SPRAT

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DEVOTED TO LOW POWER COMMUNICATION

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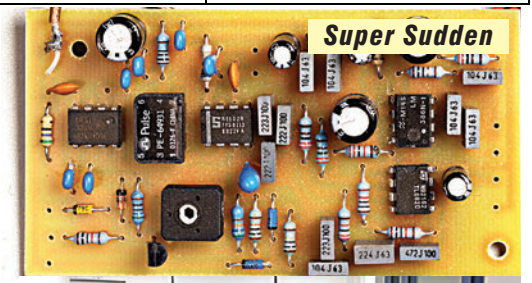
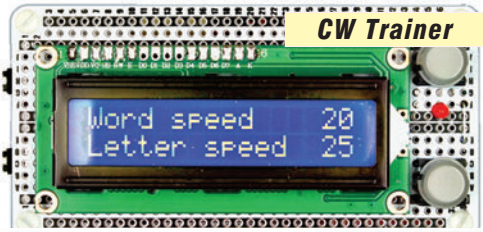
Contents





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Our founder George Dobbs G3RJV (SK)

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The Club Convention at the new Harper Adams University venue was a huge success. The good people at the Telford ARS did a great job in organising a superb venue with lots of car parking and excellent rooms. The Buildathon was a sell out and the VFO 'driftathon' was good fun. The talks literally had standing room only. I have had a suggestion that we might expand the Convention to include a CW Boot Camp and a Club HF station. Would members be interested and be willing to take the lead and develop the ideas? Let me know.

Just about the only negative feedback we have had about the Telford Convention is that it is too far for our Scottish members to travel; Rishworth was just about 'doable' but Telford isn't. Some Scottish members attend the Telford gatherings but if there is sufficient demand for a G-QRP get-together north of the border, then why not? **Roy,GM4VKI,** is looking at what is possible for 2020

I have lost count of the positive e-mails I have had about the colour printing in SPRAT. Only a couple of members said they prefer mono so, as the Treasurer says we can afford the colour without increasing the subscriptions, the colour printing will stay.

Daphne, G7ENA, is now fully installed as our Membership Secretary and is ready for her first round of renewals. Please be aware of that. All of our thanks must go to her predecessor, **Tony, G4WIF**, for his many years of efficient service, and for smoothing the hand over. Tony will still be running our web-site and the members e-mail group, which is in the process of migrating from *Yahoo* to *IO groups*. Continuing on the people front, **Dom, M1KTA**, has been our Communications Manager for over a decade and has decided it is time for a change. If you are interested in taking on the role, please see his page for more details.

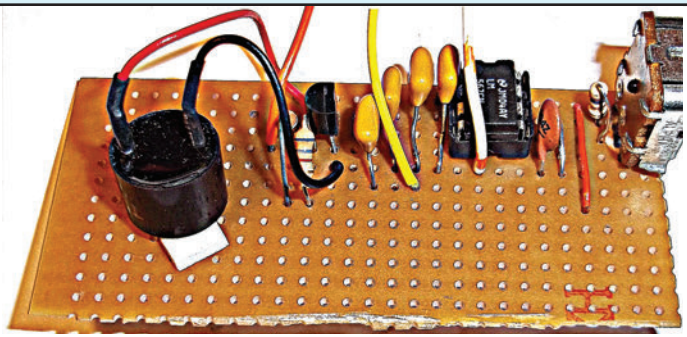
We will have a new Club Constitution to put to you in 2020. There will be no major changes but we have had advice that a few things need clarifying. I have also been wondering if we might arrange a G-QRP mini-DXpedition. If anyone is interested, let me know.

Finally, would you like to put the Club callsign, G5LOW, on the air during the Winter Sports or in a contest in 2020? Full details on how to book the call are on the Club website, or just drop me an e-mail.

