WSPR symbol period timer, fortunately a precise interval timer function is available when using a Teensy 3.2, using this function completely eliminates the problematic issues I have of direct addressing of timer interrupt address i.e. TCCR1A, TCNT1, TCCR1B etc. something I've always struggled to understand fully.

By using the IntervalTimer function, this is overcome by two lines of code:

```
// Create an IntervalTimer object
    IntervalTimer WSPR_SymbolPeriod;

// 0.682716 secs * 162 = 110.6 sec
    WSPR_SymbolPeriod.begin(nextSymbol, 682716);
```

Teensy – threads

The next headache was to display the clock, read the GPS data stream while running the WSPR TX routines (in parallel), multiple threading (multi-tasking) comes to the rescue.

This is another fantastic feature of the Teensy processor family, using threads you can run multiple tasks in parallel, well almost via master clock time slicing.

With multi-threading, you can have different tasks running with data being past between each of the threads by shared variables, and it's very easy to implement, fantastic!

So to initiate a thread, again it's one line of code in the setup routine:

```
// fetchGpsData() is the function
        threads.addThread(fetchGpsData);
```

Where the function would be:

```
void fetchGpsData()
  { gpsSerial.begin(9600);    // and comms to gps module
    while(1){
        // do all the processing...
        // updating any shared variables to be used in other threads.
        }
  }
```

This is a function that runs continuously in the background.

WSPR message encoding

Why reinvent the wheel when we have the fantastic *JTEncode* library from **Jason Milldrum – NT7S**, it's simple to implement and works flawlessly.

Software

A few minor modifications were necessary to some of the libraries to ensure comparability with the Teensy enhanced *i2c_t3.h* library, these are included with the distribution. I have liberally commented the code to aid understanding, the source code can be found here:

https://github.com/m0khz/Teensy_WSPR_er

System configuration

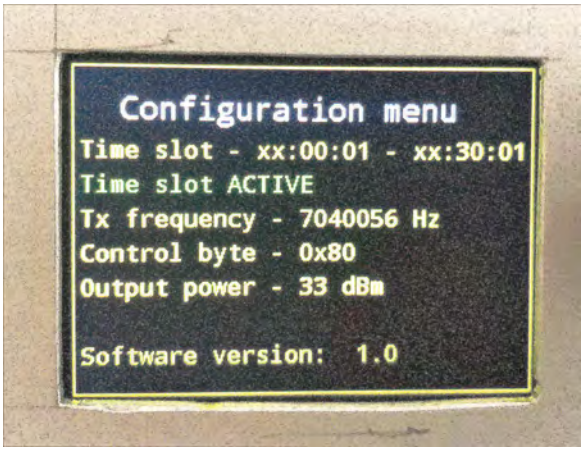
You will need to configure the software to suit your own needs, call and locator are obvious however to configure the transmit frequency WSPR message power and time slot you need to modify the configuration data array at the bottom of the config_*menu.h* file. It should be self explanatory but note the ControlBit is not currently being used and is intended to switch bandpass filters in a later revision.

```
Config_Index [15] [5] ={
   // Time slot |Band |ControlBit | Power | active    |
    {   0       ,    5  ,    1      ,  10 ,    1    },  // "xx:00:01 - xx:30:01"
    {   1       ,    5  ,    2      ,  10 ,    0    },  // "xx:02:01 - xx:32:01"
    etc.
  };
```

This will make more sense when you have the software open and you can view the source code and see the individual index arrays. In the above I have 40m (index 5) 33dBm (index 10) and time slot 0 active (0=not active).

You can review your selection while the system is operating by pushing the encoder but-

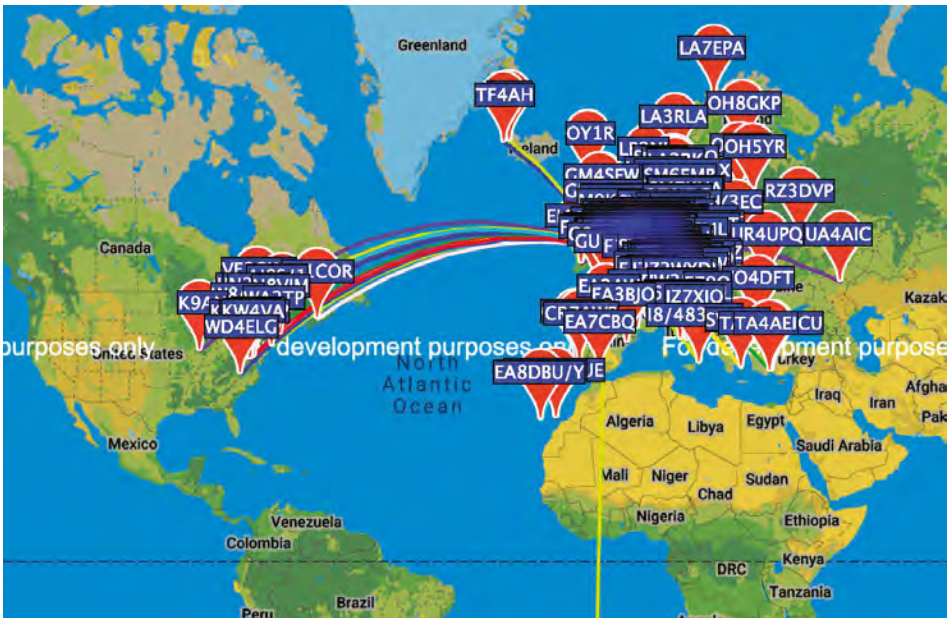
ton, this toggles between the main & configuration screens. Each configuration screen displays one time slot, pushing the up/down buttons cycles through each time slot.



In conclusion

I've had lot of fun pulling this project together and can confirm it works very well, in my implementation the output from the Si5351 is fed into a homebrew 2W Class D amplifier (currently residing on strip board).

This design has been successfully built and tested here in my shack, here is a typical 24 hour stop map from ***WSPR.org*** for this system.



Future planned expansion

Eventually, as 'my to-do-list' shrinks, I intend to design an add-on board to this system. My current thinking includes; a digital attenuator, small class D PA, a relay controlled 3-band BP filter set and L-C matching circuitry to match my horizontal delta loop to the WSPR frequencies. Thereby negating the need for external antenna matching. To fit all this is I intend to mount the project into a longer project box, such as a Hammond 1455N2201.

Happy homebrewing.
73 Kevin M0KHZ

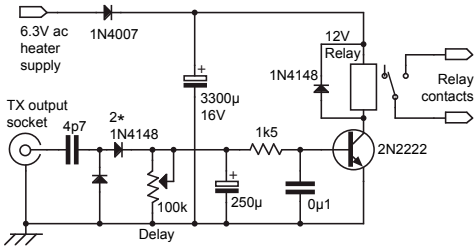
Codar AT5 RX/TX Changeover Relay

Tim G4ARI

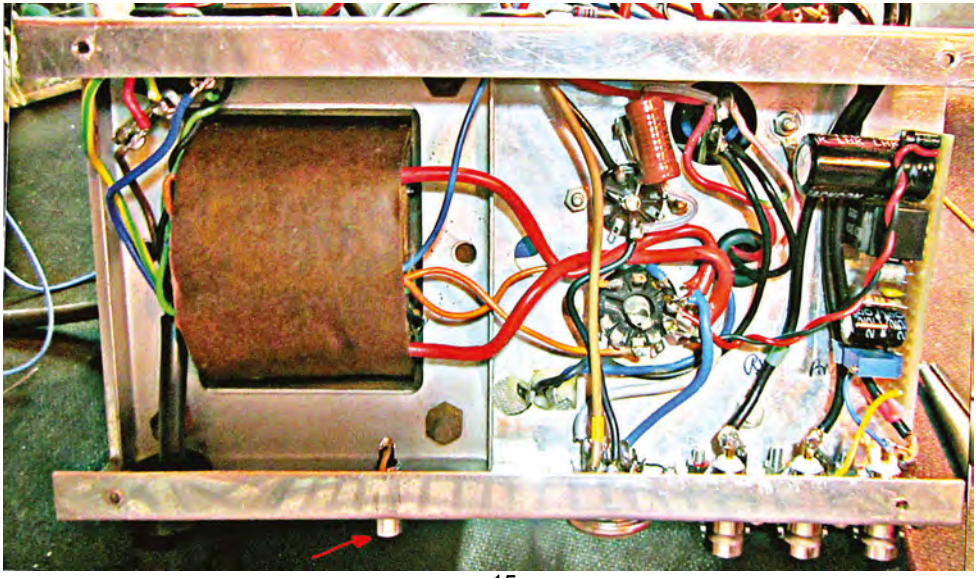
The Codar AT5 transmitter and mains power supply (Type 250/S) provide basic RX-TX changeover, by means of a 3-position, 4-pole rotary switch on the front of the Codar power supply.

This switch provides a 'Netting' signal, running just the VFO, a Standby position, which runs the valve heaters, and connects the antenna to the RX output socket on the back of the power supply, the last being a Transmit position. When the switch is in the Transmit position the antenna socket is disconnected from the RX output socket and connected to the TX output socket, the RX output socket is earthed and HT is supplied to the Codar itself.

I found the level of receiver muting just wasn't enough, so I have added an RF sensing circuit inside the power supply which activates a relay which I then use to switch off my receiver whilst transmitting. The 100K pot can set the delay from between 3 seconds to a few milliseconds.



The 1N4007 diode and 3300uF capacitor provides 8 volts DC which was easily enough to activate a 12-volt relay which had 700Ω coil resistance.



ON-AIR Activity Manager

Peter Barville G3XJS email: g3xjs@gqrp.co.uk

After the excesses of Winter Sports (and Chelmsley) I'll be honest and say that there is little to report this month. Despite really encouraging signs on the HF propagation front a few months ago the figures and propagation have taken a few backward steps recently.

