SPRAT

THE JOURNAL OF THE G QRP CLUB

DEVOTED TO LOW POWER COMMUNICATION

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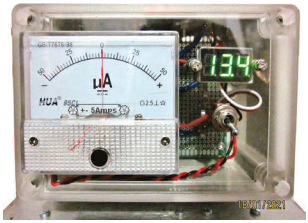

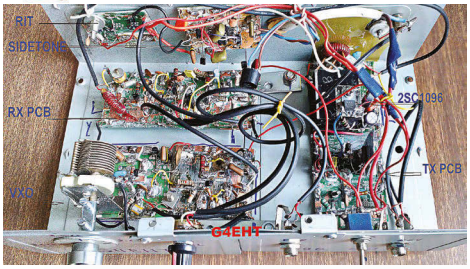

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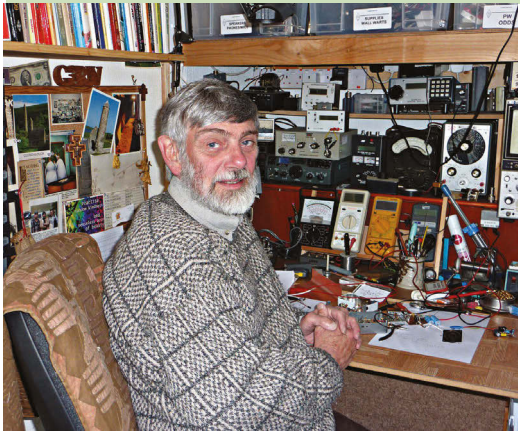
This could be your last SPRAT. Check your delivery label and please read the Membership Secretary's notes on page 3



Our founder George Dobbs G3RJV (SK)

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As I write this there is much uncertainty about events in 2021. However, we must make plans in the expectation that things will return to normal at some point. So here is something to look forward to; the Club's Annual Convention will take place over the weekend of the 4th and 5th of September.

There is a provisional booking in place for the Hamfest's university venue just outside Telford. However, the success of the virtual convention convinced us that we should continue to enable on-line access.

The Committee has therefore started to think about who our speakers will be, some at Telford and some on-line. If you have any suggestions, please let me know.

Congratulations to all of our trophy winners for 2020. You will find full details on pages 7 and 8 in this *SPRAT* and on the Club's website. The entries were all of very high standard, and the winning entry is featured in this issue.

Following a very successful 'RSGB Tonight at 8' broadcast I was asked about sharing kit and component supplier details. Tony, G4WIF, has revamped the Club Website to make it clearer that we do have such a list.

It requires members to recommend suitable suppliers, and to let us know if they no longer exist. Listed suppliers should be on-going businesses, not one-off auction sales or shack clearances. Please send appropriate recommendations to Tony. Full terms are on the webpage.

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

Membership News

Daphne G7ENA, 33 Swallow Drive, Louth, LN11 0DN

Another year has passed, and what a strange year it has been. It appears that there has been more time for radio and it is nice to welcome back members of old. I have also seen a steady stream of new license holders join which is wonderful.

I am still collecting stamps for the horses rest home and would like to thank everyone who has sent me extra throughout the year.

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 cannot identify your payment then your membership will be thought of as 'lapsed'.

Please everyone, check the wrapper now. If underpayment applies to you, there will no further Sprats until you send the balance.

Providing information with your payment.

Astonishingly our overseas representatives and I receive payments with no information about the identity of 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 should 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. If you contact us we will gladly refund your unused membership fees and delete your data.

Your last *Sprat*?
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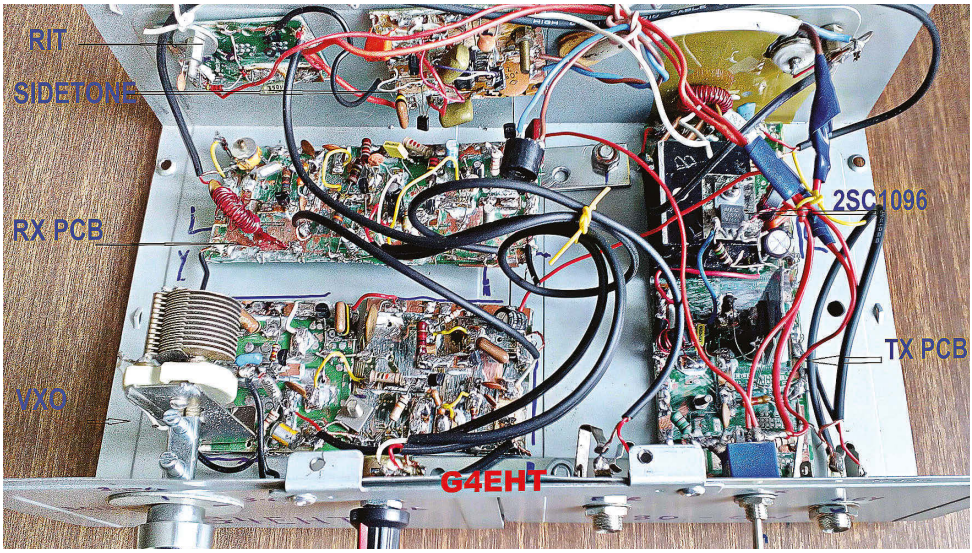
Discrete Component 80m CW 'Transceiver'

Bill G4EHT 558

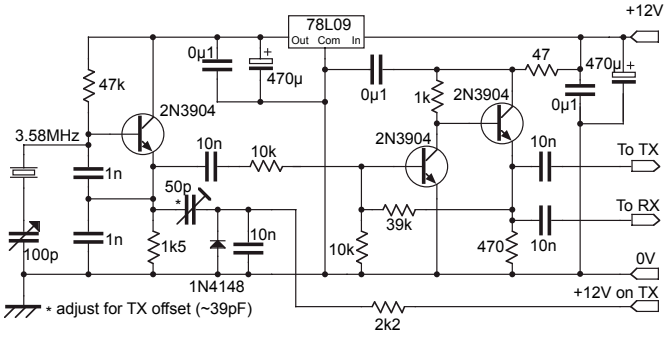


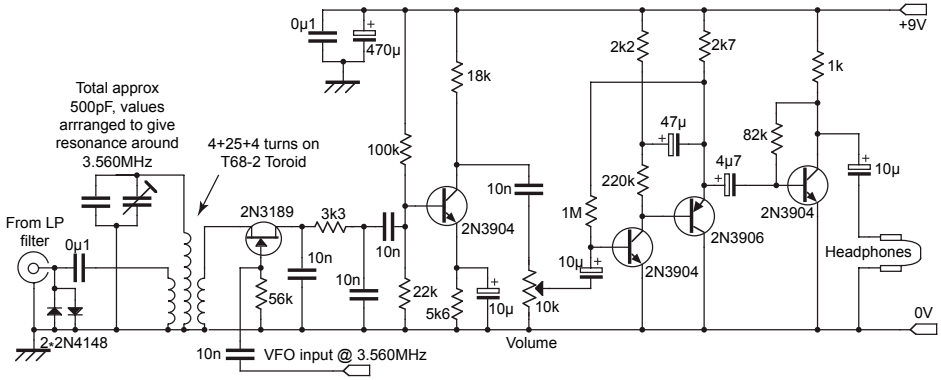
This transceiver evolved as a result of reading Philip G4HOJ's article that followed on from my 30m Transceiver in 'Sprat -183' So some credit must go to Philip. It is not a replica of his circuitry. But there are similarities of course. Initially, I was looking at the 'Mixer' which uses a jFET which is something I have never tried, so I set about 'playing' (as usual). I found the results very encouraging, so followed on from there with my own 'AF' stages, using all discrete components (No ICs whatever apart from the 555 in the sidetone)

Ceramic Resonator VXO

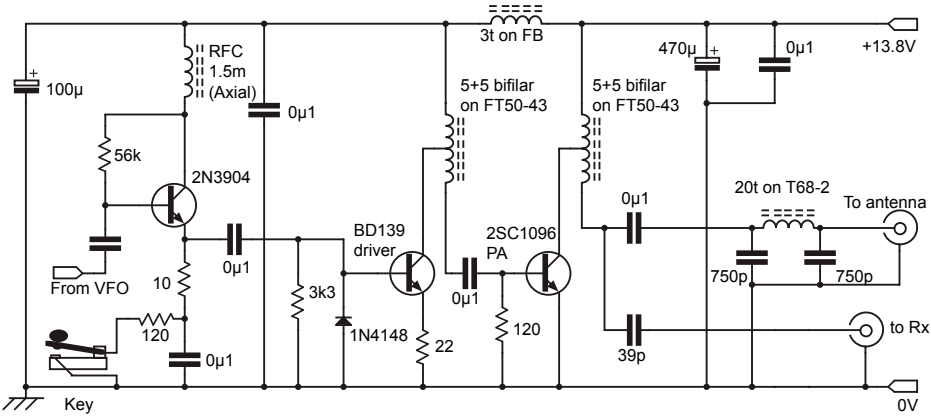
Another article in Philip's contribution showed the use of a 3.58MHz ceramic resonator. Again this is something I hadn't considered trying before, so once again I set about 'playing' (as usual) Hi Hi! I had previously bought some 3.58MHz Resonators from the club sales, but had never tried one until this point. Again, I was encouraged with the results! Rock Stable, and good coverage too. What more could you ask for?

I then decided that if this was to be used in a transceiver, then I would design it to have two outputs(one for Mixer RX) and one for TX Driver Stages (TX) Thereby,





eliminating the use of a 'Relay' to switch The VXO outputs on RX/TX respectively, which is what I often do. The circuit of the ceramic resonator oscillator is the result. I also added 'RIT' to the circuit, but found that a much larger value capacitor was needed, and by trial/error found a value of 39pf to be about perfect, which comes in automatic on 'TX' Having built the whole RX section and evaluating the performance, I set about the TX strip. This basic circuit, uses just three transistor and gives me an output of between 3–4W on 80m. But remember to use some form of 'Heat Sinking' for the driver and PA transistors.

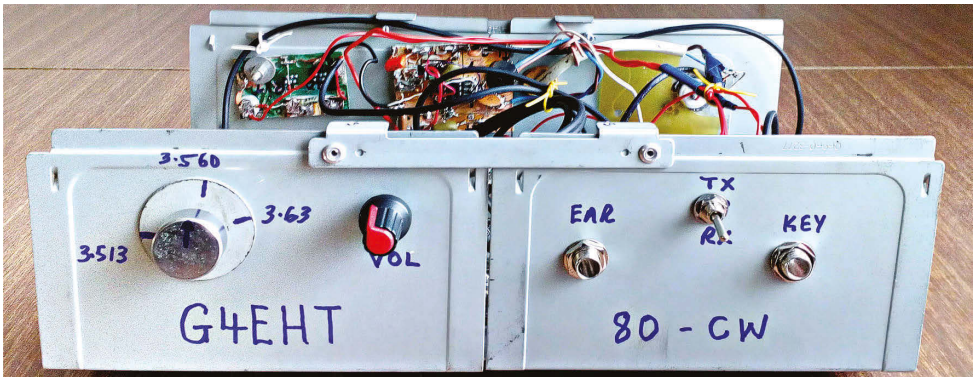


No Relays

Another idea, was to try and eliminate the use of any relays in the design, and I am pleased to report that I managed to get it working without problems. Do make sure that you include TWO back/back IN4148 Diodes on the input to the receiver section, as I've shown in the circuit diagram.

Another inclusion (although not shown), was an RF activated 'sidetone' identical to the one published in *Sprat* issue 183 that I used in my 30m Transceiver, that was also incorporated, which is a must!

Also, the RX supply is 9V, for which I used a 78L09 9V regulator for this. I've not shown this part on the circuitry as I have almost 30 'HomeBrew' Rx/Txs This latest rig has been



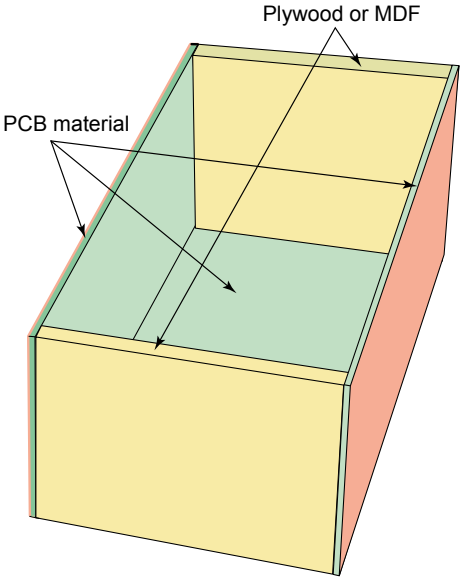
installed (as seen by photographs) in the outside cases of two computer PSUs, and even the PCBs were built from a scrap computer bits that I had taken apart .... The 'ultimate recycling rig' built to date! Hi Hi.

I hope this Transceiver project will encourage you to 'give it a go', as it is very straight forward and will bring lots of fun and reward for you.

Regards de Bill - G4EHT

Boxing it up

Peter Howard G4UMB



Whenever I make a project plans, I always think of what case to put it in. Where to buy a cheap box for it. I have been using biscuit and sweet tins, wooden boxes and plastic food containers but they never look quite right for a radio or electronic instrument enclosure.

I don't want to go to the trouble of bending aluminium sheet and make boxes that used to be available because unless you know the bending alllowance and what sort of aluminium to use, it can crack and once bent, it can't be easily undone again.

So I saw this easy to make universal box described many years ago in a magazine by R A Penfold I think? It doesn't need much in the way of explanation and If you use PCB material it will probably cut and break just like glass by scoring it both sides with a scriber, clamping and then snapping it by pressing it down on the edge of a table. The main thing is there's no bending involved and the parts of wherever sizes can be made from rectangular pieces and screwed together.