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

A CW tone cleaner

Peter G4UMB



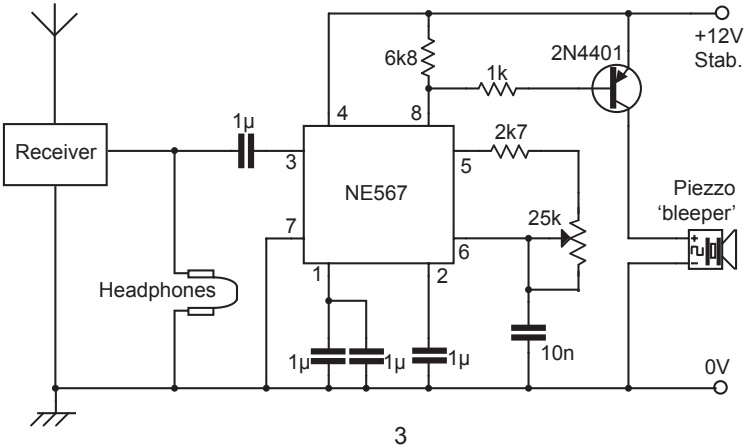
This is my simplified take on a circuit by R A Penfold that I found in a Maplin's Magazine April 1989 which I have experimenting with. It doesn't cope well with fast morse but does work with slower morse if the tone is good and free from warble .

It removes the background noise and cleans up the CW signal so that can you listen instead to a Miniature Piezo sounder once the signal is locked on, provided you can stand the whistle!. I made this because I downloaded a free Android App of a Morse Code Decoder which uses the mic. on your phone to pickup the signal.

When it picked up all the background noise it couldn't work properly; but it does work better with this unit. I have used a twin adaptor from the receiver phones socket to allow me to listen on both the headphones and to feed this circuit. It's based around the IC NE567

A tone decoder which is able to select a narrow band of audio frequency controlled by the resistance between pins 5 and 6 . You can use a fixed resistor of 15k instead of the variable resistor and 2k7 as shown. In any case you will need to tune your receiver so that the pitch of the CW note makes the Piezo sounder repeat the CW signal. It needs a stable power supply. Do not exceed 12V.

Use a small low power piezo bleeper otherwise it's too loud !



G-QRP CONVENTION 2019

Steve Hartley G0FUW

The new Convention venue proved to be a huge success. The Harper Adams University is a modern campus with excellent facilities. The Telford and District ARS did us proud by hosting the Convention in conjunction with their annual Hamfest which also saw an increase in attendance and lots of positive feedback. Thanks to **Martyn, G3UKV**, and all the Telford team.

The Convention started on the Saturday evening with the Buildathon. In memory of our founder, G3RJV, we built an updated version of the VFO from his SCD project from the 1980s. The update involved using readily available components and shifting the frequency to 5-5.5MHz so it could be used for a 60m SCD, or with a Club crystal filter for a 20m or 80m superhet. All 20 spaces were taken and we had assistance from **Lewis, G4YTN**, with **Tex, G1TEX**, and **David, GM4ZNQ**, also in attendance to offer advice.

I had experienced some issues with drift in developing the kit so we decided to embrace the 'Joy of Oscillation' and run a leader board of drift results – the Buildathon led to a Driftathon. The kits used a mixture of coils and capacitors to provide data on what worked best. An original G3RJV VFO was loaned by **Michael, MI5MTC,** to prove that 100% stability was possible – there was some suspicion that the thing had been bathed in holy water to add in some 'insurance' against drift.

What we found was that the biggest impact on drift was the Spectrum Communications 5u3 coil, which replaced the obsolete TOKO KANK3334. Tony from Spectrum had advised that temperature cycling the coils helped to tame drift so we had some 'uncooked', some 'cooked and frozen' and some with genuine TOKO cores fitted.

The later performed best with less than 500Hz drift after 5 minutes. Winner of the least drift was **Peter, M1FGN**. The greatest drift were the 'raw' coils with original cores and no temperature cycling. The joint wooden spoon went to **Trystan, G0KAY** and **Vic, GW4JUN**, with drift of 13.4kHz. All 'winners' were invited to select something from G3RJV's treasure trove (aka junk box).