Daytime propagation on the LF bands in particular has been very poor at times, but that's not to say that contacts have been impossible to make. Along with **Colin G3VTT's** inspired Monday Activity Day (any band/mode) 20m hosts regular QRP activity sessions every Tuesday, Thursday and Saturday centred around 14060kHz between 0900z and 1000z.

I am often QRV for the 20m sessions and usually have 3 or 4 QSOs per session, but find that it pays to spread out a little and not to stick rigidly to 14060kHz as a spot frequency.

International QRP Day 17th June. I doubt this issue of Sprat will reach you in time so did you remember the date (17th June every year) and did you make any QRP QSOs?

Colin G3VTT was active /P for a week from the Suffolk coast using his IC703 and low slung 132ft wire. He commented on his "completely noise free location for a change with my beefed-up version of the Sudden ATU (see Sprat 186) working well on all bands." He was a good signal when I worked him on 60m and 80m.

Peter VK3YE, sent a link to his latest YouTube video featuring 40 and 20m long path propagation from his '/P' location "Near The Sewage Farm." No doubt Peter ensured his signal was clean!

https://www.youtube.com/watch?v=kDZJf4fWSCY

At 06:22 into the video he has a LP 20m SSB QSO with G0WKT who was amazed to discover that Peter was running just 5W to an end fed wire, and there is an interesting section (around 15:45 into the video) showing Peter's reception of the Volmet signals from the UK and Ireland on 5450kHz and 5505kHz. You may also find the reference to his "QRP Success Pack" at 12:20 interesting. Peter is a very active member with plenty of on-line videos which may well inspire you to experiment and/or operate over the coming weeks and months.

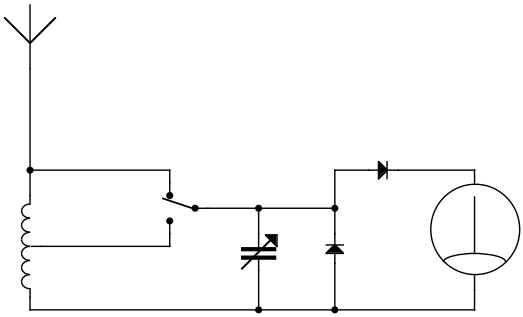
These are the International QRP Calling Frequencies:
CW: 1836, 3560, 5262 (UK Only), 7030, 10116, 14060, 18086, 21060, 24906, 28060
SSB: 3690, 7090, 14285, 21285, 18130, 24950, 28360 kHz
But they are "Centres of Activity" so please spread out if activity levels are high.

My best wishes for an enjoyable and healthy summer with plenty of QRP activity to fill those log pages!

72 de QRPeter G3XJS
"Felucca", Pinesfield Lane, Trottiscliffe, West Malling, ME19 5EN

Affordable Spectrum Analysers.

Tony G4WIF g4wif@gqrp.co.uk



Test equipment makes life easier for the constructor and you can't really have too many! Being able to detect a signal and see what amplitude it has is the province of Spectrum Analysers – of one kind or another. Perhaps the simplest of all is the Absorption Wavemeter shown here,

Values of components can be found in any national society handbook or by web search. You adjust the inductor & capacitor, and if it resonates and finds a signal the meter will indicate something. You can compare one signal with another but there is no provision to actually measure anything.

Indicating Instrument

This then is what my previous employer called "an indicating instrument". Something a little more adventurous appeared in pages 17– 23 of Sprat issue 87‡ and was called a "Spectrum Wavemeter". This used a varicap diode which was swept across a range and the results displayed on an oscilloscope. This was still an "indicating instrument" but was useful to look for harmonics rushing out of PA stages.

Expensive end

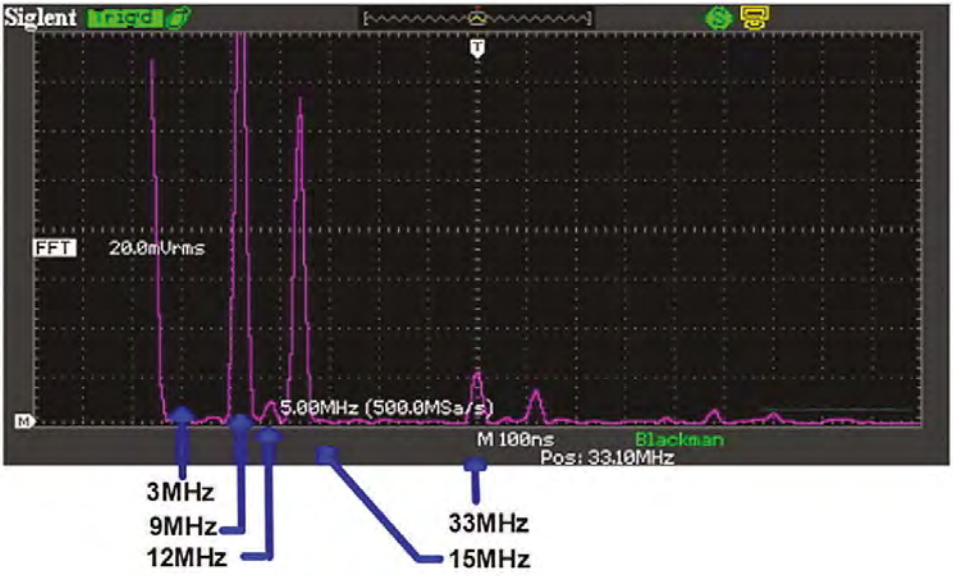
At the expensive end of the market are Spectrum Analysers from people such as Rigol. They do however represent a significant investment but they are "measuring instruments" – in a similar way that your multi-meter is a measuring instrument. Then there are devices between those extremes - and that's what this article covers.

A Rigol Spectrum analyser.
Picture courtesy of Rigol-uk.co.uk

Digital Oscillopscope

I have a six year old digital oscilloscope from Siglent. Like many it has a maths function (known as) FFT (Fast Fourier Transform). Normally oscilloscopes show voltage versus time. FFT allows you to see voltage versus frequency. I show an example overleaf. I have constructed some Diode Ring Mixers and I am injecting 12MHz and 3MHz and I

A Siglent digital oscilloscope.
Picture courtesy of siglent.co.uk



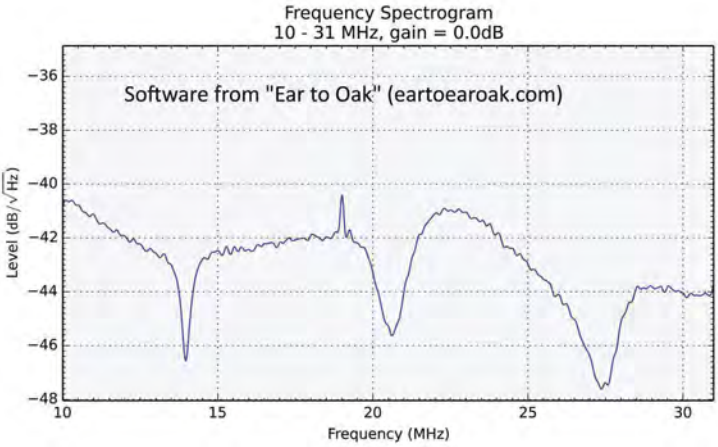
expect (along with many other) outputs at 9MHz and 15MHz. (with the input frequencies suppressed).

Although the Siglent FFT facility is pretty good at displaying the frequency with some accuracy, it only shows relative amplitude on some scale known only to Siglent. It is therefore only an "indicating instrument" but a great deal more useful than a wavemeter. An up to date oscilloscope may perform an FFT far better than mine.

TV Dongle

I have also used the ubiquitous "TV Dongle" with spectrum analyser software. Using a wide band "noise generator" and a very simple to build device called a "return loss bridge", I measured the response of a tri-band vertical antenna covering 20/15/10 metres.

You can easily see where the resonant points are (and that the 10m band is a bit low in frequency). This is moving towards a "measuring instrument" though I would take the figures with a little pinch of salt.



Real Analyser

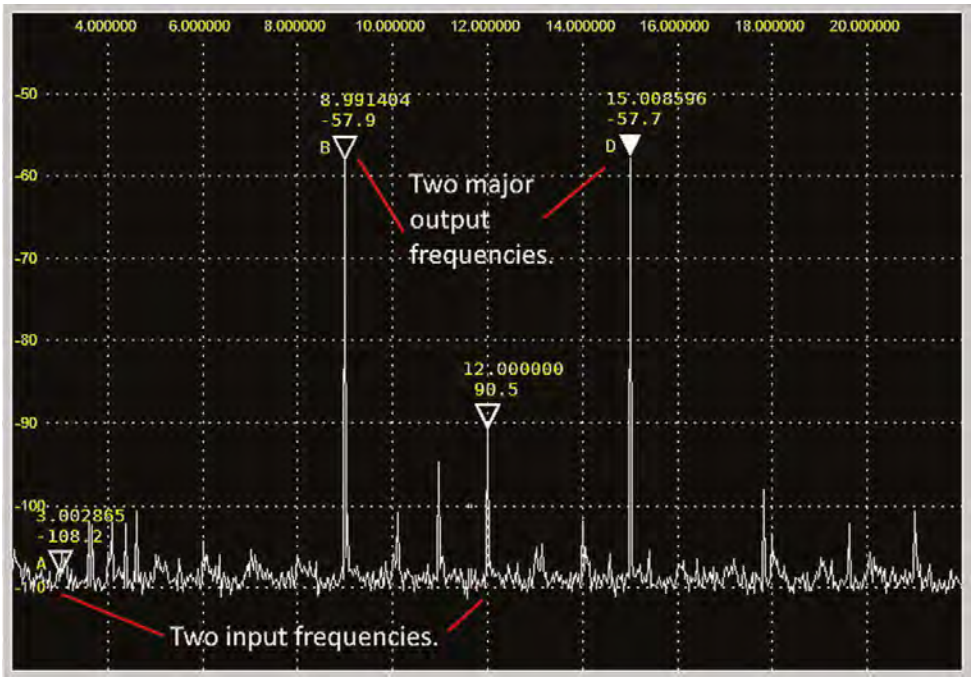
I do have a “real” spectrum analyser. It is very old and very large and it works when it wants to. I should get around to try fixing it.