G3RJV Construction Competition 2020

Steve Hartley G0FUW email: g0fuw@gqrp.com

2020 was the year of the inaugural G3RJV Memorial Construction Competition. We had planned to judge the entries at the Telford Convention but when that was cancelled, due to Covid, we clearly had to think again. The success of the virtual Convention spurred us on to think about how we could judge construction projects remotely. In the end, members sent us written details and/or web links for their projects and those who were shortlisted were invited to present their work, and answer questions, in a short Zoom session with the Club Committee.

First up was an LCR Bridge by **Cor, PA3COR**. The design originated in a Practical Wireless article from the 1960s. Cor's construction exhibited much 'kitchen table technology' with good use of 'junk box' parts all housed in a tea bag storage box. Calibration was achieved using some precision parts of known value.

Next was **Tony, G4WIF**, with his Arduino-based WSPR beacon. Tony had based his project on the work of Tony, F4GOH, to produce a very compact waterproof beacon. The construction included a mix of matrix board and breakout boards with a 'plug in' PA module to aid replacement of blown transistors.

Kevin, M0KHZ, also produced a WSPR beacon, but his was designed from the ground up using a Teensy micro-computer and bespoke PCBs all housed in a robust Hammond enclosure. Kevin outlined how modern CAD allows easy PCB design and ordering of small quantities of PCBs from the far East.

Finally, **Colin, G8TMV**, showed us his surface mount version of the old Rockmite transceiver, the Quartzmite. Colin had discussed his plans with **Dave Benson**, the designer of the original rig, and had added some improvements to produce a very compact transceiver that fits in a small mint tin, has reasonable QRP performance and includes a keyer; this was clearly no cheap Pixie!

The Committee had a very difficult job in selecting a winner; all four projects were excellent in their own way and any one of them would have been a worthy winner; all four builders had shown some ingenuity and construction craft and all four projects were repeatable. In the end, the Committee members were unanimous in thinking that if George were judging, the LCR Bridge would be his choice, so Cor, PA3COR, was awarded the very first G3RJV Trophy. The G8TMV Quartzmite came in as Runner Up and the other two were awarded Highly Commended certificates, but it was a very close run thing.

George G3RJV – SK

Each of the projects will feature in more detail in the coming editions of SPRAT and we will be calling for entries for the 2nd G3RJV Construction Competition in the Summer.

GQRP Club Trophy Winners 2020

Steve G0FUW

The Club now has eight trophies which are awarded annually. We also recommend who should receive the RSGB's G4STT memorial trophy.

The G2NJ Trophy

The trophy is awarded this year or the best contribution to International QRP and goes to **Pete Juliano, N6QW**, for his many articles in QRP Quarterly and SPRAT, his YouTube videos and his Blogs.

The Partridge Trophy

In 2020, as previously, this is awarded for the best antenna article and this year it has been awarded to **David Holland, G4LDT,** for his article 'Yet Another Aerial Article' in *SPRAT* 185.

Gordon Bennett Trophy

The best practical article receives the Gordon Bennett Trophy and this year it has been awarded to **Andy Eustace, M0RON**, for his article 'Set up BPF with SDRPlay', which appeared in *SPRAT* 182.

W1FB Trophy

Simple articles are always popular with members and the best one receives the W1FB Trophy. This year it has been awarded to Roy Kavanagh, GM4VKI, for his '10p super mod' from SPRAT 185.

The Suffolk Trophy

This is awarded to the best log submitted for operation on World QRP Day, 14 June, was once again won by **Valery Bobrov, RW3AI**.

The Winter Sports

Certainly one of our most popular activity periods, running between Christmas and New Year. The best log wins the G4DQP Trophy and for 2020 it was received from Chris Osborn, G3XIZ.

The Chelmsley Trophy

This is awarded for the best log covering the whole of the year, and at a time of minimal sun spots, working anything can be a challenge. This year's winner is **Peter Estibeiro, GM0EUL**.

The latest addition to our trophies is the **G3RJV Memorial Trophy** which was awarded for the first time this year to the winner of our Club Construction Competition, **Cor van Rij, PA3COR**. Cor's LCR Bridge will feature in SPRAT, as will the others that were short listed.

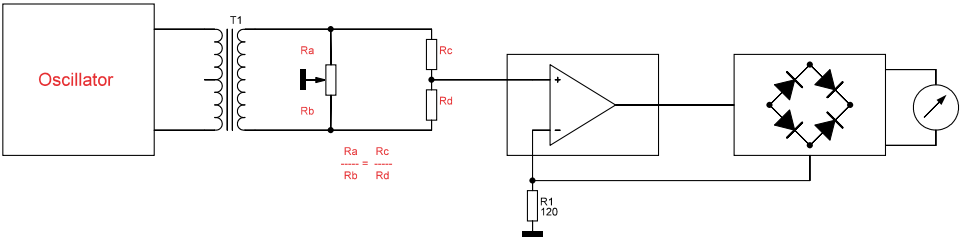
Congratulations to all of this year's winners, who have been contacted.The RSGB will be announcing the winner of their **G4STT Trophy** at their AGM in April, so we will not steal their thunder here, but our nomination is truly worthy having contributed to the QRP world for many years.

An LCR Bridge

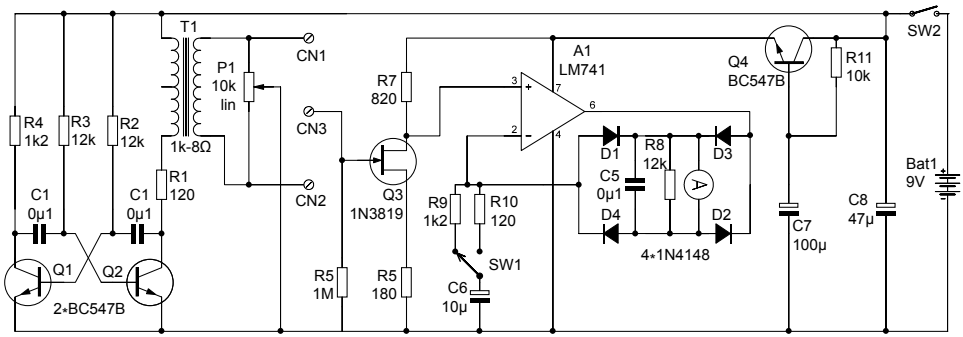
Cor van Rij PA3COR, email: corvanrij@gmail.com

After acquiring a Digital Multimeter, the next thing you probably want is to measure are capacitances and inductances. A must when building receivers or transmitters yourself. This nifty LCR bridge helps you do precisely that! It is based on the simple bridge circuit. It works by putting an unknown component in series with one of a known value.

Take two resistors (one adjustable) and vary the ratio until you do no longer measure a voltage difference between mid-points of the capacitors and the resistors. Apply the ratio to the known capacitor/resistor/inductor to obtain the value of the unknown part.



As you can see above, the set-up is pretty straight forward. An oscillator on the left, an audio transformer (salvaged from an old transistor radio), the actual bridge circuit and finally an amplifier with VU meter as a bridge balance indicator. It can easily be seen that if the ratio RA/RB and RC/RD are equal, there will be no voltage across the bridge.



The various blocks are easily recognized in the actual circuit diagram. Transistors Q1 and Q2 form an oscillator that runs at around 610Hz. A transformer in the collector of Q1 is used to isolate the bridge from the oscillator. In this way it is possible to connect the node between the two resistors to ground and use the other bridge connection to measure the voltage difference eg. the bridge balance/unbalance.

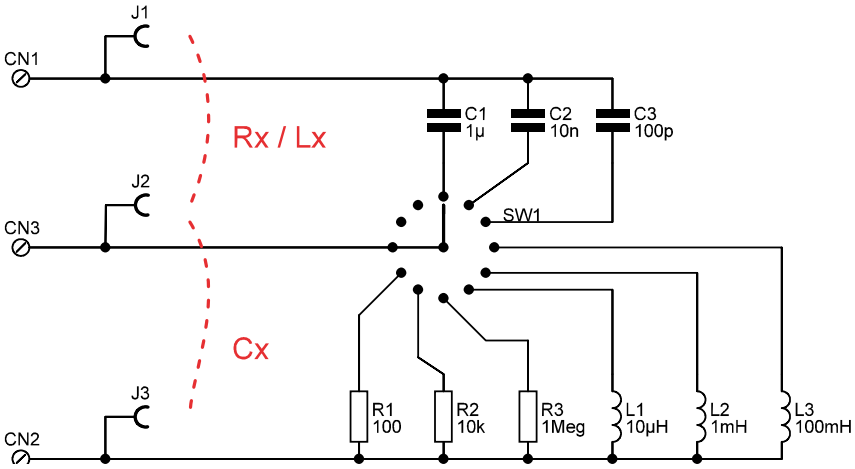
Buffer Stage

A JFET 2N3819 (Q3) is used as a buffer with a 1MΩ input impedance and a low output impedance. Resistor R5 is required so that the gate always sees a path to ground.

Depending on the position of switch SW1, Op amp A1 is used to multiply the signal by 10x or 100x. This feature is handy so that in the 'normal' setting the dip can quickly be found and the final tuning is done with the '100x' setting. C6 ensures that at DC, the amplification is 1x. The bridge rectifier diodes are germanium, though Schottky diodes will work just as well.

Low Pass Filter

Transistor Q4,R11,C7 form a low pass filter circuit on the amplifier supply, to isolate the detector from the switching noise from the oscillator. The filter has a cut-off frequency of $fc=1/(\beta*2*\pi*R11*C7) \approx 0.013Hz$



The chosen bridge setup requires a range selector switch with only a single mother contact and also features the option of "pairing" components.

The scale used is 0,1x – 1x – 10x. This means that the middle has a 1x ratio, when the potentiometer is turned fully counter-clock-wise the multiplier ratio is 0.1x and when the pot-meter is turned fully clock-wise the multiplier is 10x. So, with the reference values in the left column you get the following ranges:

	Reference value	Low-end		High-end
L	10 µH	1 µH	↔	100 µH
	1mH	100 µH	↔	10 mH
	100mH	10 mH	↔	1H
C	100 p	10 p	↔	1 nF
	10nF	1nF	↔	100nF
	1 µF	100 nF	↔	10 µF
R	100 Ω	10 Ω	↔	1 kΩ
	10 kΩ	1 kΩ	↔	100 kΩ
	1 MΩ	100 kΩ	↔	10 MΩ
Pairing		η1	:	η2

Construction

A tea-bag storage box was used as a housing. The plastic-glass in the lid (with the reference to it's original function) was removed. In the corners some small pieces of wood were glued for mounting the front panel. Two layers of walnut stain were used to darken the wood. Boiled linseed oil was applied for a durable finish. A couple of bolts were glued to the bottom as standoffs for the print and the battery. Household 'silver' paper, (aluminium foil) was glued to the inside as shielding material.

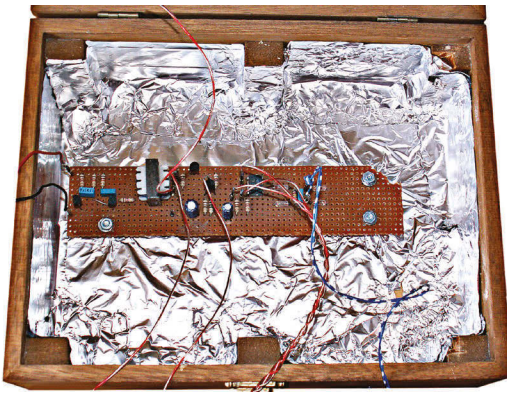
The front panel is made from 3mm birch plywood. More foil was glued on the back panel. A front panel was drawn on the computer, printed out and glued to the front side. Finally the controls were mounted.

Calibration

To calibrate use a couple of precision (1% tolerance) resistors. A good selection would be to use values from the E-12 range spanning 2 decades eq. 1K, 1K2, ..., 8K2, 10K, 12K, 15K, ... 82K, 100K. Put the calibration resistor across the terminal and turn the dial on the right until lowest signal is measured, then mark this on the right dial. Repeat this for each calibration resistor. The accuracy of your measurement now only depending on the accuracy of you reference values.

Future changes

For low inductance values, the performance can be disappointing. There a probably a couple of causes for this. Low inductance values give low impedance. This could be remedied by increasing the oscillator frequency a twenty fold increase should easily be achieved. Another reason could be that inductors tend to be “dirty”components with lots of series resistance. This could possibly be remedied by changing the bridge layout to a Hays or Maxwell bridge setup. Any way, enough room for experimenting and learning!



An Active Loop with Rotator

Chris G3XIZ

Many of us suffer from local QRM, even to the extent that it often makes the reception of some QRP signals impossible.

Due to such QRM I am usually unable to receive stations on the 160 - 30m bands with my end fed aerial unless stations are strength S7 or above.

I have been impressed with the directional and signal to noise improving qualities of loop aerials since making my first one in 2002. This was necessary in order to pick up the weak and noise-ridden signals on the 136 kHz amateur band. I later made similar units for MF, Top Band and finally a 4-band loop to cover 80, 60, 40 and 30m.

A prime advantage of loop aerials is their ability to drastically reduce interference coming from a specific direction, the null being achieved with the loop broadside to the QRM and maximum pick up being when the plane of the loop is pointing at the signal's source.

The null is very sharp if careful orientation of the loop can be achieved and I've measured reductions of about 24dB (4 S-points). I shall describe here my HF loop as that will be the one of most interest but the amplifier circuit is similar to those of my other loops.