Post Buildathon mods have shown that changing the core to a genuine

TOKO core largely cures the drift issues, within reason.

The VFO and the rest of the SCD will soon reappear in print, and hopefully in kit form, but more of that later.

The convention continued on the Sunday with three talks in the Buildathon room, and Club Sales in the main Hamfest hall. The first talk was by **Peter, VK3RE**, via Skype, and he outlined his approach to QRP and showed many of his projects.

Colin, G3VTT, followed up with a talk about his adventures on a radio ship out in the North Sea the radio station is not QRP, but being afloat is a great base for QRP operating when off duty. Finally **Heather, M0HMO**, presented an amazing tale of building, launching and tracking a high altitude balloon. All home brew and some incredibly innovative use of licence-free QRP. Whilst the talks were going on, Club sales did well with many members signing in and meeting the team.

Plans are already in train to do it all again in 2020. Ideas have been put forward for making it even better; maybe a CW Boot Camp, maybe an earlier start on the Saturday to allow more time to meet and chat, share information and show off latest projects, and maybe a live QRP Club station? There is also work in train to see if a Scottish G-QRP Convention is viable. Let us know if you think we could add anything else, but be aware, we may ask you to take the lead in making it happen!

When I shared the results of our experiment with Tony at Spectrum Communications, he explained he had experienced some difficulties getting the coils made. "*You wouldn't believe how difficult it is to find anyone in the World to make these. We originally had a company in India but they were notoriously difficult to contact.*

Then after the Fukishima disaster they couldn't get the formers from Japan. Then we found another company in India that it turned out wasn't making them but was subcontracting to a smaller company. Then I found another company this time in China that made good coils but in matt tin-plated cans that quickly discoloured.

They also didn't use the coding I required and used R instead of u and didn't add the H or L suffix. Then I managed to contact the company who had been doing the subcontract in India. They did well for a year or so then a batch we received last December of 1000 of each of 5 different values were all faulty.

That has still not been rectified but hopefully I might get replacements by the end of January 2020. In the mean time I will maybe go back to the Chinese company for samples." Tony will, no doubt, keep us informed of developments.

An Arduino - Based Morse Training Aid

John Fletcher G4EDX. Email: easydogxray@gmail.com

This is the latest version of a project that I started in January 2018. It is a training aid which sends accurately-timed Morse letters, numbers and words. It should be equally useful for absolute beginners and for those already proficient in Morse who want to increase their reading speed.

The Philosophy

To learn the whole Morse alphabet in one go can be daunting. With this device trainees can start by learning to read just the six shortest letters, made from one or two elements (dits and dahs).

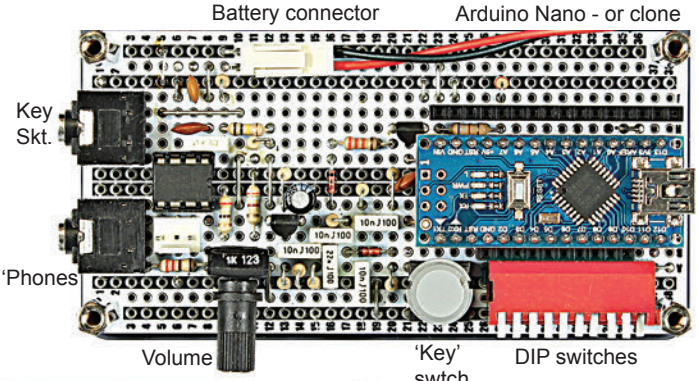
When connfident on these, you can progress to reading these at their chosen final target speed to boost their confidence before moving on to the next group of letters. Alternatively they can introduce new letter groups as they progress, or learn the whole alphabet at once.