However, when it works it does provide a pretty good comparison to the following two devices that might suit your pocket. They are the “TinySA” and the SDR receivers from a UK company SDR Play. Using all three spectrum analysers I tested a commercial diode ring mixer from Minicircuits and results of all three are pretty much in the same ballpark.

The new TinySA Spectrum analyser.
Picture courtesy of electronics-lab.com

Minicircuits TFM-2P *Results (dBm)*	**3MHz**	**9MHz**	**12MHz**	**15MHz**
Anritsu MS710E	-74.00	-29.20	-63.00	-29.30
TinySA	-81.72	-30.66	-65.66	-30.62
SDR Play	-87.90	-33.90	-68.70	-32.50

Below you can see the (example) display from the SDR Play software. In conclusion it seems that you can do useful work with budget priced Spectrum analysers - but even “indicating instruments” have their place.



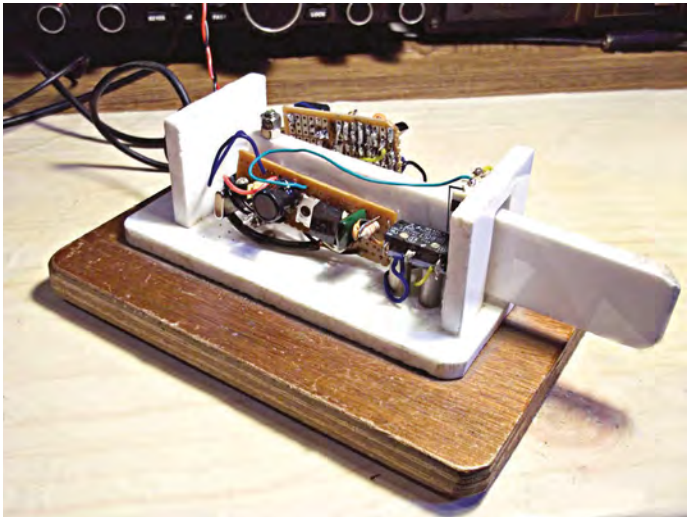
Combined Paddle, Keyer & Tx.

Peter G4UMB email: pahowd@gmail.com

I combined a small PIC Keyer IC circuit with a simple ceramic resonator 80m transmitter.

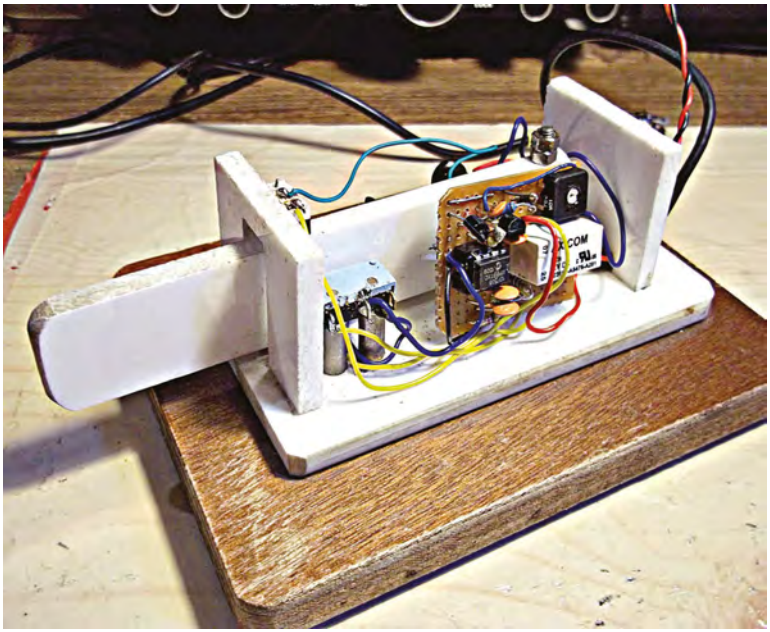
The unit is housed in a plastic fabricated case which includes a simple keyer paddle using three micro switches.

The paddle is quite loose on the pivot screw and can be lifted up to touch another micro switch for tuning up.



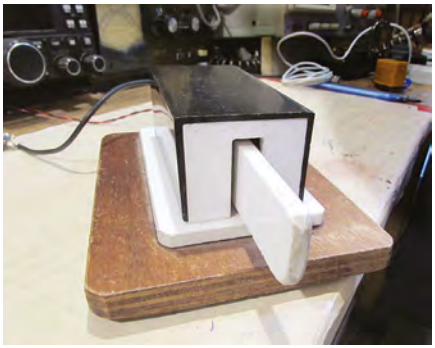
The transmitter is on stripboard on one side of the paddle. While the PIC keyer is placed on the other side of the paddle.

The original project website:
https://owenduffy.net/module/pik/index.htm



The keyer is a PIC Chip and is without a side tone so I fitted a piezo buzzer but as this transmitter is used with a receiver it's really unnecessary.

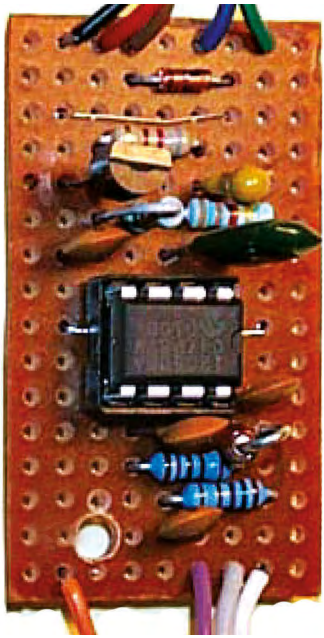
The circuit was from an old VK10D project on the website The chip will need programming and I have the HEX Code and a programming unit to do it with.

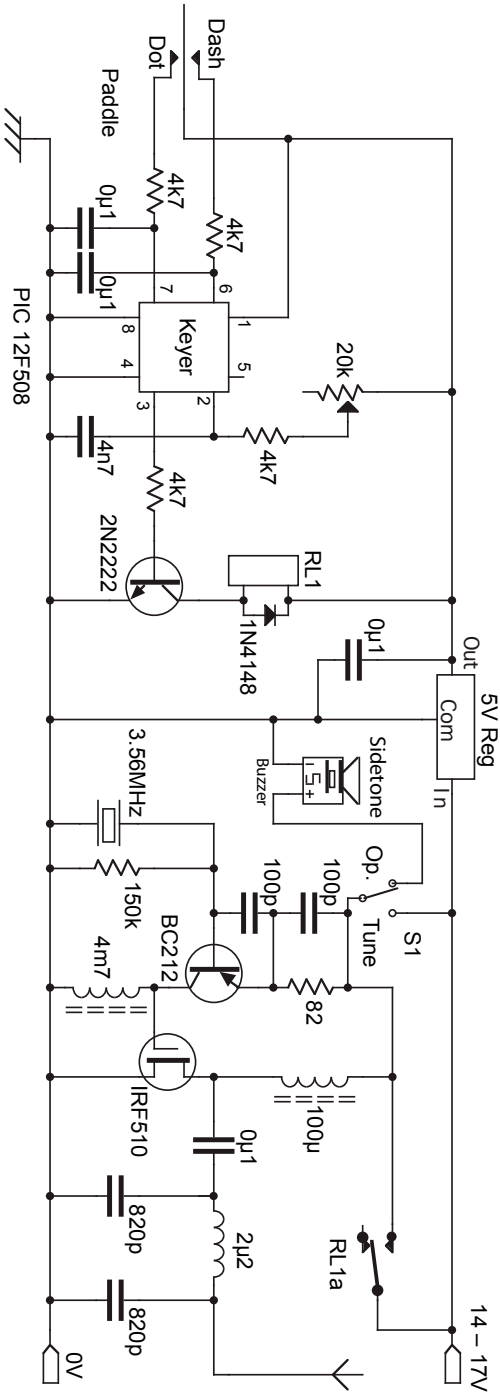


So if any member wants a pre-programmed IC they can send me one with an SAE or I can Email them the HEX code. The keyer is Iambic so if you fitted two paddles you can make it a squeeze keyer with alternative dot dashes.

As you can see from the photos I have made the circuits on strip board, The keyer is one side of the paddle and the transmitter on the other side.

The original keyer layout.





QRP & the Commonwealth Contest 2021

Steve G0KYA

The 84th Commonwealth Contest was held across the weekend of 13th/14th April. I put in a QRP entry this year having given it a miss in 2020. In 2019 I came fourth in the QRP category with 35 QSOs. In 2018 I was fifth with 30 QSOs. That gives you some idea of how hard it is with 5W and a couple of bits of wire.

I chose to operate QRP for the sheer hell of it! Friends think I'm mad, but I think it is a good idea to fly the QRP flag now and again to show what is possible.

I didn't intend to be on air for the full 24 hours, but to jump in and out around other chores. Unlike the RSGB's 80m Club Championship (where I also run QRP), the Commonwealth Contest is strictly 5W and not 10W.

Preparations started on the Friday afternoon as I erected a homemade tri-band 10-15-20m end fed half wave vertical, which I had modelled in MMANA-GAL. I had made a 49:1 EFHW matching unit with an FT240-43 toroid and a 100pF capacitor. Two coaxial traps were made for 10m and 15m, but the final design turned out to be tricky.

A 10m fishing pole was put up in the back garden and the wire was fixed on to it with PVC insulation tape. It was supported by four nylon guys and a screw in base, which I have had for years.