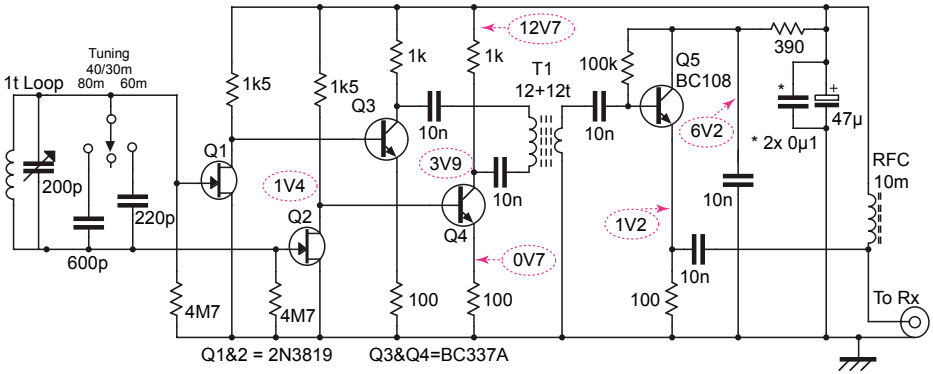
Active Loop

This comprises a wooden cross of two foot square which is suspended from one of its arms. It has a single turn of heavy copper wire strung on metal hooks from the corners and is suspended about 3 foot off the ground. The amplifier is a differential type and is mounted in an aluminium box positioned at the centre of the loop.

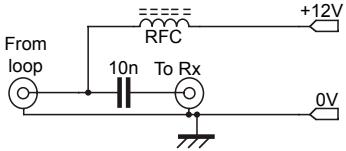
An SO239 socket with a BNC adapter connects the amplifier to the outside world. The loop's amplifier is powered through the coaxial cable from the receiver end using the usual choke / capacitor isolation circuitry as shown with the loop amplifier circuit diagram.

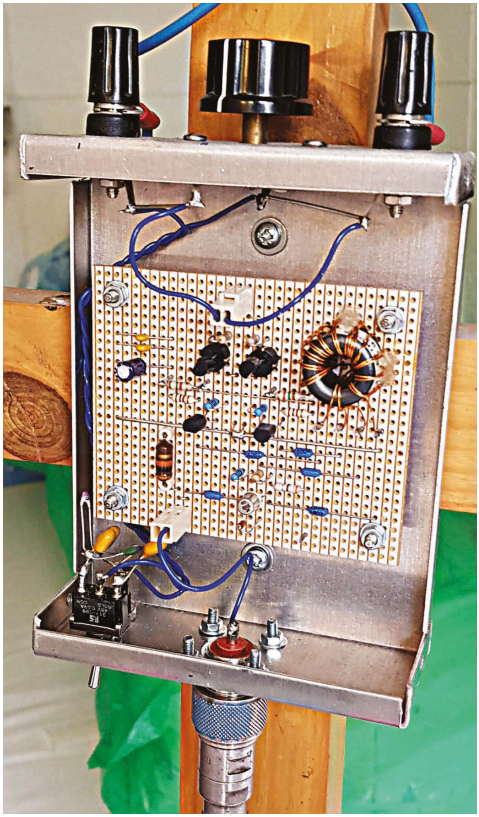
Location

The location is of some importance and the loop needs to be situated as far as possible from any domestic wiring. Mine is housed in a wooden shed at the far end of the back garden. The coaxial feed cable runs along the garden fence into the shack from whence it is powered.



The loop amplifier showing the voltages that I found on my prototype. Shown left, the power is fed to the amplifier through a bias-T





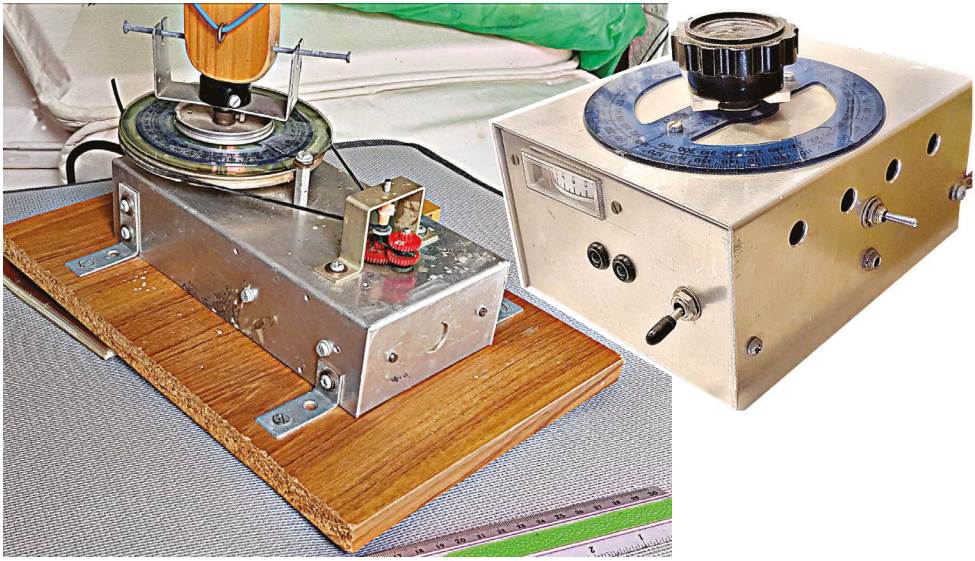
Rotator

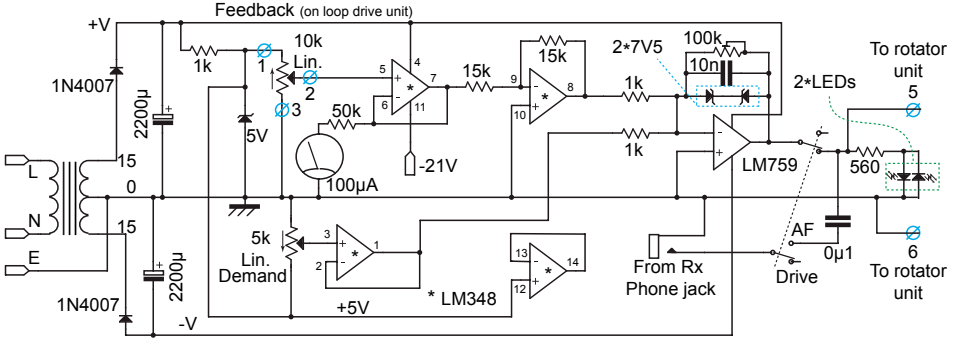
I made a remotely controlled rotator for use with these loops so that a QRM null (or maximum S/N) may be facilitated from the receiver end whilst monitoring signals audibly or by means of an S-meter.

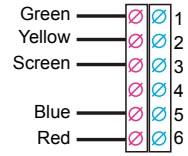
The rotator unit was made using an aluminium chassis of about 8 x 6 x 2 inches. An old cassette tape recorder motor drives a worm and wheel arrangement from which a narrow pin emerges through the top of the chassis. This pin goes through a series of cheap plastic gears (obtained from a model shop) and is connected to an old radio's variable capacitor driving drum using rubber sleeving.

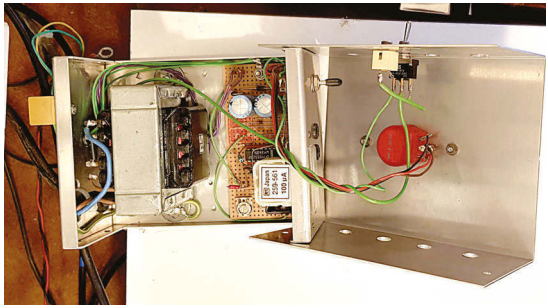
A rubber band will suffice but these tend to perish over time. The driven drum's axle is the shaft of a 10k linear potentiomer and it is this which provides the feedback to the control unit.

The wooden loop itself engages on to the rotating drum by means of two pins (nails) and these locate into a notched u-shaped bracket which is fitted on to the drum (see photo)









Rotator Control Circuit

As previously mentioned the loop's position is fed back using the voltage derived from a rotating linear potentiometer.At the control unit this voltage is summed with the 'demanded' voltage and any difference between them will cause the motor to rotate either clockwise or anticlockwise until the demand and feedback voltages are equal.

The 'setting' potentiometer on the loop's control unit has a perspex pointer which indicates the bearing in degrees by means of a cheap school protractor.

A refinement was to add two LEDs which light up to show the direction that the loop is

rotating. They go dimmer as the loop approaches the set orientation, eventually being extinguished. There is also an edge-wise meter to indicate the loop's orientation more accurately – test sockets for using a DVM would be even better.

My unit is some years old and uses an LM759 power op amp to drive the rotator's motor. These devices are now quite expensive so the use of a suitable alternative op amp may be advantageous.

Initial Tuning and Setup

The loop amplifier will need to be fine tuned for the band in use. As the loop is remote from the monitoring receiver one of the connecting wires is used to feed the audio signal back to the loop's location. Earphones may then be plugged into a suitable socket on the rotator unit and the loop's tuning capacitor adjusted for maximum volume.

To orientate the loop correctly first set the control unit at due North. Once the rotator has stopped moving and with the aid of a compass manually position it such that the loop is pointing in that direction. Depending on the quality of the potentiometers good setting accuracy should be obtained over 180 degrees of rotation e.g. E - N - W

With experience and allowing for some inertia I can set the loop to within a degree or two and the resulting deep response notch drastically reduces the QRM.

Recently I've used the loop on 30m and signals which are of good readability with the loop are not even discernable when using my noisy end fed wire.

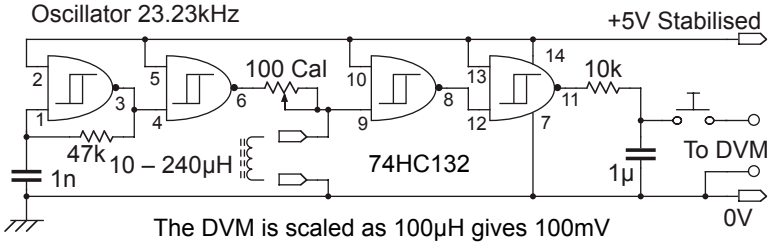
A Simple Inductance meter

Peter G4UMB email: pahowd@gmail.com

Here is a very simple Inductance meter circuit that I found on the internet made around a four gate NAND IC 74HC132. It unfortunately only has a small range but I found it to be pretty accurate. The first gate generates a square wave at a frequency of about 23kHz and this is placed across the coil. The other gates produce needle pulses from this which are made into a steady DC voltage by the 1µF cap

It allows you to measure the inductance of small coils ranging from about 10µH to 240µH using a standard DVM on its 200mV & 2V ranges. I was able to make mine with a fixed resistor of 82Ω instead of the calibration pot. You will need some spare coils of known value to calibrate this with. I used 100µH, 10uH, 33µH and 68µH ones.

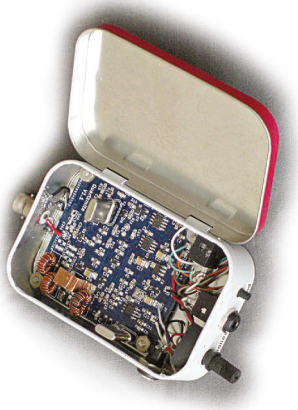
To measure a coil of less than 10µH I put a 1uH in series with a 33µH and noted that it then read 34µH. With no coil connected the DVM will show a voltage of 2.5v If you don't want that, then put a n/o push switch in series with the 10k resistor like shown and place a test coil before pressing.



The Quartzmite SMD QRPp CW Tx/Rx

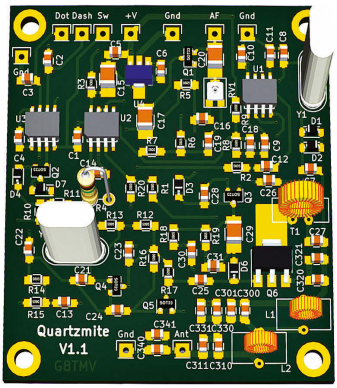
Colin Tuckley G8TMV email: colin@tuckley.org

The Quartzmite project started when I decided to build a surface mount version of the popular 'Rockmite' QRPp CW transceiver. After talking with **Dave Benson, K1SWL** the original designer and **Chuck Carpenter, W5USJ** who did some efficiency modifications to the P.A. and low pass filter I came up with a variant of the circuit that uses nearly all SMD parts.



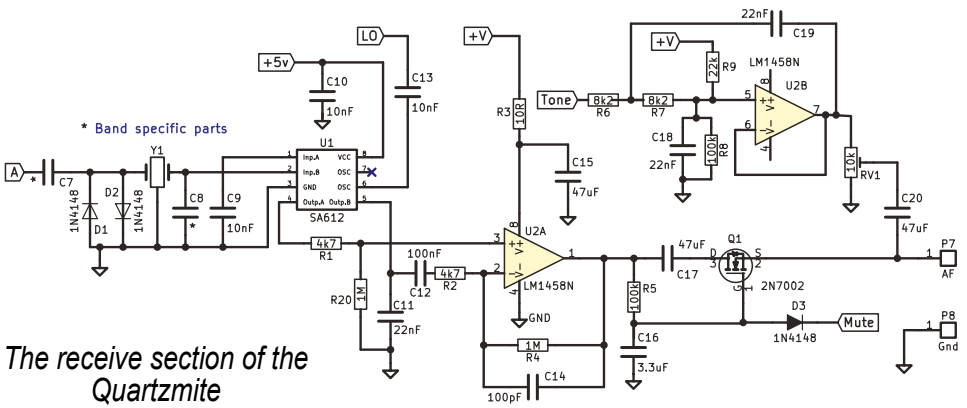
As well as the improved Tx low pass filter my design makes use of the second op-amp in the LM1458 to implement a Sallen-Key second-order active low pass audio filter for the sidetone, making it sound much less harsh than the square wave of the original Rockmite. I've also put a pre-set pot in the sidetone circuit so the user can set the sidetone volume independently of the Rx audio.

With a 12v supply the radio is delivering about one watt. On Rx it draws about 15mA and on Tx about 370mA. Some effort was focused on increasing the power output by adjusting things in the driver and PA part of the circuit to make them more efficient.