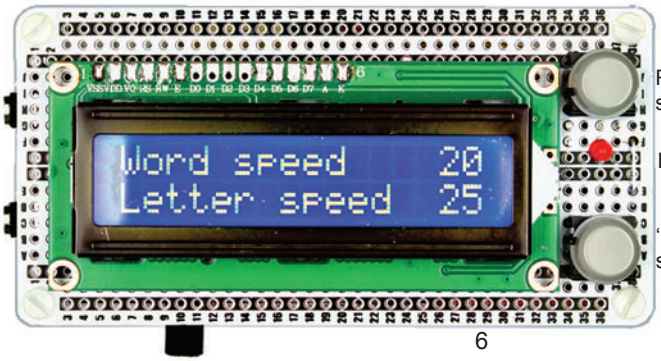
Speeds

There is nothing to be gained from learning to read very slow Morse, so the available letter speeds are 20, 25, 30 and 35 words per minute. Farnsworth timing (using extended spaces between letters) gives word speeds of 40, 60, 80 and 100% of letter speed.

The microcontroller, an Arduino* Nano or one of the inexpensive clones, runs one of

Lower board has all the control components on it.





Upper board has a 16 character by 2 line liquid crystal display

several programs to generate Morse letters and numbers or complete words. It is mounted in sockets so it can easily be swapped, removing the need for reprogramming, although a single Arduino can be reprogrammed using free PC software and a USB lead. Two of the many programs I have written are described in detail below.

The training aid is built on two 100mm x 50mm prototyping boards. The lower board carries the Arduino, the tone generator and audio amplifier, the DIP switches, Key switch and two jack sockets. The upper board carries the display, another Key switch, a Reset switch and an LED which flashes in time with the Morse being sent. Simple programs can be run on the lower board alone. The Arduino has its own Reset switch and LED.

The Arduino's digital pins are used to switch the tone generator on and off and to read the settings of the ten DIP switches and the Key switch or an external Morse key. Two of the Arduino's analog pins are used for an I2C interface (a fast serial interface) to control the 16 character by 2 line display. A third analog pin monitors the battery voltage, which is shown briefly on the display each time the training aid is switched on.

The tone generator is a sine wave oscillator with a pleasant, click-free keying envelope. Its pitch is fixed at around 700Hz but its volume can be adjusted. An audio amplifier drives headphones or a small loudspeaker.

The DIP Switches

The DIP switches are used to set the various functions of the programs. Switches 9 and 10 set the letter speed as follows:

9	10	Letter speed
Up	Up	35wpm
Up	Down	30wpm
Down	Up	25wpm
Down	Down	20wpm

For each of these settings the word speed can be set as a percentage of the letter speed by means of switches 7 and 8:

7	8	Percentage	Resulting word speed in wpm			
Up	Up	100%	35	30	25	20
Up	Down	80%	28	24	20	16
Down	Up	60%	21	18	15	12
Down	Down	40%	14	12	10	8

Morse Letters

The Programs (just two of the many variants) are conrolled by the first four DIP switches. These select which group or groups of letters will be sent. They can be used singly or in any combination.

Switch 1	A, E, I, M, N and T	Letters of 1 or 2 elements
Switch 2	D, G, K, O, R, S, U and W	Letters of 3 elements
Switch 3	F, H, J, L, P and V	4 elements starting with dit
Switch 4	B, C, Q, X, Y and Z	4 elements starting with dah

Setting the switch up enables letters from the associated group to be sent. When all four switches are down, the numbers 0 to 9 will be sent instead.

When switch 5 is up, groups of five letters will be sent; when down, random length groups

will be sent. This switch has no effect when sending numbers, which are always sent in groups of five.

The program sends 96 characters, including spaces. This number was chosen because it fills the display screen three times.

Morse Words

This program contains a library of 170 words and abbreviations varying in length from 1 to 8 letters. The trainee can choose the maximum word length using the first two DIP switches.

1	2	
Down	**Down**	**Words of 1 to 3 letters (80 words available)**
Down	**Up**	**Words of 1 to 4 letters (110 words available)**
Up	**Down**	**Words of 1 to 6 letters (140 words available)**
Up	**Up**	**Words of 1 to 8 letters (170 words available)**

If the word speed is set to 16 words per minute then the program will send 16 words. This might take less than or more than one minute depending on the range of word lengths set by DIP switches 1 and 2. The words are chosen randomly, but no word will be sent more than once each time the program is run.