The problem was not knowing the exact L and C values for the traps. I estimated them at 100pF, but that was wildly optimistic! All the wire lengths turned out to be wa..ay too long with the result that the vertical ended up with a low SWR on 10MHz and nowhere else!

Anyway, pulling the antenna apart, putting it together one section at a time and cutting the wire back with a pair of wire cutters, little by little, I finally ended up with a 1.8:1 SWR on 10 metres, 1.5:1 SWR on 15m and 1.1 on 20m metres – and a lot of bits of wire!

With a bit of fiddling I thought it could be made an even better match, but time was running away. The vertical was to be used on 20, 15 and 10m with a 135-foot EFHW commercial antenna from MyAntennas being used on 40 and 80 metres. This is supported by two oak trees and has proved to be quite useful on those bands.

The radio in use was an FTDX-3000. I have used my FT-817 in the past but I find the variable filtering on the 3000 to be much better. So with the power wound back down to 5W and N1MM logger loaded it was time to start.

With a solar flux index of 81 and a Kp index of three, it was never going to be easy. In fact in the first hour of operation I had only contacted 5B4WN in Cyprus on 10 metres (the only station I heard on the band). Still, the vertical did its job and I look forward to more sunspots.

Then it was GD6XX on 40 metres on the Isle of Man – a headquarters station for an additional 10 points. 5B4WN then came up again on 15 metres and thanks to the vertical, he was in the log.

With 15 metres as flat as a pancake, I moved to 20 metres and tried my luck with some VE stations. VY2ZM, VE9CB, VE3J, XL3A and VE3JM were soon in the log and it was time for lunch.

I've found the trick with QRP is: **a)** don't bother calling CQ, it's search and pounce all the way, and: **b)** don't bother calling weaker stations. This is because they are unlikely to hear you

if they are running 400-1000 Watts, or if they do you'll end up with a string of "dit-dit-dah-dah-dit-dits?" as you have to send their number over and over.

Frustrating for both of you! Then it was 15 metres again for 5B4AGN and back to 20 metres for 5B4WN again, plus more Canadians.

The highlight came at 16:30hrs with VK6LW. Working Australia with 5W always astonishes me, but it was hard work. Lots of to-ing and fro-ing for my serial number ensued and I'm still not sure he got it, because someone was trampling all over me by putting his callsign in before I had finished. GRRR!

After logging a few more Canadians I went on to 80 metres to catch up on UK "HQ" stations. These were relatively easy as they were 20-40dB over S9. GB5CC, GI6XX, and GW6XX were soon put to bed, followed by Jeff VY2ZM who has a fantastic station on Prince Edward Island. With 2 x 2 elements on 40m I think we know whose antenna was doing the work!

I finished the evening with a few more Canadians on 40 metres – VE3JM, VY2ZM (again) and VE3EJ – as well as G3DR. I then went to bed just before midnight, intending to carry on in the morning.

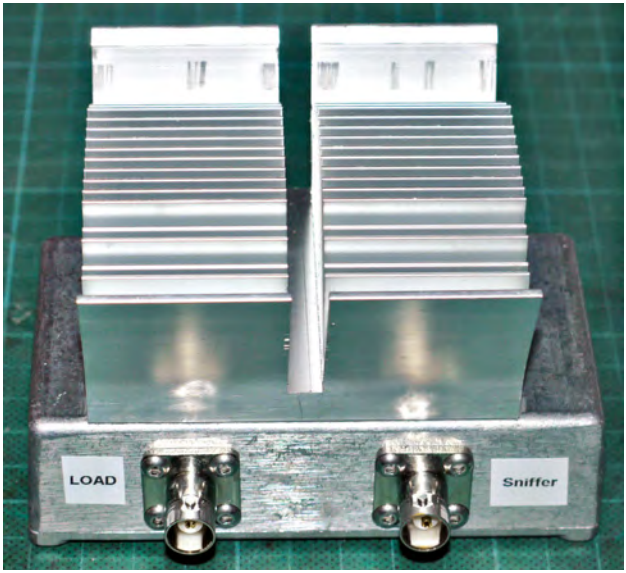
Waking up at 5:30am I went back into the shack and worked GM6XX and GD6XX on 80 metres, who were the only UK HQ stations who were audible.

So there we have it. Thirty-two QRP QSOs in the 24-hour period, which currently puts me in sixth place (subject to RBNs). Getaways were 9H1PI in Malta, ZF2CA in the Cayman Islands and 6Y5HN in Jamaica. I never heard ZL this year at all. The highlight was hearing Steve VK6VZ at a genuine 599 on 40m – astonishing.

All good fun, with just 5W and wires. It's not a prize-winning entry but a good example of what you can do with QRP if you put your mind to it. My apologies to the stations who struggled to hear my puny signal – much appreciated!

A Useful Dummy Load/Sniffer/Attenuator

David Holland G4LDT email: g4ldt@outlook.com



After receiving many kind emails complementing me on my last article (Yet Another Aerial Article Sprat 185) I have decided to try my hand again. Several of the emails that I received suggested that I write something that was simple for beginners to make as well as being useful. I hope that this will fit the bill.

A few caveats before I begin. I am not a qualified RF or electronics engineer, just an old amateur who has been pottering about mixing and adapting designs that others much cleverer than me have come up with.This device will take the full output, key down of a 100W transmitter for quite some time before the heatsink gets too hot. Certainly long enough to carry out most tests and measurements. Also the output socket can be connected directly to a scope input so you can see your signal at full power.

I recently bought a "Tiny SA" from ebay. This is a fully functional spectrum analyser, albeit with a very small display (it can be connected to a computer though). I was delighted with this purchase as I have always dreamed of owning a spectrum analyser. However, as Corporal Jones of Dads Army would say "They don't like it up 'em". Spectrum analysers are VERY easily damaged by excess input. Of course power attenuators are available but they cost a fortune.

The dummy load sniffer socket gives a vastly attenuated output, suitable for connecting to a spectrum analyser or scope. I can see the radio engineers screaming and pulling their hair out. Yes it is frequency sensitive but for most uses it is perfectly satisfactory, certainly up to 50MHz anyway. With some experimentation with the length and positioning of the sniffer wire a reasonably accurate attenuator can be made. To calculate the attenuation in dB you will need an oscilloscope. Measure the peak voltage of the input and output waveforms. The RMS values are 0.707 of the peak. Using these RMS values and the formula 20*(V1/V2) calculate the voltage attenuation. As mentioned above this will be frequency sensitive but the change over the HF band will be very slight.

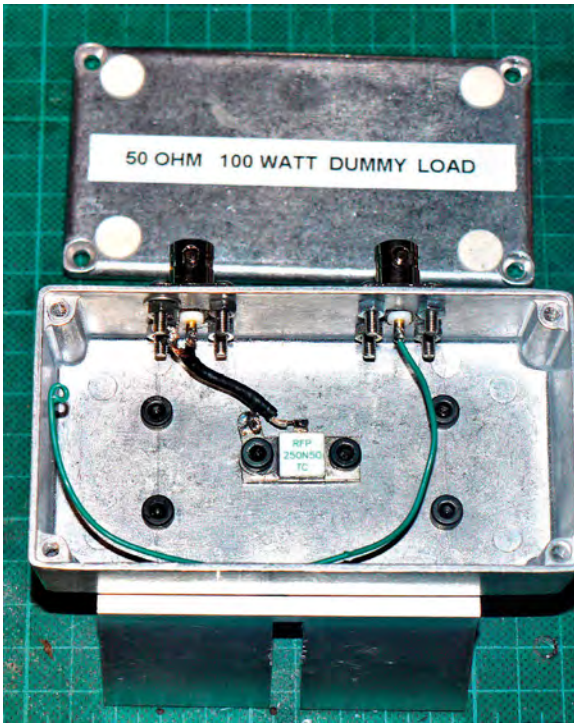
Right, now that that's out of the way I will begin. This all started when I noticed that sites such as eBay were selling little 100w UHF dummy load resistors for very low prices. I just knew that these would be useful so I bought a few. As you will see in the photographs these resistors are very small, about 3/8" square and are designed to be mounted on a heatsink using the two holes in the plate.

The ones that I bought were rated at 100W – obviously when attached to a suitable heatsink! Being a bit of a miser I was not prepared to pay the prices being asked for commercially available heatsinks. What was I to use? Raking my junk box I found an ex-PC processor heatsink that seemed to fit the bill. These should be very easy to source cheaply or for free, given the number of scrap PCs out there. This heatsink had a flat face on one side and lots of fins on the other. As it was originally designed to be clamped on to a processor there was no other obvious mounting method.

I gathered together all the bits, none of which are critical. A small die-cast box that I had lying about was chosen as the chassis for the project. These seem to be readily available at rallies, though with Covid 19 rampaging about the country, your favourite internet seller can offer something suitable.I used two BNC chassis mounting sockets simply because I had them. SO239, N-type or even phono sockets will do. The photos should be fairly self explanatory but some guidance is perhaps needed for those not used to home brewing.

The first thing to do is to mount the sockets. My method is to centre pop the required positions and then drill pilot holes. I use one of the amazing step drill bits available on the internet to make the large holes, but a round file will achieve the same thing. To do it this way simply drill a series of small holes in a circle, as close together as you can and then carefully break out the centre using large side-cutters. Then, using the round file, enlarge the holes to the appropriate size.

The next thing to do is to mount the resistor. This should be mounted so that the tag on it is as close as possible to the input socket. After determining the position, working from the inside of the die cast box, drill the two resistor mounting holes clearance size for 3mm screws (3.4mm or 1/8”). Care is needed from this point.



Carefully place the heatsink in its final position and, using a sharp pencil through the holes just drilled, mark the positions on the base of the heatsink. Remove the heatsink and centre pop the position of the two holes just marked. Drill them 2.5mm dia (3mm tapping size). Drilling should ideally be done with a pillar drill or a drill in a stand to ensure the holes are vertical. If you haven’t got one of those then you will have to use a hand held drilling machine. A mains operated one will be best as the majority of rechargeable drilling machines do not have a high enough speed to drill a 2.5mm hole. Having said all that you use what you have got!