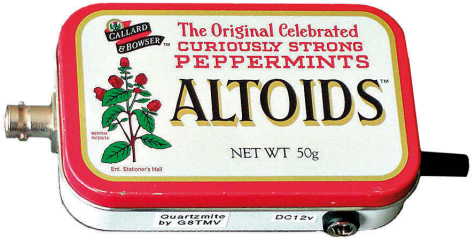


The graphical overlay

One area that took some work was the 'shift' function that moves the local oscillator between two frequencies about 700Hz apart, this is used to separate the Rx and Tx frequencies. The original Rockmite design is rather basic in this area and it proved impossible to get a sensible shift with any of the available zener diodes. After some experiments I decided that rather than use a single zener diode to generate a reference voltage and use ground (0v) for the



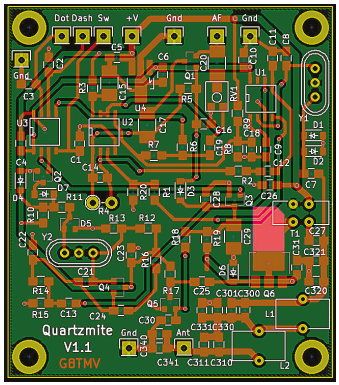
The receive section of the Quartzmite



other voltage, it was better to use two zeners with the lower voltage one switched by the FET. As well as making it easier to get the required shift this has the additional benifit of allowing the use of the low end of the varicap capacitance range, which means we are pulling the crystal less and so the oscillator is more stable.

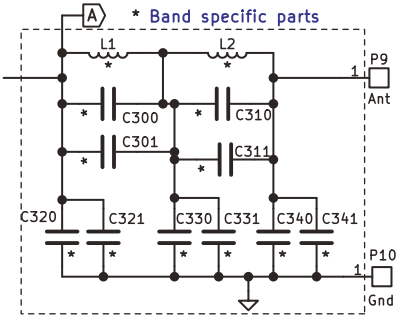
The output waveform on a 'scope is a nice sine wave and my spectrum analyser measured the transmitter 2nd harmonic at -52dB so the low pass filter is performing as expected.

The last thing to do was to put it in an enclosure, I had an Altoids tin at the ready since the board is designed to fit one with enough space left to mount the required sockets etc.



A skeletal look PCB

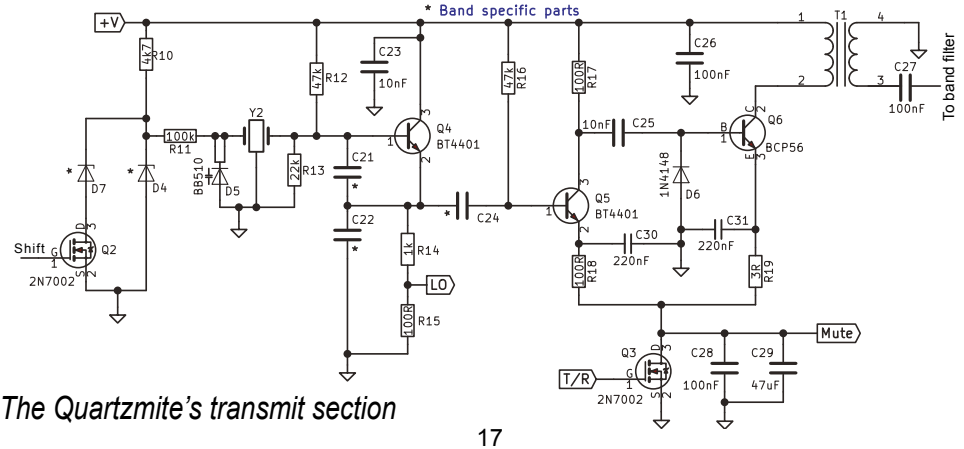
The Quartzmite keyer is functionally identical to Dave Benson's original Rockmite keyer. A quick push of the control button reverses the Tx/Rx frequency shift. If a straight key with a mono plug is connected at power up then the iambic keyer is disabled and the rig operates in straight key mode. With paddles connected, pressing and holding the control button enters speed change mode where one paddle increases the speed and the other reduces it.



The important bandpass filter

The part circuits shown here are from the full circuit diagram which, along with a bill of materials and a set of construction notes are available on the project web page at:

https://www.tuckley.org/qmite/



The Quartzmite's transmit section

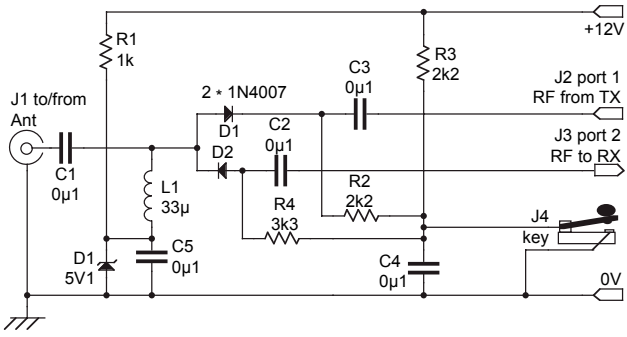
Low Power TX/RX Diode Switch

Bob, G4VSO, Treonnen, Three Ashes, Herefordshire

Introduction:

First, the circuit described in this article is not by any means original, the acknowledgement for that must go to **Mike Rainey AA1TJ** for his work on the minimalist TRX Reggie. The main objective of this work is to evaluate the performance of the diode switching circuit as developed by Mike AA1TJ and to share the results.

My circuit differs from that used by AA1TJ in the following way. A Zener diode was used to set the reference voltage with an inductor in series to reduce insertion loss. Although one could use a resistive divider, it was felt that the bias voltage needed to be stiffer during switching.



With the key down, diode D1 is forward biased and D2 is reverse biased, so the path from J1 (Ant) to RF port 1 (TX) is low impedance and the path to port 2 is high impedance.

With the key up, diode D2 is forward biased and D1 is reverse biased, so the path from J1 to RF port 2 (RX) is low impedance and the path from RF port 1 is high impedance.

I found that the resistors R2, R3 and R4 were not that critical and are different in the AA1TJ circuit. The forward current through the diodes needs to be kept up in their appropriate switching positions.

Please note that the diodes used are 1N4007, the use of this particular diode is important. I did try 1N4004, but found that the reverse isolation suffered by about 5dB. RF power switching diodes are much more expensive and do not operate well at lower HF frequencies, and the power handling capabilities are quite modest at 100mW (20dBm).

Note the keying circuit should be capable of pulling the key line down to near 0V. If the circuit is going to be used to generate CW, then adding a key click filter circuit should also be considered.

The circuit was first built in a rat's nest form and then transformed onto some prototyping board to evaluate its performance. Its performance did not substantially change.

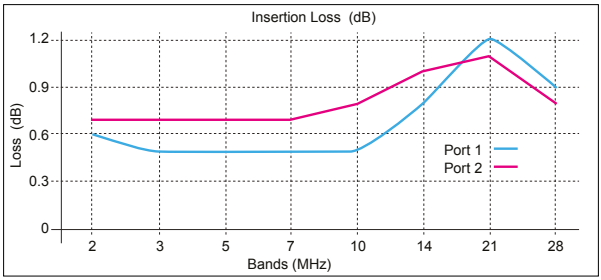
Objectives & Results

To present a series of performance graphs to allow the reader to consider the circuit for other potential uses. To evaluate the performance of the diode switch circuit with the following tests: Insertion Loss: Power handing: SWR across frequency range and switching voltage.

All the measurements were performed with a homebrew power meter based on the AD8307, HP8656B signal generator, MFJ-259B (SWR) and a Fluke 110 for the voltage measurements.

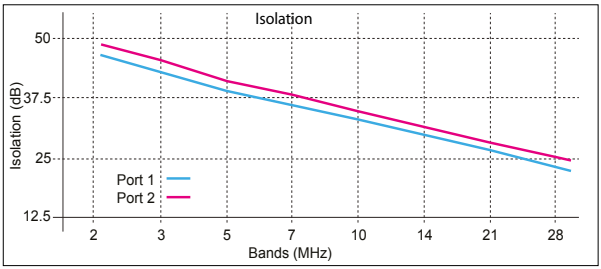
Port 1 & 2 Insertion Loss

The Insertion Loss remains relatively constant up to 10MHz.



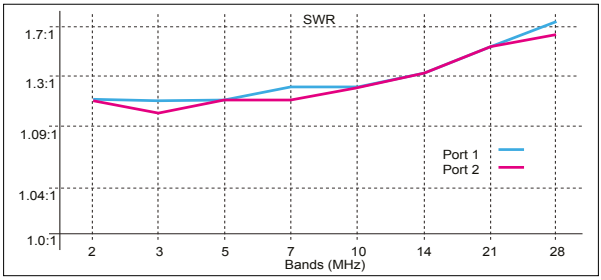
Port 1 & 2 Isolation

Isolation deteriorates as the frequency increases and reduces to less than 30dB above 14MHz.



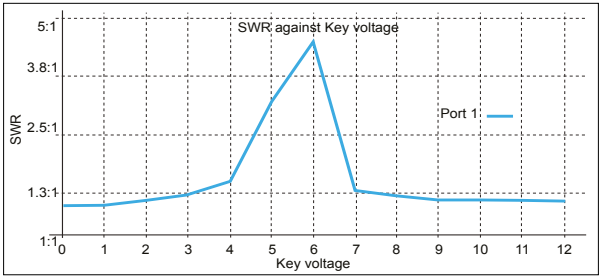
Input SWR to Port 1 & 2

Again the SWR remains below 1.3 up to 14MHz, but increases to 1.8 at 28MHz.



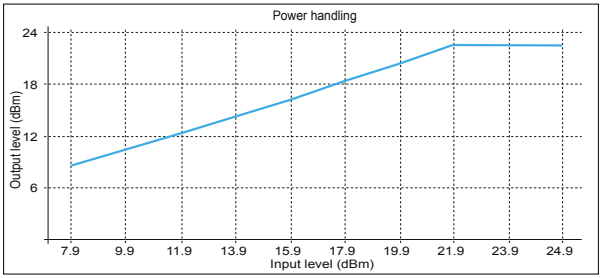
SWR during Key switching Voltage at 3.5MHz

SWR goes over 3:1 between about 5 and 6.5 volts. Depending on the characteristics of the keying circuits, this may help reduce load pulling effect.



Port 1 Output Level dBm at 3.5MHz

Output power reaches saturation at 21.9dBm. Note this measurement may be subject to measurement error and I suspect it is high by about 1dBm.



Uses:

Apart from the obvious, there are a number of other potential uses for this circuit:

- TX/RX switch: QSK operation
- Key a fixed oscillator or generator:
- Evaluate Test Oscillator or Amplifier for Load Pull effects or chirp
- Evaluate a RX AGC performance.

Conclusions:

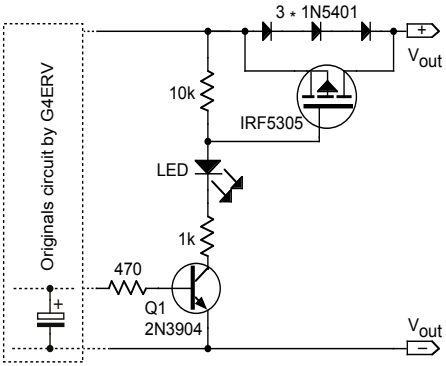
The power handling capability is quite modest at 100mW (20dBm). The loss through the switch is quite reasonable up to about 10MHz at less than 1dB, but does then increase with frequency.

Care needs to given in the use of this circuit much above 10MHz, as the reverse isolation reduces to below 30dB by 14MHz. This would result in an on channel spurious of -10dBm (or -30dBc), so any station reasonably close would be able to hear it. I do remember over 20 years ago a station commenting that he could hear me with a simple 6m CW TX with the key up, where only the PA transistor was keyed.

It would be interesting to see how this circuit performs with single stage Colpitts transmitters, which can be prone to chirp, in particular when using ceramic resonators.

Modification For a LiPo Dropper

Franco Trainini IK2NJV email: ik2njv@gmail.com



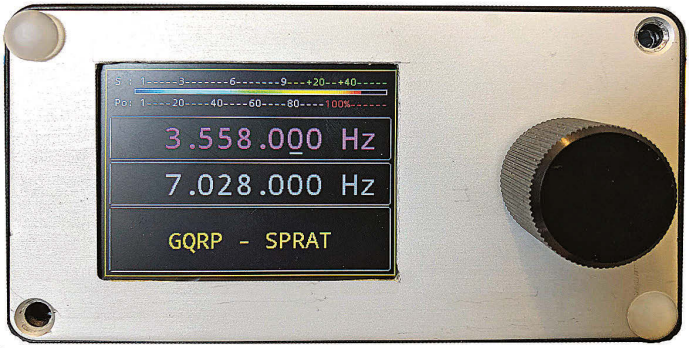
In *Sprat 185* there is an interesting article by **Bill G4ERV**, about using the LiPo (Lithium Polymer) battery, and in particular how to use it with our QRP equipment.

Since I had a problem obtaining the relay with a high resistance coil, I made some modifications, using a MOSFET P-type with a very low 'on-resistance' (RDS), instead of the relay. I used the IRF 5305 (RDS=60mΩ), but any other P-type MOSFET with similar parameters (V_{Max} & I_{Max}) would be more than suitable for the purpose of this application.

The modifications are very simple and they are shown here. Should you have other questions, I'd be happy to answer any questions by email: **ik2njv@gmail.com**.

A Simple VFO

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



This project was born from the need to create a transverter VFO, however the software is completely configurable for:

Any IF frequency

Any BFO

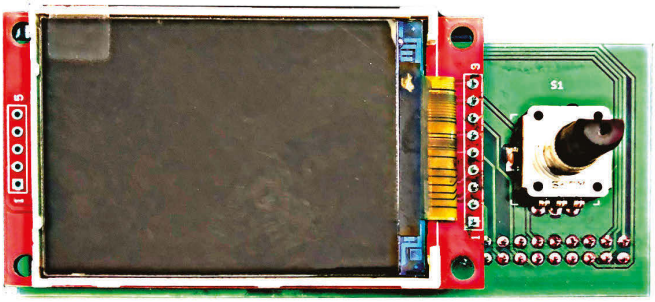
Any transverter offset

Just by commenting in/out and altering the frequencies as required, as described below:

The Arduino IDE is used and the target microprocessor is a Teensy 3.2, all the source files (software and KiCad hardware files) can be found here:

https://github.com/m0khz/Simple_VFO

The hardware is spread across three separate boards, that plug together and slide into a standard Hammond case, providing a complete 'plug-and-play' platform for experimentation. The project presented here uses a Si5351 breakout board, a GPS breakout board, a Teensy 3.2, an inexpensive 2.2" SPI TFT Display Module 240x320, together with a few additional bits and pieces.