Now the really tricky bit. I have been using hand held tap wrenches

for sixty years and I still can't get it right, especially with small holes in soft metal material. The answer is to put the 3mm tap into the chuck of a pillar drill or drill on a stand. Then, while using the machine to exert gentle downwards pressure, turn the chuck by hand. When tapping the swarf must be continually broken off.

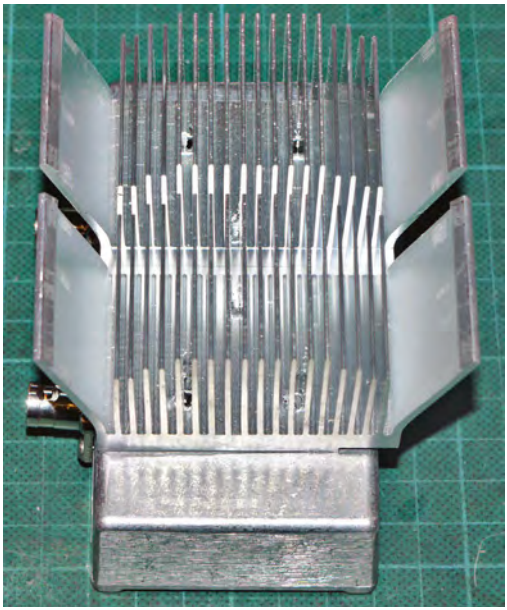
To break the swarf off, simply do half a turn forwards followed by a quarter of a turn backwards. Repeat this until the parallel section of the tap is through the hole. Then carefully remove the tap by turning it out backwards. It should be possible to do this just using your fingers on the tap

Now temporarily fit the resistor to the heatsink with the die-cast box sandwiched between them. Insert and tighten the two 3mm screws. Now, again working from inside the box, centre pop the position of the four holes that will be used to fasten the heatsink to the box. Drill the four holes 2.5mm right through the box and heatsink. Disassemble the unit and enlarge the four holes in the box to 3.4mm or 1/8". Then, using the procedure outlined above, tap the four holes in the heatsink 3mm.

Now clean everything and remove all trace of swarf etc. Smear some heatsink paste all over the flat surface of the heatsink and the flat surface of the resistor. Loosely fit everything together and then tighten up. Be careful as it is very easy to strip threads in aluminium. All it needs is a firm fixing. Do not overtighten!

The last stage is to solder the resistor tag to the input socket, directly if possible but if not then use a short length of 50 ohm coax. If you do this then it will be necessary to fit a solder tag on one of the resistor screws and one of the socket mounting screws.

Then solder a piece of solid core thin hook-up wire to the output / sniffer socket and place it so it doesn't move. You could use flex and fix it with hot-melt glue etc.



Parts list:

- 50Ω – 100W UHF resistor from eBay
- Suitable box, such as a die-cast, steel or even just an aluminium plate
- 2 x chassis mounting sockets to suit, SO239, BNC, N-Type, Phono etc
- Suitable heatsink – see text and heatsink paste
- 6 x 3mm machine screws about 12mm long
- Short length of solid core hook-up wire
- Short length of miniature 50Ω coaxial cable

That's it, any queries just email me.

PSU Fault Finding Notes

Paul Debono 9H1FQ Email: paulrdebono@gmail.com

Some of these guidelines, may seem odd or perhaps silly, but we may often forget them!

Take great care, lethal voltages can be present

Start by checking:

- The electricity supply.
- You may want to check the mains 'in' only, but, there is no harm to check up on the plug and the cable.
- Check the plug for any loose connection
- Check the fuse. Incidentally, the 13amp fuse that comes ready inside, should be changed with suitable rating to the equipment in use.
- Clean the brass pins until they shine!
- Next, check the cable, 'wiggle' it for any intermittent connections
- And finally, check that mains (or battery power) is getting in, using a multimeter.

A 'blown' electrolytic capacitor. The one on the left has ruptured the weakened can end, which prevents it exploding completely.

If the mains is 'there', then check:

- Any internal fuses. Modern equipment often uses fuses in the form of a 'zero ohms' resistors!
- On a conventional power supply, check the primary windings of the mains transformer for continuity or internal short circuit. Ohmic readings of mains transformers vary.
- Some designers like to use a resettable, or non reresettable fuse, often unseen, because it's embedded within the first winding layer of the primary!
- Check for any leakage between the windings and the transformer frame.
- Check for AC on the secondary windings, then check the rectifiers.
- Electrolytic capacitors, should be removed from the circuit, for testing. They tend to give a good reading, when tested, but, they fail with power on. Whenever in doubt, I always change them. A clear indication of a leaking, electrolytic is visible fluid leaks and the 'top' that is bulged outwards. A good capacitor should have a totally flat top!

Always replace electrolytics with high temperature oness, typically 125°C or better. Tantalum types, are even worse, but they are not much used today, on power supplies.

Check any regulator chips. They may be in shutdown mode, as a result of a short circuit. Resistors may go high, although, it's rare! Check any protecting diode, and zeners. Check for any PCB burns.

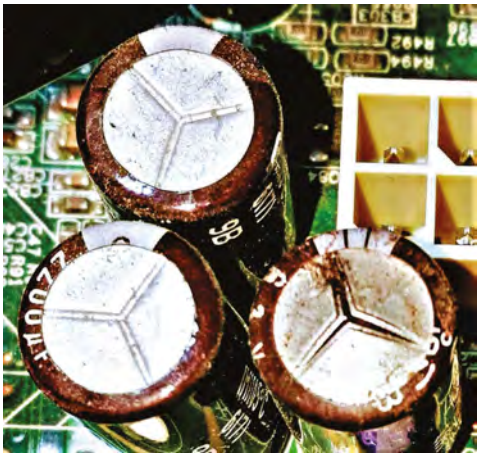
Switching type PSU

Please be careful when opening portable PSUs, often suplied for printers and PCs! They are often wrapped in some kind of foil to eliminate interference, but, if not handled properly, they tend to discharge static, enough to give quite a shock. Even after a few weeks being idle!

Check the usual fuse. It may take a form of a zero ohms resistor.

Very common to find leaking electrolytics! When in doubt, it's better to change them. Check for burnt components and PCB tracks, open or shorted rectifiers, resistors that may read high, or even show open circuit.

In many modern pieces of digitally controlled equipment, a small residual supply, waits for a pulse applied to the microprocessor to switch the main supply on!



Another dead capacitor. Make sure to replace with exactly the same type and specification to avert more problems

Solid-state 'fuses' come in two types:
Self resetting (just remove the load), and:
Non resetting (needs replacing).
Always replace like-for-like!

John Worthington G3COI (SK)

. . . . can never resist any opportunity for showing off his code speed

Previously published in
Short Wave Magazine *and*
Worthington's World

UV Light Box

Neville Marr, ZL2BNE, nev@marrnz.com

My method of choice to create printed circuit boards uses the photosensitive dry-film that is available from all the usual stores/websites. A UV light is the preferred light to affix dry-film to a copper board. I've used the sun and other light sources with varying success.

I tripped over the idea of repurposing a scanner to make a UV light box somewhere on the internet and acknowledge this is not an original idea.

The strips of SMD UV LEDs are available with many options. I purchased a 5m reel of 12 volt 2835 leds, with 120 leds per metre. I cut the reel in to 16 x 300mm lengths, a total of 4.8 metres. As shown in the photo they were attached to the base of the scanner as evenly as possible.

The only modification to the scanner was the removal of the mechanical parts. The circuit board was left in place. The circuit board, powered by an external power pack, has a 12V regulator. The regulator datasheet said it was good for an amp. The leds draw a bit over that but I figured (hoped) that the regulator would be fine for the short period it takes to develop a PCB. So I simply connected the leds to a convenient 12V track on the circuit board. (It's still working at the time of writing).

I did a few tests to establish the exposure time. I've settled on 3 minutes. To keep things simple I use the timer function on my phone and the on/off switch on the wall to operate.

Finally, an eye health and safety note … this is a concentrated UV source.

There's a Youtube video about using dryfilm for PCBs at:

https://www.youtube.com/watch?v=2hQfGtSFe_0

Making Printed Circuit Boards

Mike Dunstan G8GYW Email: g8gyw@dunstan.uk

There are several ways to do this at home. This procedure works for me and produces excellent quality boards both single and double sided. Here's a list of what's needed, with suggested suppliers:

- Schematic capture and PCB layout software (*https://ibfriedrich.com*)
- Image editing software (e.g. *Adobe Photoshop*)
- Laser printer (*monochrome or colour*)
- Toner transfer paper (*https://coolcomponents.co.uk/*)
- Laminating machine (*capable of 140ºC or higher*)
- Ferric chloride solution (*https://cpc.farnell.com/*)
- Acetone (*e.g. nail polish remover*)
- Dremel drill and drill press
- Immerse tin powder (*https://www.modellingelectronics.co.uk*)

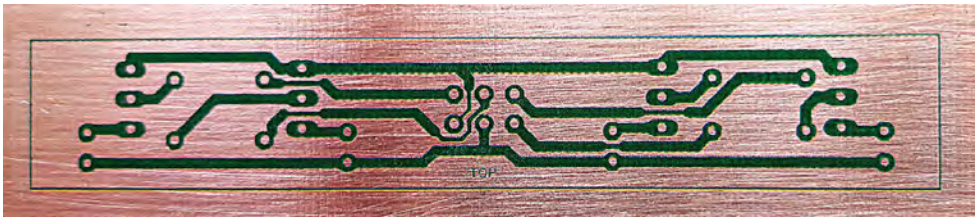
I use *Target 3001!* to draw the schematic and produce the board layout. It's a very powerful program and free for non-commercial use. Video tutorials are available online. When the design is complete and has been checked for errors, save the project in Gerber format. The files for the PCB outline and copper layer(s) then need to be converted to PDF for printing. I use an open source command-line tool called *Gerber2PDF*.

You can (download from *https://sourceforge.net/projects/gerber2pdf/*).

Here's a sample command line which combines a PCB outline and bottom copper layer into a single file called *MyPCB.pdf:*

Gerber2pdf -output=MyPCB -background=255,255,255,0.0 -page_size=extents -combine pcb.Outline pcb.Bot

Next, open the PDF file in your image editor. If the board is double sided, the top layer needs to be mirrored. Also if you are using a colour printer it's likely that the black toner won't have sufficient density to resist the etching process. In this case, change the colour of the tracks from black to dark green to increase the amount of toner laid down.



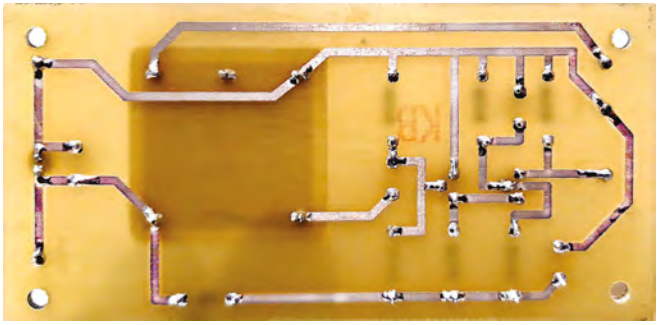
Now print the track layer in the centre of a sheet of normal paper. Cut out a piece of transfer paper, fix it over the printed image with a laser label and put the page back in the printer. Set your printer for heavy glossy paper, adjust the print density to maximum and print the layout again.

I have tried using a domestic iron to transfer the toner onto the board but couldn't get it to work as the surface area makes it impossible to generate sufficient pressure. The rollers in a laminating machine produce the required pressure and the temperature should be high enough for smaller boards.

It might struggle with large double sided boards, but if you know what you're doing it is possible to modify the laminator to increase the temperature. As always, an internet search is your friend but be careful when working with mains voltages.

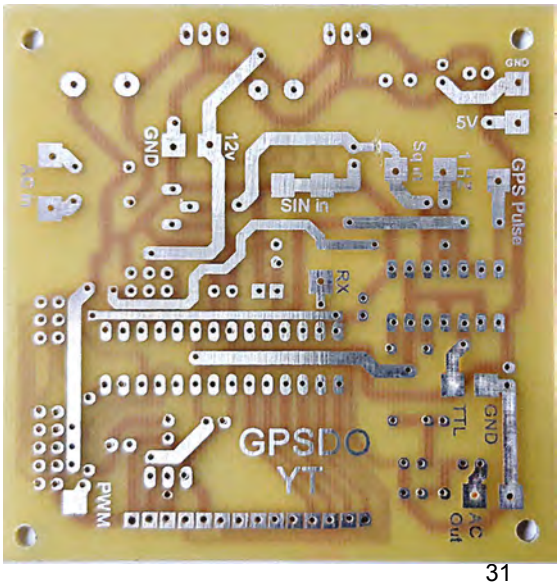
Warm up the laminating machine and set it to maximum temperature. Scrub the copper clad board with green dish scourer and washing up liquid, rinse and dry. Cut the transfer paper to size, lay it on the copper clad board and feed it through the laminator a number of times. Experiment for best results; ten passes works for me. If you use the same transfer paper as me then drop the board into cold water and after a couple of minutes the paper will float off. If using any other sort of paper it might be a bit harder to clean the board up.

If you're making a double sided board, protect the blank side with parcel tape then place the PCB in the ferric chloride solution and agitate frequently. It should take about 15 minutes for the unwanted copper to dissolve. Don't forget to wear gloves and goggles and dispose of the used ferric chloride responsibly. Rinse and dry the board, then remove the toner by scrubbing with green scourer and acetone.



For a double sided board, print the second layer onto transfer paper then drill a couple of 1.2mm alignment holes through pads in the paper. Drill the PCB through the same pads then use Vero pins to align the transfer paper on the opposite side of the board. Secure it in place with a laser label and pass it through the laminator. Protect the other side of the board with parcel tape and etch the second side.

Once the board has been cleaned up, drill the component holes using the Dremel drill press and a 0.8mm bit. Use larger bits for any headers, mounting holes etc.



To finish the board off, make up the tinning solution by dissolving the crystals in water according to the instructions provided. Scrub the board clean and immerse in the solution for five minutes, then rinse, dry and the board is ready to go.

If all that sounds a bit complicated, it took me less than two hours to print, etch, drill and tin the board shown above from an existing layout.

Finally, shown to the left here, is my double sided board that I made using a design I downloaded from the internet:

Valve QRP Reports April 17th and 18th 2021

Colin Turner G3VTT email: g3vtt@aol.com

There were plenty of stations active again this time but we could do with more! I would like to thank everybody for the reports submitted and the photographs. I was active with my Ameco AC1 single valve transmitter and the Drake 2B.

G4XRV's QRP station

Derek G3NKS wrote he had a bit of a disappointing weekend radio-wise as he was away from home overnight on the Saturday so he missed the normally busy Saturday evening and Sunday morning sessions. He did however record eight QSOs in the log-book including **Peter GM0EUL** who was using a recently built one-valver, his first attempt at constructing a valve transmitter, using the usual two 6V6 CO/PA, perhaps properly described now as a VXO/PA as on 80m with a variable capacitor in series with the crystal enabling him to shift frequency a little away from 3560. **Rupert G4XRV** had clashing events for the latest VQRP weekend.

When he could get on the bands he found conditions to be pretty terrible but was pleased to have a few QSOs on 80m with other valved QRP stations including G3NKS and G4AQS. CQs on 60m produced no QSOs and he didn't hear anyone else around 5262 so conditions seemed way down on normal. He's included a picture of his station below with the famous 6J5/6V6 CO/PA and his new AD5X transmit receive switch. That 'civilian' 1937 McElroy bug and Nato straight key work as well as they look.

Chris G3XIZ had an enjoyable valve weekend but unfortunately worked only a few of the regulars during this event. He was beavering away up to the last minute trying to get a new valve transceiver operational and just managed to get it going on 80 metres in time so the other bands will had to wait. The new transceiver uses only EF80 valves, eight of them and the PA give a maximum of 1.5W or, if really caned, 2W but that seemed to be enough for many QSOs. Unfortunately the direct conversion receiver is rather insensitive and Chris is aware of some QRP stations who called him but he failed to hear so to them he sends his apologies. Despite that he made 17 contacts.

GM0OUL and his 'Icom' special

Peter GM0EUL enjoyed his few hours of 'filamenteering'. He made a VFO for his otherwise crystal controlled "Icom" radio but it didn't work too well so he went back to the drawing board with that

and back to crystals for the weekend. He camped out on 3.359 MHz and worked YU1EA, which was a YU contest call giving him 599 B, to which he responded with 599 001 and the contact was over in seconds. (They usually are). Later on Saturday he worked EA3AZ, Petro, who was also QRP. Sunday was fun with longish contacts with Wim, PA0WDW (valve, 3w), Derek, G3NKS then finally Gordon G4FGJ with a 2 watts valve transmitter. Peter's station is home brew, crystal controlled, with a single ECL82 putting out 5 to 7 watts to an end-fed half-wave,

G4CKH's busy operating position

Graeme G4CKH sent a short note to tell of his activity during the event and on the Saturday evening found good propagation conditions on 80m and worked with G3MCK, DK6JK, G3TYB and G4ARI all valve QRP except DK6JK. On Sunday evening conditions on 80m seemed poor but he did hear a number of stations in particular G3NKS in contact with GM0EUL. He checked 4m0 and 20 m over the weekend but the ongoing contest made things very difficult. The shack he has is a 14 x 9 foot heavy duty timber shed with expanded polystyrene foam insulation to all walls and ceiling with plywood covering. The equipment is all quite old and runs on a lot of nostalgia. The rig used for QRP is a restored Heathkit SB102 at 5 watts into a low 100 foot end fed wire.

A newcomer to the event is **John G3NUA** whose equipment consisted of an HRO and PSU which he had renovated/built during the lockdowns. The CW transmitter, dating from 1965, consists of a VFO, buffer/doubler & 6CH6 PA. Above in the photograph is a homebrew Z-Match.

John G3TYB a keen supporter of the event from Sittingbourne and only managed to get on the air on the Sunday and found no propagation on 60m. In all he had thirteen contacts and ten were valve to valve QRP. Most were on 80m but he had a QSO on 160m with G3XJS and one on 60m. Conditions on 60m seemed strange. He spent a considerable time on the band on Saturday and only heard two or three stations including G3NKS, whom he called, but had no reply. His station was a homebrew CO/PA and regen receiver on 60m, and a homebrew VFO/PA and superhet receiver on the other bands.

Peter G3XJS also found no propagation on 60m so he stayed on 80m with the Drake twins working six stations on 80m and one on 160m. He compared his Drake R4B to the R4C and thinks the recovered audio is better from the 4B. Peter would like to hear more activity from QRP operators. **Dave G4FKI** had a good weekend of activity during the weekend and for him Saturday appeared a better day for conditions on 80m. Ten stations worked with the lowest power from **Graham G4JBD** running a few mW.

G3NUA's nostalgic QRP station

The R4C & AT5 of G4FKI

On the Sunday only 3 contacts including GB1DOE were made. He used a Codar AT5 and a newly acquired Drake R4C with an Inverted L antenna.