Project highlights:

Dual VFOs, with A/B, A=B.

Independent frequency control via the encoder.

S meter display using a 'rainbow' algorithm creating a nice looking UI.

Call sign, Lat/Long, Time/Date and Maidenhead is also displayed. In this mode the active VFO LO is available on CLK0 of the Si5351 module.

When in Signal Generator mode, you can set two independent frequencies between 3 - 200 Mhz, available on CLK0 & CLK2.

Switching between VFO and signal generator modes is achieved via the encoder push button, all other navigation is via push button switches on the top button board.

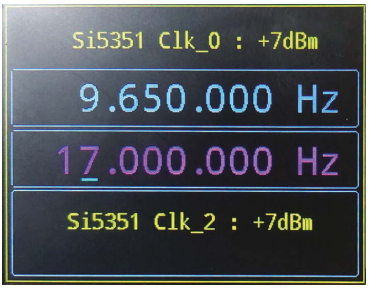
To prepare your system to enable development using the Teensy hardware follow the instructions here:

https://www.pjrc.com/teensy/td_download.html

The software is organised across multiple 'tabs' to help you navigate through the code,

these ‘tabs’ have been logically named and provide a lot of re-usable software functions to help you develop your own projects in future. I am not a programmer but have learnt enough (just) to start developing my own projects from scratch, this is my first ‘clean sheet’ software project.

The hardware has been developed using the Open Source KiCad EDA schematic capture and PCB layout software. I highly recommend you have a look at this software, it’s free with no restrictions. As usual there are many tutorials on YouTube but I found this series particularly useful:
https://www.youtube.com/watch?v=9hcQQQxoRI0&list=PL3by7evD3F51fKkyrUbH-PCdwPCWc9F8a



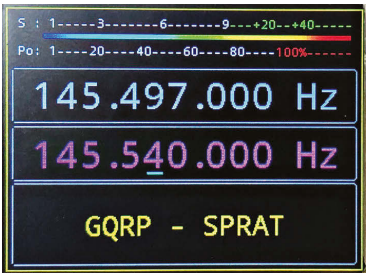
Software:

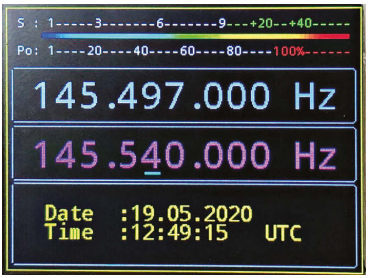
To assist in software navigation ensure you enable ‘Display Line Numbers’ using the ‘Arduino> Preferences’ , and check box options. There are a few libraries that you will probably need to install, before you can compile the code, for example:

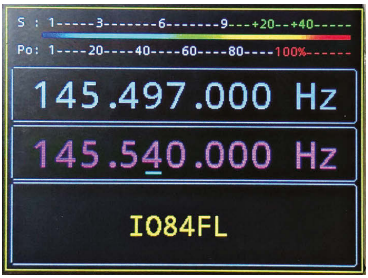
ILI9341_t3.h
si5351.h - from
https://github.com/etherkit/Si5351Arduino
TinyGPS++.h

Once you have built your hardware and can compile the software, you can tailor the code to suit your specific requirements. I have commented the code throughout to aid understanding and below I have highlighted some changes you may wish to make.

File - *Simple_VFO_Plus_V1_01*
Line 149 - add your Call Sign
Line 175, - The ’splash’ screen is pulled in here, use this utility to create new picture content:
// http://www.rinkydinkelectronics.com/_t_doimageconverter565.php





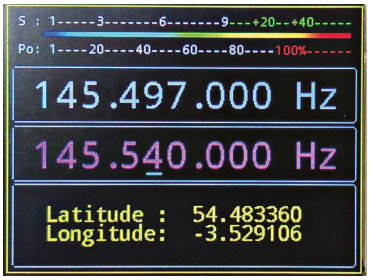


And replace the generated file in the “image_240_320.c” file, choose any picture you like, perhaps your QSL card but ensure you scale your image to 240x320 pixels before conversion.

File - *display_co_ordinates.h*

Lines - 77 - 80 define the VFO assignments, change to suit your requirements.

//unsigned int BFO_freq = 9000000; // not used for this application



unsigned int transverter_offset = 116000000;
unsigned int if_offset = 9000000;
unsigned int vfo_default = 20500000;

Line 100

unsigned int sig_gen_def_freq = 10000000; // signal generator mode default frequency

Lines 114 to EOF, you can configure the screen colours here to your liking, do not change the positional data.

File - si5351_functions.h

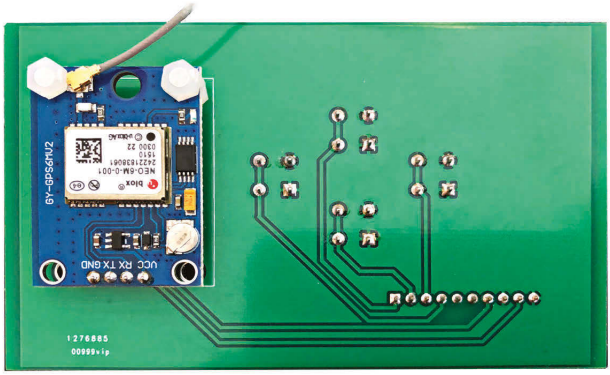
Line 24 - si5351.set_correction(31830, SI5351_PLL_INPUT_XO); // Set to specific Si5351 calibration number

Lines 47 & 56 - Uncomment to implement BFO output on Si5351 CLK2

File - vfo_and_band.h

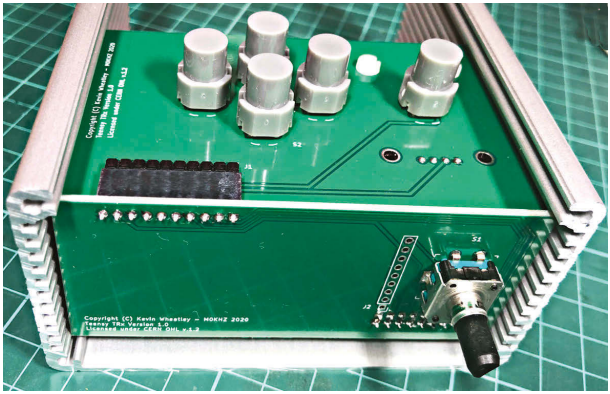
Lines 31-32 - This is where the Si5351 frequency is configured:

Change to suit your requirements.



PCB Assembly

Assembly is straightforward, most of the parts are on breakout boards although there are four 0805 surface mount components to install for the encoder interface. Mount the display so it touches the PCBC and ensure the headers are mounted on the correct side of the PCB, or the assembly will not fit the suggested enclosure. Rather than words here's some pictures:



There are a number of different ways to power this project depending on your intended project, direct for the Teensy programming cable, +5V via a pin header or +13V8 through the processor board voltage regulator (not fitted in above). One work of caution, if not running from the Teensy USB connector, there is an isolation track to cut on the bottom of the Teensy development board, as detailed here:

https://forum.pjrc.com/threads/19228-confused-again-Cutting-VIN-from-VUSB-Teensy-3-0?p=44024#post44024

With a small amount of metal bashing with drills and files, the PCB assembly slots directly

into a standard Hammond case, Hammond 1455N1201 Extruded Aluminum Enclosure 123 x 103 x 53mm(a longer version is available if your project need more space).

Future Developments

I am currently prototyping a backplane and power meter/external relay switching PCBs, the existing software will be modified to incorporate these, access via a 'long push' on the VFO Lock button.

Once the modifications are installed, you will be able to switch between VFO/Sig Gen and Power meter measurement using the long push method.

In theory with this addition to the hardware and loading different software (not yet ported/developed) it should be possible to run **Farhan VU2ESE**'s *Sweeperino* software - See :

http://hfsignals.blogspot.com/p/sweeperino.html for details.

And finally

The PCBs have been designed to meet the 'sweet' spot for manufacturing costs, I use SeeedStudio, the cost of manufacture for each of the boards attracts a price of $4.90 for 10, plus postage. You do have to wait a few weeks before delivery, but if your anything like me you have multiple projects on the go, so the delay for PCBs isn't an issue.

This design has been successfully built and tested here in my shack and also by **David G4RVH**. Happy homebrewing

73 Kevin M0KHZ

Club Sales Update

Graham G3MFJ email: g3mfj@gqrp.co.uk

I have just spent a few days bagging the contents of my latest order of toroids – over 3000 of them and weighing 10kg. I am not complaining or looking for sympathy, I took the job on 20+ years ago, and I am very happy supplying the parts that members now in lockdown are using to actually construct things.

However, what I find upsetting are those orders for 'the maximum' of every item, and I 'cracked' when I received an order for 2 packs of all toroids, and 20 or 30 of every semiconductor I stock. Not to mention the 50-off all the capacitors I stock.

I already spend over half my spare time dealing with orders, and I do not intend to stop, I do not wish to stifle home construction, quite the opposite, but what I will not do, is stock members shelves so that when they eventually become SK, their partner has to dispose of hundreds, maybe thousands of items, that the member has bought from club sales because they are cheap – all items that I have had to count.

So, from now on, I will refuse to supply unreasonable quantities of items – if you need 2 packs of toroids, then please say why. I will no longer supply the "2 bags of all toroids" folks any more.

The same type of rule also applies to the "20 of all semiconductors" folks as well. Should you really need large numbers of these items, then please say why.

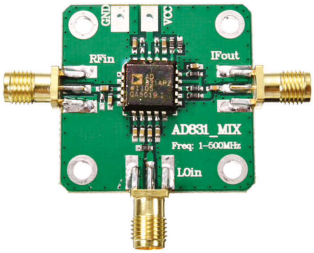
Project Building Blocks

Paul Debono 9H1FQ Email: paulrdebono@gmail.com

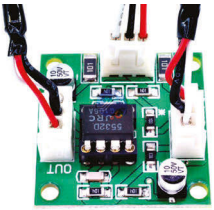
Browsing through online shopping outlets, I came across various breakout boards and components, that sparked my imagination for projects. That's how this article originated! I have absolutely no connection to any seller or enterprise and my intention is to light a spark, only as a guide, based on personal experience.

So, here is what I came across, some of which have been included in my projects.

RF Mixer AD831



Not seen often in ham hf projects, but it's certainly, a much better performance than the NE602, except, it has no built-in oscillator. LO input can be as low as -20dBm, and does not overload with high level signals or BC breakthrough with the club's Toko LPF. Not really suitable for portable work, because it draws just over 100mA.



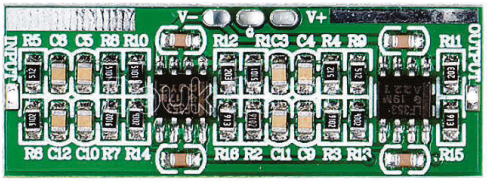
Audio Preamp-NE5532

This low noise high performance audio preamp chip is still used in audio professional equipment today, despite its age! It can be configured with both single and split supply. Excellent as a post Tayloe, switching mixer amplifier. One chip (containing two opamps) can provide up to 100dB gain needed for DC receivers!

Audio Power Amplifier-TDA2822

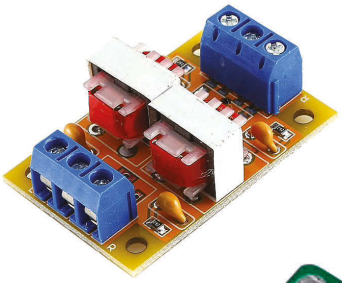
This certainly, is a much better amplifier than the usual LM386! Many designers do not give much attention to noise at audio level. Much lower noise, more gain, and it's a stereo amplifier. For some applications, we are tempted to use the two amplifiers, in bridge mode. Be careful, not to run in this mode, with a supply voltage higher than 5V because, it will blow up! There is plenty of volume, with the two amplifiers in bridge mode! It's an excellent amplifier for a monaural project.

For those who still prefer the classic LM386, lots of boards available, with either SMD or DIP formats. For lower noise, omit the electrolytic capacitor between pins 1 and 8, to drop the gain to 20dB. Still plenty of audio, but much less noise!



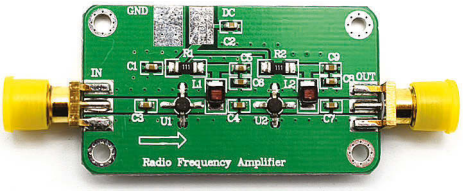
Mains Hum filter

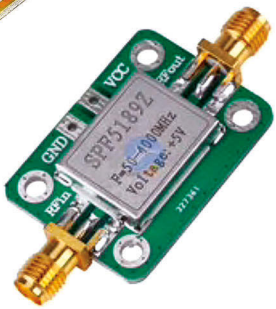
Will help clean DC receivers from mains hum picked up via the antenna. To be used between audio stages. Cheap price, when compared to almost all others available in the western world.