Gerald G3MCK made 12 contacts on 80m with mainly S7 reports to G stations using his co/pa 5 watts to an inverted vee dipole. **Ian G4GIR** worked a couple of stations with his Codar AT5 and AR88 but he then succumbed to the good weather. **Mike G4AQS** was very impressed with the single 6V6 transceiver that **Geoff G3YVF** designed described in Sprat 137 and Geoff sent him a slightly modified circuit from that using relays and semi-break-in. Mike developed it a little more using a Pi output wound on a toroid. The output was then 4W and it worked equally well with a KT66 but with a bit extra output. The receiver section is very sensitive and only falls down when the band is crowded. He worked 9 stations, all except one were using valves, G4FGJ, G4ARI and G3TYB solely with that little transceiver and the rest flicking in the KW77 when receiving became difficult. Interestingly he worked Wim, PA0WDW who was also using a 6V6 TX plus a super-gainer receiver. Finally **Wim PA0WDW** himself informed me he tried an old WS18 with 2 watts output to work SK4EW on 7030 KHz getting a 559 report. He intends to use this rig in the next event. After this he switched to 80m and sat on 3560 with a 6V6 crystal oscillator and his valve supergainer receiver and worked a further seven stations.

I am very sorry to report the passing of **Ted G2HKU** at the age of 98 in mid-April. Ted was a keen supporter of QRP since the early days of GQRP and operated with a variety of rigs starting with a PM2 and graduating to an Icom IC703. He will be remembered in the annals of QRP as the first station to work the US from the Isle of Sheppey using 4 watts in the early 1950's using a mediocre antenna from a noisy environment in the centre of Sheerness showing what can be done with QRP despite the odds. I can also report I have been playing with the Phoenix kits SCAF filter which although it isn't a piece of valve kit has enhanced my QRP operations. Finally the date of the next Valve QRP event is July 17th and 18th 2021. Please send me your reports and a photo in Word as soon as possible after the event.

Reports to: ***g3vtt@aol.com***

or

Colin Turner G3VTT
182 Station Road,
Rainham,
Kent ME8 7PR

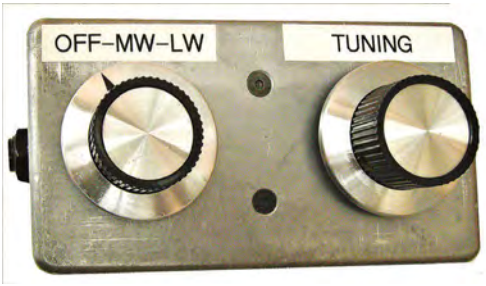
PA0WDW's crystal controlled WS18 station

How I got Started - or My First Radio Project

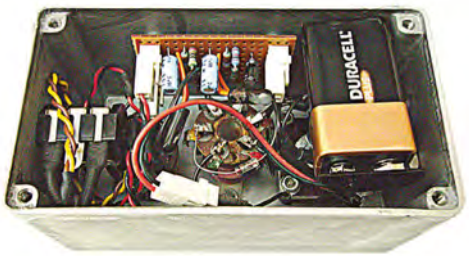
Lewis Thomas - G4YTN G-QRP 12885

I guess it all started when I was 8 years old, I was given the 1965 Boy's Own Annual, in which I discovered the *BOP Ether Ranger* single valve receiver by **Gilbert Davey**. I was fascinated by this radio but never built one.

A few years later a school friend of mine, **Martin** who is now **G4EEZ**, was given a small battery powered radio. Clearly it was 'home made', it had MW and LW and you listened using a pair of high impedance headphones, very uncomfortable! It was built into a small box made of hardboard, the switch, coil and variable capacitor were mounted on a piece of paxolin sheet and components wired using the 'birds nest' technique. It had two knobs, one for 'tuning' the other for 'OFF, MW, LW' and sockets for aerial, earth and phones, the transistors were OC71s.



Lewis' skill have improved to create this copy of the 50-year old design



I was so impressed with this radio that I decided I would like to build one myself; however, there was no circuit diagram. I persuaded Martin to let me borrow the radio for a while so that I could build a copy. The parts needed were obtained from a local radio shop (Pitts in Picton Street, Bristol), and the radio assembled using Martin's radio as a pattern. The radio worked very well using a 'long wire' antenna, I used it for many years.

The next project was a *'Five Band TRF'* as featured in *Practical Wireless* [1]; my first steps as a SWL and into Amateur Radio. On a recent visit to a second hand book shop I found a copy of the 1965 *Boy's Own Annual* and was taken back in time when I read about the *Ether Ranger* so, I wanted to find out more about Gilbert Davey and came across an interesting web site dedicated to Gilbert Davey's radio sets [2], where there's a section on '*The Focus Transistor Set*'.

I recognised the Focus circuit to be that of the radio that I had built some 50 years ago. I still had some of the original parts so decided for fun to build another, my construction skills having improved a bit since the early days. It worked as well as the original with selectivity as bad as I remember. I still have the TRF receiver; perhaps this will be the next rebuild project!

My thanks go to Martin, G4EEZ, and **Les Franklin** for their assistance.

[1] Beginners' 5-Band Receiver, F.G.Rayer, G3OGR, Practical Wireless, Dec 1966

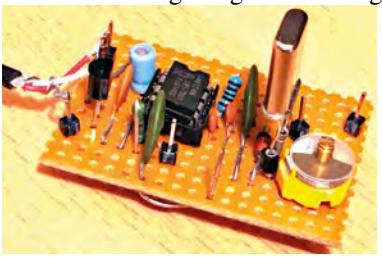
[2] www.daveysradios.org.uk

MEMBERS' NEWS

by Chris Page, G4BUE

E-mail: chris@g4bue.com
gc4bue@gmail.com

We moved to our new QTH in Bexhill-on-Sea, East Sussex on 26 March and are still unpacking! There are lots of things to do to get the house as we want it and so putting up an antenna and getting on the air again is going to have to wait a while.



G4EFE says the noise levels across HF at his QTH are so high his 'operating' is largely restricted to running beacons. In an attempt to combine WSPR with a KISS-approach TX, Martin part-built the **ZL4SAE** design (<tinyurl.com/wsprtx>) that generates a 30m DSB signal by mixing the (pulled) 10140kHz crystal with the audio from an old MP3 player to generate WSPR tones (left). In two weeks of 24/7 QRV he has been spotted in 12 DXCC in Europe, the furthest being **SMØEPX/RX2** at 904 miles. Using decreasing power levels with a QRPLabs Ultimate 3 TX to a low full-wave loop on 40m, on 27 February he was spotted by **LX1DQ** while running 0.01mW equating to over 33 million miles per watt! Martin also built an automatic antenna switch to select his (low-noise) Wellbrook loop for RX and the main station antenna for TX. He bought a 0.1-600MHz RF power meter from Ali Express for £15 including delivery from China that claims to measure power levels from +16dBm down to -75dBm (40mW down to, effectively, nothing!) and after checking it against his trusty QRPometer, said it seems spot on at 10-40mW levels.

G4GHB sent a picture (far left) of his new tidy shack. To the left is his construction area, roller coaster with variable capacitor ATU, speaker and Morse key in front of the 19 Set running 3W usually on 5262kHz, right is the 61BT valve TX at 2W, next the TW Topbander now with modulation, above is the PSU for both TXs, left is a homebrew rig, above a 4m AM Bantam used /P over 30 years ago, on top is a Heathkit HW202 and hardly visible his FT817 and finally a 817/19 Set PSU and battery charger. Pictured right is his RA17L with the Zenith on top.

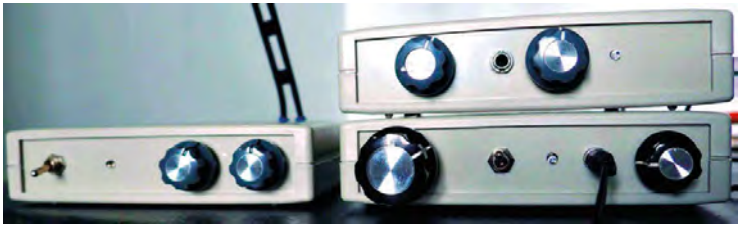
MØNTV's latest project is another SSB TCVR that he says is reinventing the wheel with homebrewed diode ring mixers and a crystal ladder filter, and is 'open plan' in its development! Despite that, Nick has made 80m QSOs with its 10-12W, 8.5W on 40m and is now working on 20m. The IF amps are **W7ZOI** bidirectional TIAs; the audio preamp and amp are **ZL2TCM** designs and the PA comes from an **EI9GQ** book. The VFO/BFO is an Si5351 controlled by an Arduino Nano and the PA uses genuine RF MOSFETS (2 x RD16HHF1) rather than IRF510s. Nick says the RD16HHF1s are more expensive but much better behaved, and not as easy to destroy! The MOSFETS are mounted on a repurposed CPU cooler heatsink and fan.

45 years after **G8GYW** got his licence, he finally made his first QRP QSO, with a QRP-Labs QCX+ CW TVCR kit, but as he never learnt CW, he modified it for SSB using **PE1NNZ** and **DL2MAN**'s instructions leaving out half of the components! Mike's first QSO with 3W was on 40m with **MMØTDS** followed by **SB6A**. His antenna is a modest EFHW 36ft high so an excellent first result.

A new member **R2AUK**'s recent project is a 40m 5W superhet SSB rig (left & right) using a STM32F030 MCU, 1602 LCD, Si5351, LM386. The PA is three stage AB mode: 2N2222, 2N2219A and IRF510 and he says many ideas were from **VK3HN**, **ZL2CTM**, *Experimental Methods in RF Design* and *Solid State Design for the Radio Amateur* books. Alex has done a *YouTube* video at <https://www.youtube.com/watch?v=RRgbGrtiN2I>. Using a trap inverted-vee for 20 and 40m on a 33ft mast, his best DX is **S51CK** at 1180 miles.