Mains hum Isolation

An pair of audio transformers, to isolate mains loop hum, it can be used between audio stages. Normally 600Ω, in and out. Ideal for coupling your computer to a rig for digital operation



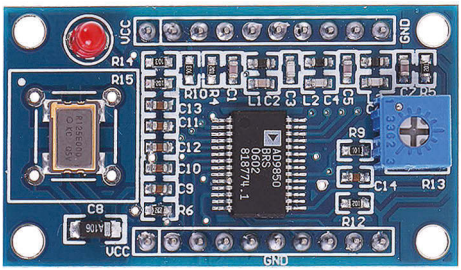


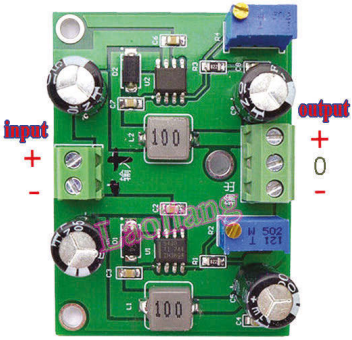
Low Noise Amplifiers

There are several types of these wide band RF amplifiers, many claiming to cover very wide band. They're also available with different frequency range and gains, sometimes variable.

DDS VFO

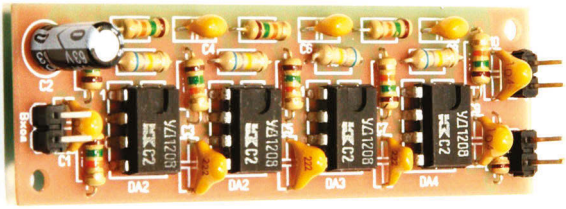
All sorts of DDS are available, some covering up to 6GHz, with prices, as low as $20. The AD9850/51 types are particularly useful from audio to 30+MHz with a very clean sinusoidal output as well as a square wave at the lower range of operation.





Single To Split Dual Rail PSU

Always check the supply requirements of all modules, especially, the audio modules, as some of them may operate only on dual rail supply, others, on both! This module will produce a dual + & - and ground from a single supply rail. Dual split power supplies are used , especially on audio chips to cut hum, almost completely!.

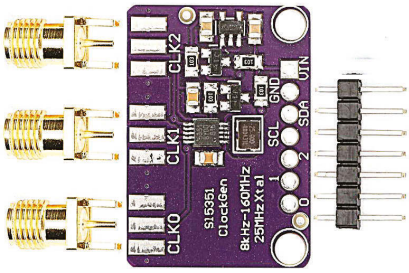


SSB CW Audio Filter

When making your own receivers there's often a need for a suitable audio filter. There are literally scores of effective filters, available. Some fixed, others, variable, perhaps even switched for both SSB voice and CW operations. One multi-pole, multi-IC audio filter type is shown here that came from the Russian federation.

Volts/Amps Digital Readout for PSU

Very useful. I have three bench power supplies, and they are all fitted with these meters. When finishing and power up a new project, very important to check the current drain, as an indication that all is well, before a possible blow up!!!

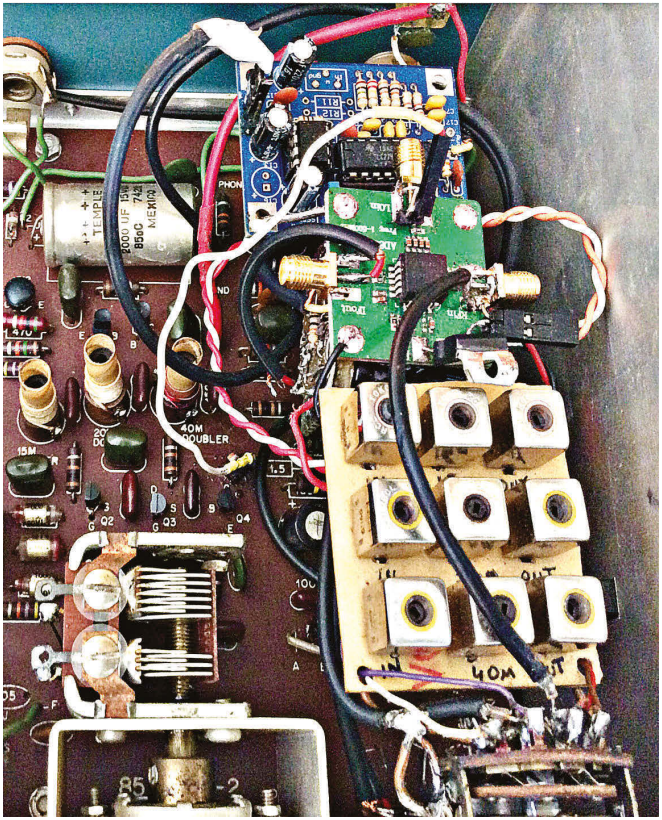


SI5351 VFO

For some purposes, you could use a non-sinusoidal output, one such chip is the SI5351, that can have three differing outputs. They're also available as a complete unit, programmed with quadrature output, so, the typical 74AC74, divide by four stage, can be eliminated in a phasing or Tayloe mixer SDR rig.

In Use

Some of these modules were used to modify the deaf rig shown below, making use only of the very stable VFO. The VFO was injected into an AD831 mixer, feeding an NE5532 opamp, then to an audio filter, and finally, a TDA2822 amplifier. The result, was a very clean signals, and can read 1µV signals easy.



Obtaining modules

Most if not all are available from the local or your favourite far-eastern suppliers. But before ordering, always check reviews and seller ratings. Always, check the modules do what you need them to achieve. There are at least four far east sellers.

Importantly, always check the safety features, especially on switch-mode type power supplies.

Valve QRP Reports Winter Sports 2020/2021

Colin Turner G3VTT. Email: g3vtt@aol.com

One of the things I like about the Valve QRP activity sessions is how many folks take up home construction and actually strive to get on the air. As WU2D says on his You Tube channel, (well worth a view), 'Just build something'. You can find him under the name 'Mikrowave'. His projects reach out to the safe reality of the past and show what can be done.

Alan G4BLI from Plymouth unfortunately missed the deadline for the November activity period, (please try and get them to me a week after the event in Word format), and he tells me he operated with a two valve transmitter designed by G3NKS, using a pair of 6V6s as I recall, and a three valve VFO from a 1965 Frank Rayer design.

Good old Frank Rayer G3OGR who produced a wealth of simple valve and transistor designs in the 60s and 70s. Alan's receiver was the recent Sprat G4HOJ TRF receiver. Alan has asked for GQRP to keep these sessions going.

Dave G4FKI from Bedford used a Codar AT5 and inverted 'L' antenna from December 29th to January 2nd. He worked a half dozen stations including G4ALG who was a prolific QRP operator and it's great to see Steve back in the logs.

The VFO & Tx used by G4BLI

Mike G4AQS was pleased to hook up with me on New Year's Eve. But unfortunately he had disconnected his valve transmitter for alterations and had to use his MKARS80. However he did have an enjoyable time with his new valve transmitter and of course the KW77 receiver. The transmitter was an experiment with a ceramic resonator VFO and it covered approximately 3.5 to 3.6MHz.

G4BLI's regenerative receiver

Initial tests proved it to be extremely temperature sensitive but epoxying the resonator within a 1/2" lump of steel calmed it considerably, plus very loose coupling of a few pF to a triode strapped EF80 was followed by another EF80 and a 6P1 power amplifier to give 4+W.

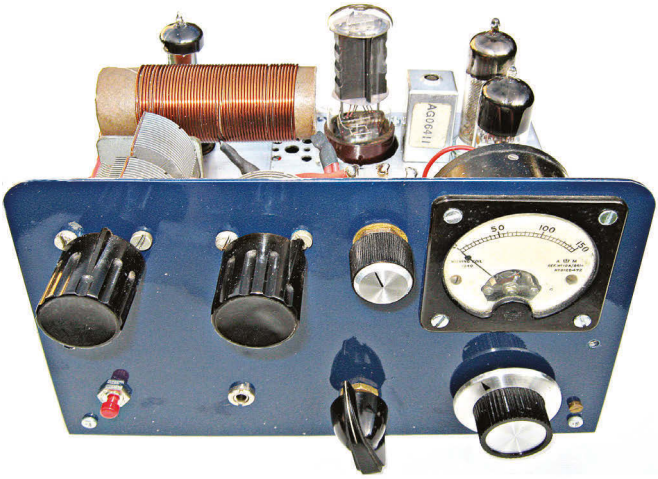
He had varying report from 'drifts' to 'sounds great!'. He worked a string of stations including the infamous G4ALG! It's great to see Steve back on the air. On New Years Day he switched to his Paraset to work our G4XRV and G8XEV with the TRF receiver in the Paraset inhaling the signals. Mike's 6P1 transmitter is shown overleaf.

Paul G0OER told me that 2020 with the lockdown was the 'year of the valve' for him with so many projects completed. He updated his HRO 80m coil to bandspread it and had an

article published in the November copy of 'Signal' the VMARS magazine. This is an excellent periodical and is highly recommended. He also completed a TRF receiver designed by G3YHV using B9A valves with an ECC82 regenerative detector and an ECC81 audio amplifier.

He has subsequently fitted a muting circuit which is always a problem with TRF receivers. In the Winter Sports he contributed by using valve equipment and worked a fair number of stations, (including G4ALG!), and used his DDS VFO for divining frequency. Like many others before he has had to learn how to use the HRO phasing control and looks forward to more valve activities.

Mike's 6P1 transmitter



Ancient and modern sit alongside each other

Richard G0ILN used his hybrid TS530s and made 14 contcts with the power held down to 5W. He also used his QCX and FT817 transceivers and an old clunky Katsumi electronic keyer.

Actually these are quite good keyers and send positive firm CW with an inbuilt keying relay and they certainly do not move around the desk with the frenzy of the QSO.

For the whole of the last day of Winter Sports **Peter G3XJS** used his valve gear. Although his Drake 2B covers 60m he didn't have a valve transmitter to go with it on that band. He therefore concentrated using his Drake 'C' Line on 80m. The first first QSO was with Ian G4GIR who was running his AT5 and subsequent contacts were with QRPers but only Martin G4ZXN (6V6 CO/PA) and Dave G4FKI (AT5) were running valve gear.

He later had an AT5 to AT5 contact with G4FKI and during the contact Dave was using a Codar CR70 TRF receiver. Peter has a bit of work to do improving changover between the AT5 and 2B. Hopefully he can organise something to give the changeover between

the AT5 and R4C making a valve compliant separate station. As our Communication Manager Peter considers the valve section of Winter Sports to have been a success and he certainly enjoyed his interaction with the 'heaters'. Well we 'filamenteers' certainly enjoyed him joining us!

Chris G3ZJK operated on 160m and 80m using a home made transmitter and his TS830s for a receiver. His antenna is a 70m long doublet using home made feeder and a PA0LL tuner. The transmitter was another G3OGR design using a pair of 6AM6s for VFO and driver and a 5763 PA.

The transmitter has AM capability using an ECC83 and a 6BW6 arrangement and he has fitted an internal power supply and semi break in circuit. The power supply uses a regulator to control the HT supply instead of a dropper resistor and he worked a number of QRP stations including the G5VZ, G3MCK and G4ALG. A picture of his transmitter is above with the front panel that is from a German company.

Finally I've heard from **Ian G4GIR** who tells me he also had a good time in the event and is enthusiastic about incorparating Valve QRP into the Winter Sports. Ian used Wireless Sets 19 Mk 1 and 2, a CO/PA with and 807 PA, a transceiver using a 12AX7 and his latest creation using a 6V6 PA. The construction technique is based on the 'Longfellow' design but used a 6L6. He made thirteen QSO's in all and gets a good 5 watts on all bands with his various rigs. You can find details of the 'Longfellow' at https://qsl.net/ve7sl/longfeller.htm and the 6L6 design comes from https://w5dxs.tripod.com/6L6.htm. Nice to see the modern internet supporting nostalgia technology.

My thanks to you all for your reports, I hope I didn't miss too much out, and can I remind you that the next valve QRP week end is April 17th and 18th 2021 and please send me your reports as soon as possible after the weekend in Word format. Just send a short note about the equipment and any interesting contacts. I don't need logs but a picture of the equipment would be nice. Try and call CQ on the half hour and hour and remember to tune around for those crystal controlled, just like the old days.

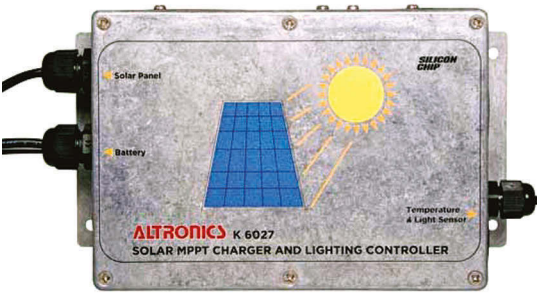
Colin Turner G3VTT, 182 Station Road, Rainham, Kent ME8 7PR

Simple Solar Panel Current Monitor System

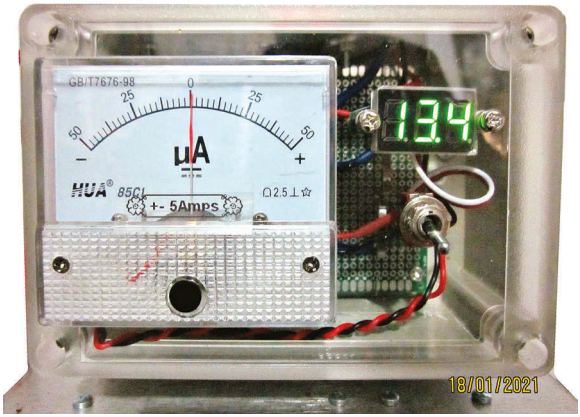
Glenn Percy VK3PE, email: vk3pe@bigpond.com

I read with interest, the article "Starting with Solar Panels" by G1TEX in SPRAT #184. I have a similar system using two solar panels rate at 120W total. In his article, 'Tex' lamented the lack of discharge current indication.

My own system is slightly more 'complex' in that I use an MPPT system based on a kit by Altronics™[1] here in Australia, to float-charge a 12V deep discharge battery. The system project was described in *Silicon Chip Magazine* February 2016.



The Altronics kit (catalog K6027), also has no provision for monitoring of current (or voltage) of the battery. But it has been installed for more than a year with no problems.