Pictured right is **G8YXR**'s 'birds nest' 160m 600mW TX using acorn valves, that he dismantled after making a 1000 mile CW QSO with southern Spain using a 144ft inverted L on a 33ft glassfibre pole. and an Elad FDM-S2v RX. Stages were VFO, buffer, class-C PA, a pi-output network out of sight to the right using HT 170V. Ed says, "Lots of fun, but a bit chirpy!".

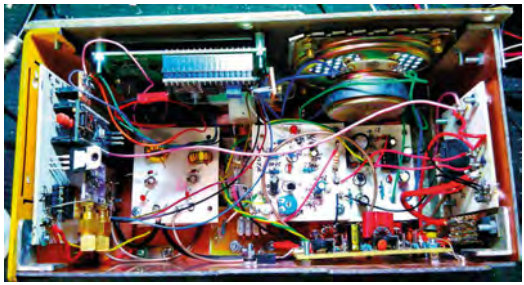
GØEBQ's copy of **N6KR**'s SST on 20m (right) is now up to 23 DXCC, the best being a W and two VEs in the ARRL DX Contest and a UA9, plus some two-way QRP QSOs. Nigel built a 30m version which he says works well, although a bit QRO at 2W!, and an



ATU based on the Norcal BLT (to left of the 20m SST below the 30m version in the picture).

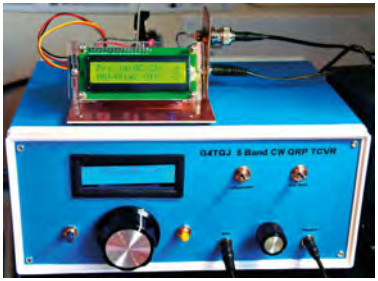
G3XIZ finished his ATU (right) which is working well, but has replaced the coil tapping switch with a plug and socket arrangement when the switch died after using it with QRO! Chris also got his eight valve TRX, that is still under development (bottom previous page), ready for the last valve weekend, and made a companion PSU for it built into an old Bremi valve PA case utilising its existing transformer.

It gives 25-400V regulated HT and the LT is 12.6V DC regulated, ramping up to full voltage over 30 seconds.



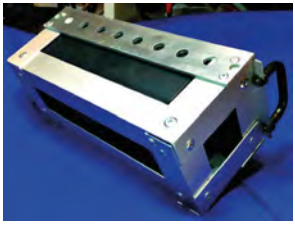
Above is **G8NXV**'s latest project, a 3W PEP 20m SSB TCVR made from designs of **N6QW**, **ZL2BMI** and **ZL2CTM**. Ron says, "I just cobbled it all together and did the metal bashing". Using FT8 and his poor antenna (an internal base loaded multi-band whip with tappings from 80m to 6m), he has QSO'd **F4DZA** and **LZ1LZ** with it. **GM4CAQ** made a few 6m FT8 QSOs to Italy, and on 20m finds it is a 'a bit of a lottery' when calling stations as to what power level they are running. Bob says, "If they are 50-100W stations, I expect my signal to be about 12db down on their report, so what power are they running when my reports are 25db + down on theirs! Great mode FT8 - no guesswork on signal report validity!". He has been 'playing' with a Chinese Pixie he built for 40m that he fitted a SMA socket to on the antenna and bought a SMA male to a bulkhead BNC female pigtail to make fitting it into a box easier. No contacts yet but at least it works into a dummy load, he says.

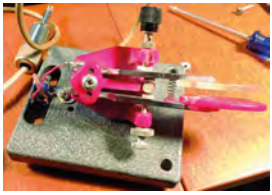
VE3IPS has been busy with QRP above 30MHz using a 1296MHz and 222MHz transverter to complement the 6m, 2m and 70cm capability of the IC-705 (right). John just acquired a **DK9SQ** square loop set-up and another 32ft mast to the collection. He has **VE-1368** registered for Parks on the Air and hope to use *HamRS* as the logger on his Android. John uses a mast made from Manfrotto rigging parts off the trailer hitch on his car and has managed various Covid-52 RF Super Spreader events getting lock-down amateurs to get on simplex and explore making contacts without a repeater.



G4TGJ finally built his TVCR into a case (left), then built an MSF shack clock based around an Arduino Nano that has a remote active ferrite rod antenna (due to all the SMPS noise in the shack) and NE602 mixer. Richard says after amplification by a dual op-amp, the signal is fed into the microcontroller's ADC for tone

detection, decoding and conversion to UTC. He is now working on a two-band portable version of his TCVR specifically for SOTA activations.



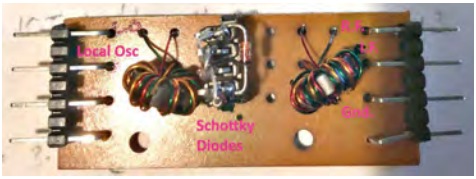


KA9P writes, "Cage rage seems to be infecting the IC705 ranks, so last month I decided to build my own with a $10 rivet tool kit and some scrap aluminum. It's pretty clear from the pics (above) what happened - it's sturdy and serviceable and more than a bit ugly. It's for use in or out of the $6 water-tight plastic ammo box as shown". With some tedious Dremel tool work, Scott cut the remains of a badly broken boot sale paddle and repurposed it as a trail paddle into a small boot sale box (above).

PH2LB's new shack (below). Lex has upgraded his QCX+ and QCX-Mini with the Electron Volt Ltd AGC but says he didn't completely follow the manual and has documented his installation on his website at <www.ph2lb.nl)>. He owns two FRG-7s, one missing the original main dial knob, and used *TinkerCad* to make a near copy of the other for it (left). The design is also on his website.

N2CQR has been experimenting with RTL-SDR dongles, and homebrew upconverters based on the NE602 chip. This has led to a renewed effort for Bill to understand the Gilbert Cell.

Inspired by **ZL2CTM**, **G4WIF** and **G8INE** have built, what has turned out to be, pretty good 'double balanced diode mixers' (below), and learning how to test them. Tony writes, "Considering the commercial alternatives can be pretty pricy indeed, these home built versions are very cheap to make. More information at <www.gqrp.com/187.htm>". **MØKHZ** has created a walk-through video of his Teensy based 'Simple VFO' on *YouTube* at <https://youtu.be/oWSVf3w8YGg>. Kevin can supply a set of three PCBs for £10 including postage, contct him at <kevin.m0khz@gmail.com>.



Thanks to all the contributors of this column. Please tell me how your summer goes for the Autumn 2021 edition of *SPRAT*; what you have been building, who you have been working, and any other information about QRP, by 12 August. 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 your home QTH during the autumn and winter months, especially during the Winter Sports, so I can let members know to listen out for you.

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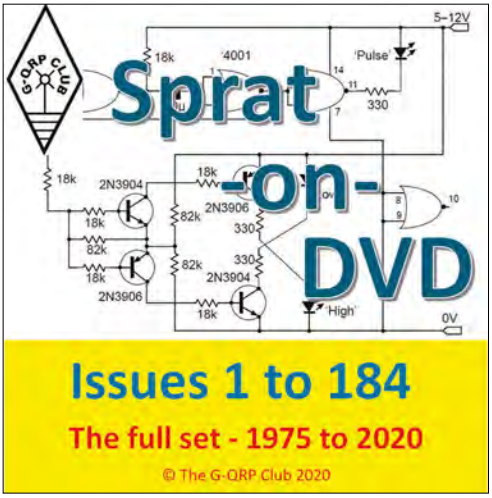

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Polyvaricon capacitors –2 types - 2 gang (A = 8 to 140pF + O = 6 to 60pF), and 2 gang – (both 8 to 280pF)
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5.00, 6.00, 7.2, 7.6. 8.0, 9.0, 10.0, 10.70, 11.0, 12.0, 13.50, 15.0, 16.0, 18.0, 20.0, 24.0, 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) } £4.50 (DX)
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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 - £2.00 (note – I may supply NE or SA, 602 or 612 as available. (Max of 2 per member) } things
MC1350 - £2.00 (Max of 2 per member) } like binders,
LM386N-1 - 4 to 15v, 300mW, 8pin **DIL - £0.50 10 for £4.75** } 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
TA-7642 Radio IC – direct equivalent of **MK484** (& ZN414) – **75p each** } Use just
BC109B (metal) (npn) fT - 100MHz, hFE-320 **- 10 for 50p** } that postage
MPSH10 transistors (npn) fT - 650MHz, hFE 60, VCEO 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 (max of 2) } 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 – 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. 3 sizes } with parts.
21SWG (0.8mm dia) – 2metres = £1; 26SWG (0.45mm dia) – 3m = 70p; 30SWG – 3m = 60p }
Litz wire – double silk covered multi-strand wire 7/.04mm -12p, 14/.04mm. 25p. Both for 3 metres. }

All our magnet wire is solderable enamel insulated. Max of 3 sizes per member per order

QRP heatsinks - TO92 – 30p; TO39/TO5 – 40p; TO18/TO72 – 80p (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 – you may order 2 packs only if you actually need them.
I will no longer supply 2 packs of everything – order only what you need please.

T25-2 – 50p, T25-6 – 60p, T30-2 – 70p; T30-6 – 80p ; T37-2 – 80p; T37-6 – 80p; } **Postage**
T50-1 - £1.00, T50-2 – £1.40, T50-6 – £1.60; T50-7 - £1.20, T50-10 - £1.20; } **for toroids**
T68-2 - £2.20, T68-6 - £2.50, T130-6** - £2.60ea; } **includes**
FT37-43 – 90p, FT50-43 - £1.20, FT37-61 - £1.20, FT50-61 - £2.40; } **postage**
Ferrite beads – FB43-101 (3.5mm dia x 3.2mm long, 1.2mm dia hole) – 40p for 5; } **for all**
BN43-2402 - £1.50; BN43-202 - £2.40; BN43-302 - £3.40; BN61-202 - £3.40. } **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
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I can include up to 3 of these with parts for no extra postage.
I can supply UK & EU, will DX please order direct from Rex. ***These items from Rex's stock are pictured on the website.***

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