Since then I've added a simple monitoring system using one of the cheap three-digit voltage monitors from eBay, plus an older analogue meter for the current, bridged with a suitable shunt - of course!

The analogue meter though, is a centre zero type and although it doesn't offer 'digital' accuracy, it's just fine for this application. I have fitted an on/off switch for the meter to save power if that proved to be a battery drain problem, but it's so low I've not bothered to turn it off.

I haven't included a schematic diagram as its pretty simple. The voltmeter is across the battery and the meter, with shunt, is in series with the positive lead. The shunt value will depend on the meter sensitivity. In my case the shunt was 0.02 ohms, made from two 0.01ohm resistors available from CPC/Farnell/Element14™ (Cat #1200374) in series, giving me a ±5A indication, which is adequate for my use. Your needs and shunt value may vary. The meter has the advantage of being very easy to quickly appreciate the current flowing into, or out of, the battery.

[1] **www.altronics.com.au**

Glen Percy VK3PE, 15 Brangus Av, Narre warren Sth, Vic 3805, Australia

On-Air Activity Manager

Peter Barville G3XJS Email: g3xjs@gqrp.co.uk
Felucca, Pinesfield Lane, Trottiscliffe, West Malling, ME19 5EN.

WINTER SPORTS

As I look out of the window it truly is winter, with several inches of snow on the ground, our lane impassable and the temperature below zero. However, the good news is that those of us who participated in Winter Sports enjoyed what was, for most, one of the more enjoyable and better supported events for some years.

The general impression was that activity levels were up compared to recent years, possibly because of lockdown.

We all experience local noise, to a greater or lesser extent, and that is certainly an issue mentioned by many, but it is often possible to alleviate the problem by careful use of receive aerials.

Another often mentioned issue is that of QRM from QRO and/or contest activity. Unlike local noise, there is little we can do to combat this problem, except by maintaining a high presence on the bands around the QRP centres of activity (COA).

I was pleased to receive 22 logs, an encouraging number, including some from long-term members who have not previously submitted a log. My thanks go to everybody who took part in the event and particularly to those who took the trouble to compile and submit a log and report including: **G0BON, G0ILN, G3JNB, G3MCK, G3NUA, G3TYB, G3VTT, G3XIZ, G4ALG, G4ARI, G4DNP, G4FGJ, G4GHB, G4GIR, G4HMC, G4TGJ, MI0BPB, MW0IDX, DF1HC, DM4EA, RW3AI,** and **VK3YE.**

I wish space would allow me to include the highlights and comments from every log, but obviously space is limited. **Volker DF1HC** said he'd nearly forgotten how fascinating low power cw operating is. He also praised his phasing noise eliminator. **Gerald G3MCK** said that he used all solid-state equipment "just for a change" and achieved his best score for years (all 80m). He agrees there was more activity than in recent years but regrets there are now so few OK stations on the bands.

They used to be very active during WS years ago. **Roger MW0IDX** was called by AK8A (near Chicago) on 20m during one of his QRP SOTA operations. **Colin G3VTT** once again pulled the rabbit out of the hat and worked into USA (W3TS) on 80m early one morning using his homebrew valve CO/PA (5W) and Drake 2B receiver. **David G4HM**C commented that he was pleased to note the number of stations using homebrew equipment.

He ran an all homebrew tcvr himself. **Tim G4ARI** had plenty of fun with his Rockmite and "bit of wire", while **Valery RW3AI** stacked up a mountain of contest QSOs on the HF bands using his Xiegu G90. **Tom DM4EA** had "Big Fun" and used his new "CE0Y-7-m- Triple-Leg" aerial (see DK7ZB website). **VK3YE** used the club call VK5WAT/3 during the event, and a video of his activities can be found on:

YouTube: https://www.youtube.com/watch?v=_eyLKZmd5tw.

It has proved very difficult for the Club to decide who the G4DQP Trophy winner should be, because there are some outstanding logs amongst those received. Ian G4GIR was active with no fewer than 23 Tx/Trx, most of which are homebrew. With his QCX 17 he worked

CO8LY on 17m and on 20m he worked AA9WS using 1.5W from his KR80.

Ian continued, saying that it is the first time he has taken part seriously in WS, which he found very enjoyable but "it's now time to catch up with the housework!" The Club has not issued a Runner Up Certificate for this event before now but Ian's efforts and support have earned him the first ever such certificate. Well done Ian!

He was just pipped to the post by **Chris G3XIZ** who was active every day with at least one out of a list of 19 TCVRs, 7 TXs and several receivers – all homebrew. He had QSOs on LF, MF, HF and VHF using CW, DSB, SSB, FM and FT8. Although not included in his log, he also fired up his WSPR TX on 160/80/60 and 40m.

Perhaps the most unusual QSO (with near neighbour G4FGJ) was with his "Key Fob Tx" running 25mW on 433MHz. Not the most stable of signals, perhaps, but good enough for a solid contact. The Club is pleased to award Chris with the G4DQP Trophy and to thank him for his excellent support and fascinating WS log. My congratulations, and those of the Club, go to Chris.

CHELMSLEY TROPHY:

The Club is pleased to award the trophy to **Peter GM0EUL** for his excellent QRP log compiled throughout 2020. Peter worked a total of 31 separate DXCC entities, all on 80m and 40m.

Although he also worked plenty of Dx on 20m he did not include those contacts in his entry as his aerial on that band is a homebrew Hexbeam, which is of course multi-element. His best Dx was K1CX on 40m, which was also his first QSO with his new KX3 (5W). Our congratulations to Peter for a fine entry!

G5LOW:

Richard G3OTK used the Club's call sign during the RSGB Christmas and New Year "Hope QSO Party" Contests. Using 5W in the 10W section he achieved 4th place in both of the December CW contests and was placed second overall. In the January CW contests he managed fifth and second positions, being placed fourth overall.

The second session yielded by far the best conditions and he had 68 contacts in the 90-minute contest, the highlight being a QSO with K1RX at noon on 40m! Richard also did pretty well using his own call sign during the SSB sections of the Hope QSO Parties.

A note from **Duncan G3WZD** advises me that an announcement went out recently from ***CWops*** that, **Stew GW0ETC** is the newly-elected President of ***CWops*** and this is the first time they have had a President from this side of 'The Pond'. They have a new Slow Speed CW Contest for Europe. Details here: ***http://www.k1usn.com/sst.html***

Propagation on the HF bands has fallen away a little since the Autumn but there's every reason to be optimistic that things will pick up over the next few months. Do try and get on the bands with QRP as often as possible, and don't forget G3VTT Colin's Monday Activity Day (every Monday).

72 de QRPeter G3XJS

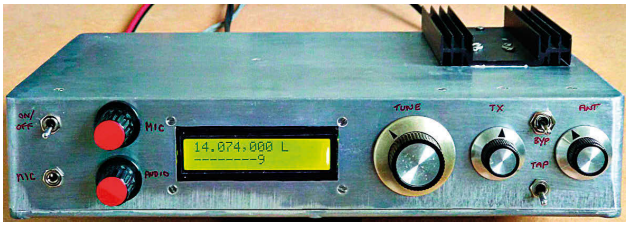
These are the International QRP Calling Frequencies:
CW: 1836, 3560, 5262 (UK Only), 7030, 10116, 14060, 18086, 21060, 24906, 28060
SSB: 3690, 7090, 14285, 21285, 18130, 24950, 28360 kHz
But they are "Centres of Activity" so please spread out if activity levels are high.

MEMBERS' NEWS

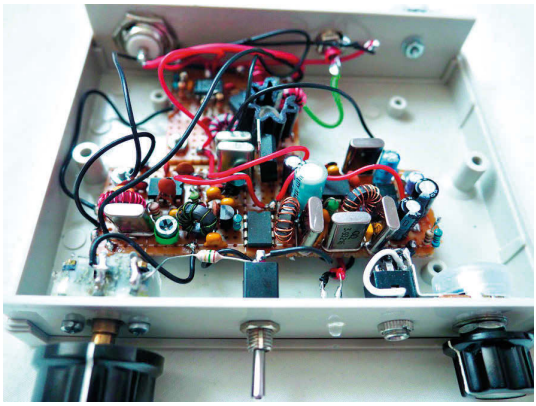
by Chris Page, G4BUE

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

Some personal news to start this column. June and I have sold our QTH at Pulborough, West Sussex and all being well, after almost 24 years here, we will move to Bexhill-on-Sea, East Sussex at the end of March. I will be QRT from here by the time you are reading this and am not sure when I will be QRV from the new QTH. It will depend on what antenna(s) I am able to put up, which will be some form of wire and/or a vertical. I have sold my towers and beams and will be joining most of you who are only able to use those types of antennas. I will report further next time.



M5AHQ is a fairly recent member of the club and the picture right shows his lockdown project, a 20m QRP SSB TCVR called 'Lockdown20'. John says, "It started out being a close copy of the elegantly simple BITX20 design by **VU2ESE** with a Si5351 synth and PIC control micro-controller and display by the end of the first lockdown. Through the autumn and the second lockdown, a number of enhancements were made to put in a high performance IF amplifier and AGC based on the Hycas design by **W7ZOI** and **WA7MLH**, S-meter, power meter, inbuilt T-match antenna match and few design ideas from *SPRAT*. The rig is on 24/7 monitoring and reporting FT8 signals and John has worked a number of SSB and FT8 stations, including South America over the last few weeks.



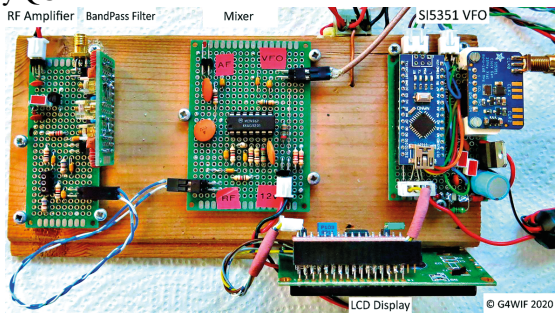
Pictured right is **GØEBQ**'s new scratch built version of the 'Simple Superhet Transceiver' by **N6KR** for /P use, although Nigel is not sure when that will be! It gives 1W out with the club 2N2866 equivalent on 20m and he gets about 25kHz shift from the VXO using two crystals kindly supplied by **G3OOU**. Nigel has managed 11 DXCC in the last few days, the best being UA9, and writes, "Our local club at Leiston are in the process of setting up zoom lectures using GQRP club material which **GØFUW** has offered his kind assistance, so we are trying to make the best of things and create some interest".

OH5JJL found a KW Ten-Tec Argonaut 515 radio (right) on *eBay* by a G-QRP member and couldn't resist it. Tuomas has had lots of fun with it and asks if mem-

bers can let him have more information about the KW series Argonauts sold in the UK, <oh5jjl@gmail.com>. He says another great classic, the Heathkit HW-9, has been in active operation recently. **G4NSZ** has had a FT-817ND for many years and recently put up a new 33 feet end-fed antenna on a 10 feet fishing pole on his balcony then down to a tree at the front of the house. Mike wound a transformer un-un for it and says it works surprisingly well, giving him some two-way QRP QSOs, including one with T7.

MØNDE says the Dover Construction Club hosted in the workshops of **G3RO**O ceased around 2009 after Nigel moved away, and there was a decline in attendance soon after. With the advent of Covid he recently suggested they should restart as a virtual club using *Zoom* to communicate, and five members are now meeting up again on Thursdays. He writes, "Our current project is the power meter and loop tuner featured in a summer edition of *Radcom*. We have had PCBs manufactured and these are populated, and we have just ordered 300 1mm brass butterfly capacitor plate sets. A club in Scotland has shared the costs of the capacitor plate laser cutting with several builders interested, and **MØPKH** has made us up our game to produce quality PCB layouts for our projects. Other current projects include a shield for the **K3NG** keyer that sits on top of the Arduino 2560. I am also laying out a portable wire tuner to be used with my QCX Mini".

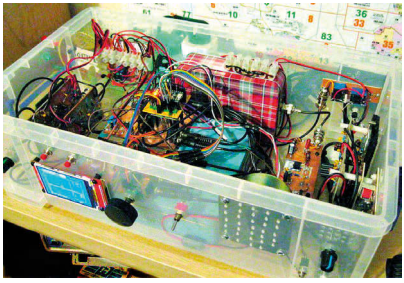
After proof reading the Spring *Sprat*, **G8INE** and **G4WIF** decided to have some early fun with the **N6QW** DC RX which appears in this issue. Tony writes, "We have documented our builds to encourage others to have a try, see <www.fishpool.org.uk/dcrx.htm> It is astonishing how well a simple DC RX can work. Also, built as modules, they can be used subsequently in other projects". His RX in development screwed to a plank of wood is pictured right.



After a recent hilltop hike to net control the RF Superspreader Covid-52 event, that promotes the use of 146.52 simplex for DXing and just plain fun, **VE3IPS** found a small folding tabletop table was in order to improve the operating situation, and the aluminum table can also act as a counterpoise. For the recent Winter Field Day event, John used a fishing pole mounted on a trailer hitch with a 40/20m linked dipole and was up and running in five minutes. Having the IC-705 in its back pack also made the ability to deploy rapidly another five minute task. **VA3GKX** set up a tree branch mount end-fed antenna for **VE3IGG**'s FT-857D, and **VA3JKL** operated a 20m hamstick from his car deployed FT-857D. Due to increased interest in the 52 channel they had many participants that do not have HF equipment, enjoy themselves for fresh frigid air and a chance to lose some toes to frost bite!

N2CQR is running out of radio projects to keep him occupied while he is SITS (Staying In The Shack). Bill recently resorted to fixing up an old but nice KLH FM broadcast receiver. **M1LCR** has been building his Russian 'Druzhba' TCVR kit from **RV3YF** that he says is a mix of older Soviet technology (transistors, relays ICs etc) and modern microprocessor driven (Arduino) DDS chips. Adrian says, "The TCVR architecture caught me slightly unawares as well; the IF frequency of 8.8MHz (or therea-

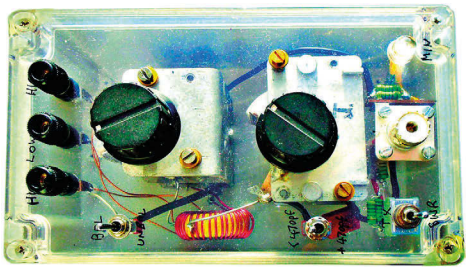
bouts) is used for both TX and RX paths, similar to a uBITX. However this is up until what appears to be a 'double-double' balanced first mixer (RX chain) or last mixer (TX Chain), both upper and lower sidebands are present in the TX path. It's only in this mixer that the unwanted sideband appears to be removed as the DDS VFO changes its frequency (+/- 2.4kHz or so), thus the unwanted signals disappear. The transformers were a little difficult to wind, one taking two attempts. Anyway the port to port isolation is very good, and testing with around 400mV from my sig genny to the input port, still resulted to a nice clean signal on my analyser. The Schottky diodes in the mixer are Russian/Soviet in origin, and clearly work very well. I have not come across this (double-double mixer) before, in homebrew or kit builds, has anyone else? Or the DDS VFO changing frequency depending upon mode?".

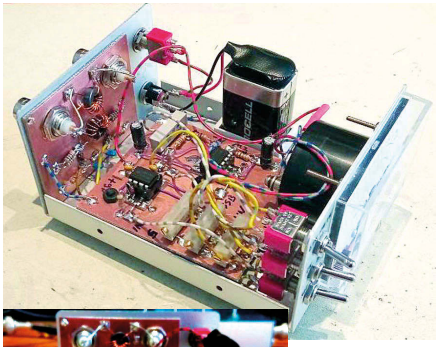


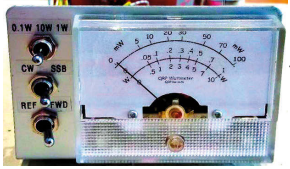
MØNTV's recent lockdown project (left) was a scratch-built, **ZL2CTM** inspired, Teensy powered, SSB SDR phasing TCVR he calls the 'Really Useful Rig' as it is enclosed in a Really Useful Box! Nick says it got a mention in the latest *SolderSmoke* podcast (228) and there is a video dedicated to it (including some on-air RX and TX) on his new *YouTube* channel - 'M0NTV Homebrewing'. **G1KQH** says you can download **IZ3AYQ**'s *Minimalist QRP Book* v5.3 at <https://drive.google.com/file/d/1dw61-PQ-4JA9feh93H_KrldD4RpN1zZT/view>. It is 77 pages, in English and is free. New member **OZ1DTF** is using a FT-818ND and wires with either a 49:1 transformer or ATU. Klas asks if a schematic of the Sotabeans power reducer (page 36 *SPRAT* 185) is available?

During a particularly cold snap, **G4XUZ** decided the dining room table was a much warmer operating position than his usual shack, so he set up a temporary table-top QRP 80m station with his QCX+ TCVR and G-QRP Sudden ATU (pictured left). Ray says it, "Worked a treat, the usual set-up is right by a window and, although it is double-glazed, there's a chilly down-drought when the weather is extremely cold, so moving my minimalist QRP station to a warmer position was very welcome. If there's not too much objection from the XYL, I might stay on the dining room table until the summer!".

G3VTT has recently built a version of the Limerick Sudden ATU (left), but using air spaced broadcast variable capacitors. Colin says it turned out heavier than the original but was an interesting exercise with its 'see through' packaging. Congratulations to **G4ZXN** and **GW4LPB** on their Paraset to Paraset QSO. John wrote, "I knew **G4ZXN** was an avid user of his and uses it on an almost daily basis, while I had the occasional brief QSO using mine, so it was decided we should try a two-paraset QSO between us on 14 May. Well, in short it worked, I called on 3560kHz and **G4ZXN** came back with a beautiful clear signal. Nothing unique but very satisfying, great fun and well worth the effort in sourcing parts and building the radio. **GMØEUL** came across the <https://shop.heathkit.com/shop/product/replacement-parts-vintage-products-32?page=2> site last year when searching for an RF choke for his HW100. Peter says, "It seems Heathkit are trading again in some form, and they say there are still thousands of spares for vintage kits still in stock (but not RF chokes for an HW100 so I ended up making my own!)".

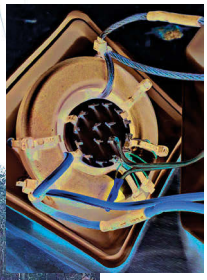




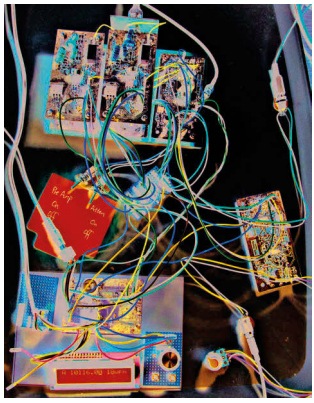


During the lockdown, **PH2LB** scratch built an analog QRPp power meter (left) based on a **W7EL** design *Simple & Accurate Directional Wattmeter* published in February 1990 *QST*. Lex added a CW/SSB (PEP) circuit designed by QRP enthusiast **DL2LTO** and the measurement ranges are 0.1, 1 and 10W, see <https://www.ph2lb.nl/blog/index.php?page=qrp-power-meter>. After building a QRP-Labs QCX-Mini, he found the ergonomics weren't good for desk/table work and designed a set of 3D printable tilt feet which can be folded back, allowing a better view angle when the QCX-Mini is on a desk or table. Strong double sided tape or contact glue holds it in place, see <https://www.ph2lb.nl/blog/index.php? page=qrp-labs-qcxmini>.

DM4EA promised to make 2021 a more radio-active year and joined the True Blue DXers Club (TBDXC) and registered for the 2021 marathon, an initiative to promote SSB/CW. One can participate either with SSB or CW, QRP, LP or HP, and Tom says it is still possible to register and enter results starting 1 January. He also erected a new antenna, a non-resonant triple leg vertical fed via ~12m of wireman based on the **CEØY** design, see <https://www.qsl.net/dk7zb/Vertikal/tripleleg.htm>, supported on a 50ft mast. A 1:4 balun allows Tom to tune 160-6m with his IC-703.



G4TGJ says his multi-band CW TCVR is coming along nicely with most of the boards now built. It covers 80m, 40m, 30m and 20m and Richard is working on a transmit board for 60m. After that, it will be built into a case and he will improve the software as the user interface needs some work. He has already made some QRP QSOs with it including a play in the Winter Sports and a dabble in a couple of contests. **G3WZD** is a regular participant in the weekly CWops CWT mini-tests, and normally runs full legal power, but a couple of times of late, after tune up, he inadvertently left the rig set to 5W and the amplifier off-line. Duncan says the amazing thing is that he hardly noticed any difference to the first call response rate, and his QSO run-rate remained largely the same! He uses an Optibeam 9-5 antenna about 50ft for 10-20m and his main 40m antenna is a quarter-wave vertical with eight buried radials



Thanks to all the contributors of this column. Please tell me how your spring goes for the Summer 2021 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 your home QTH during the summer and autumn months, so I can let members know to listen out for you.

G5LOW in the CQ WPX Contest

Dave Sergeant G3YMC 11029

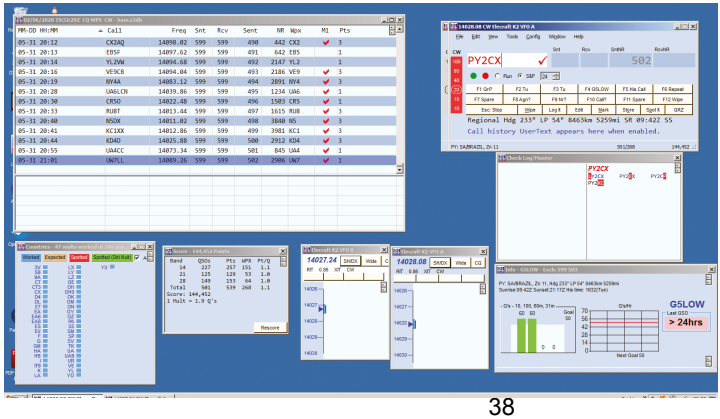
GQRP has a special callsign, G5LOW, which can be used for special events, like the GQRP Club Convention, during special activity periods like World QRP Day and our Winter Sports, and in contests where clubs can participate. As such I suggested that I used G5LOW in the CQ WPX contest.

CQ WPX is one of the major international contests of the year, with the CW section happening over the last full weekend of May. It is a very competitive event with the leading stations making 5000 or more QSOs in the 48 hours. There is a QRP section where all entrants are limited to 5W. I have entered this contest for some years and have regularly scored high in the UK QRP section. Would the attractive prefix of G5LOW increase my position?

The G3YMC Station

The station at G3YMC has for many years comprised a kit assembled Elecraft K2 with most accessories. Antennas are a fairly low 75ft end fed longwire and a Hustler 4BTV vertical, used mainly on 20m. Because of current VDSL issues I am operational at the moment only on bands 30m and above. So for WPX I could either do a 20m only entry or if conditions allowed an all band entry on 20/15/10.

All serious entrants to contests use contest logging software, in my case the free N1MM package run on my Windows 7 laptop (see screenshot). This is interfaced to the K2 for band and frequency control and also to a K1EL Winkeyer for easy sending of CW either with my Vibroflex paddle or from N1MM. See photos.



On the Day

One advantage of doing the higher bands is that there is no need to do the overnight periods so I turned on at

6.15 UK time on the Saturday morning. The rig had been left on 10m from the day before and was surprised to hear it packed with contest stations even at that time of the morning. So a 20m only entry was quickly abandoned and I spent the time equally between 20, 15 and 10.

A steady stream of stations was worked, mostly in search and pounce mode as calling CQ produced few callers. I soon realised there was confusion of our call clashing with F5LOW, a station listed in the Super Check Partial database used by all the contest loggers. Despite corrections many will have logged me as F5LOW and lose points, these big boys just don't listen and trust what their computer tells them, hi.

Although there were excellent sporadic E conditions, propagation to further afield was pretty poor and I later learnt that there had been a geomagnetic disturbance with the K index up to 5 at times. I managed a few USA stations on 20m but they were generally weak and the best dx was CX2DX on the Sunday evening. But apart from that it was Europeans all the way.

I spent just over 26 hours in the shack over the weekend and achieved 500 QSOs, a nice achievement. Results are as follows:

Band	QSOs	Points	Prefixes	DXCC
14	227	257	151	43
21	125	129	53	33
28	149	153	64	33
Totals	501	539	64	46
		Final Score144,452		

Aftermath

Was it worth it? Most definitely. Contests may not be everybody's thing but they are an excellent chance to make loads of QSOs and spread the word that the GQRP Club is active and working far more than a few short range contacts between members.

The RAW scores, i.e. before adjudication and checking, have now been published at cqwpx.com and G5LOW is second place in the G non-assisted QRP section with GQRP member **Alan G0TPH** operating as **M7R** in first place ahead of me. A double for our club!

I look forward to more members taking this unique opportunity to air G5LOW in forthcoming contests. I enjoyed it, you will too.

Interested in Morse Code?

Are you a die hard CW operator or maybe just starting to learn the code?
Maybe you collect Morse keys or just enjoy chatting about them?
If so then give the Brasspounder Morse Code & Morse Key Forum a visit!

https://forum.brasspounder.net

News members always welcome!
73 from "Brasspounder"

(sales@gqrp.co.uk) **GQRP Club Sales** *(sales@gqrp.co.uk)*

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

Antenna Handbook – 2nd 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 per book**

Polyvaricon capacitors –2 types - 2 gang (A = 8 to 140pF + O = 6 to 60pF), and 2 gang – (both 8 to 280pF)
Both come complete with shaft extension & mtg screws, and both are **£1.75 each.** **Postage is £3.50 (UK), £5.50 (EU) and £6.00 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 (* also in LP)** } **(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 - £2.00 (note – I may supply NE or SA, 602 or 612 as available. (Max of 4 per member) } things

MC1350 - £2.00 (Max of 2 per member) } like binders,

LM386N-1 - 4 to 15v, 300mW, 8pin **DIL - £0.45** } 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. 0.5WAudio amp 8pin DIL – **£0.20 each** } Use just

TA-7642 Radio IC – direct equivalent of **MK484** (& ZN414) – **75p each** } that postage

BC109B (metal) (npn) fT - 100MHz, hFE-320 **- 10 for 50p** }

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 – 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 - £2.50; T130-6** - £2.60ea. FT37-43 – 90p } **toroids includes**
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 - £1.50; BN43-202 - £2.00; 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 (ask for quote if you want more than 2 of the large toroids)

Standard MeSquares (0.25"), Little MeSquares (0.15") & MePads for SMD - £6.00 each plus post (UK & EU as parts for up to 4) :
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.***

Limerick Sudden kits RX & TX both single band (160 through 20m); **ATU** (80 through 10m) **£40.00 each plus post** UK - £3.50, EU - £6.50, DX - £9.00

NEW! Sprat-on-DVD – 1 to 184. Only £5 each to members plus postage, UK - £1.20, EU - £3, DX - £4.00
Now available as Sprat-on-a-stick – on a USB stick – same price and same postage

Sprat Binders – nylon string type – Black with club logo on spine -16 issues per binder – £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 info you will need to do that is –
The G-QRP Club Account, sort: 01-07-44, and a/c: 54738210

I can accept cash in GBPounds, or US$/ €uros (at the current exchange rates) – but please send securely!
You can order via e-mail and pay by PayPal - use sales@gqrp.co.uk – and pay us in GBPounds and you MUST include your membership number and address please. PayPal charge us about 4% so a contribution towards that is always welcome, or, send as a gift to friends/family - thanks