Three stages

Both of the above programs have three stages

Stage 1. The program invites the trainee to set the letter speed, word speed and other functions (letters groups, maximum word length) on the DIP switches, then to confirm the choice by pressing Key.

Stage 2. The program sends its random sequence of letters, numbers or words at the chosen letter and word speeds.

Stage 3. The program then shows the letters, numbers or words on the display, pausing when the screen is full so that the trainee can check their copy. Pressing Key will cause the next screen of letters, numbers or words to be shown. If DIP switch 6 is set to up, the program will also send the Morse tones again so the trainee can see and hear the characters.

Randomness

The Arduino has a Random function to generate unpredictable numbers which are used to choose the letters and words, but true randomness is impossible to achieve with a program that carries out the same instructions every time. Different pseudo-random sequences can be created by “seeding” the Random function with a different starting number. Here is how I achieved true randomness.

A counter inside the Arduino counts the number of milliseconds from the time when it is switched on or reset. By reading this number at the instant when the trainee presses Key we introduce randomness which is used to seed the Random function, producing a different sequence of numbers each time the program is run. The millisecond counter is very big (32 bits), taking nearly fifty days to overflow and start again from zero.

I mentioned that no word will be sent more than once during each run of the Morse Words program. As the random numbers are generated they are stored in an array of cells which

can be thought of as a row of boxes. Each new number generated is placed in the next box, but only after it has been compared with all the previous numbers. If a duplicate occurs it is rejected and another new number is generated. When the array is full, no two boxes will contain the same number.

Diagnostics

Holding the Key switch down while pressing and releasing Reset causes a special sub-program to be run, which I call Key Down Reset. This can be used for diagnostic purposes. In the current version it sends the word MORSE repeatedly for one minute. MORSE is considered to be a word of average length, so by counting the number of times the word is sent in one minute the word speed set on the DIP switches can be confirmed.

Results

At the time of writing this article there is only one complete training aid, which has not yet been lent to beginners for testing. In fact, I have had little opportunity to use it to improve my own speed as most of my time has been spent on developing the hardware and programs. In a further article I will report my results and the experiences of other users.

Future Developments

I added a connection for an external Morse key for the time when the trainee has reached the desired ability in copying Morse and wants to learn to send. The intention is to write a program that sends a letter or word, which the trainee then sends back using a straight key. The training aid measures the timing and displays an indication of accuracy.

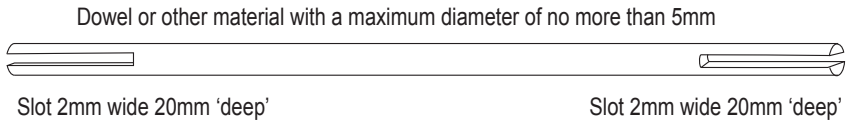
This is a very brief description of the product of many hours of thinking, building, calculating and programming. I would welcome readers' comments and suggestions for other functions.

** Arduino is a trademark of Arduino AG.*

Toroid winding shuttle

David Smith. G4COE davecoe@blueyonder.co.uk

Winding many turns on a toroid can be tedious, a simple tool can be easily made to avoid wire kinks and knots. The shuttle to carry the wire can be made out of plastic or a scrap bit of circuit board.



The length I used was 130mm, this can be left to the user but I would suggest 5mm width maximum as this allows the shuttle to pass through T50 and T68 cores. The cut out again can be left to the user I used 2mm x 20mm, can easily be done by file or saw.

Simply loop the wire between the cut outs on the shuttle, if need be one end can be secured by wrapping the end on one leg.

My Pixie-Max

Ian Liston-Smith G4JQT Norfolk. Email: ian.ls@hotmail.co.uk

What else can be written or improved about the little Pixie QRP transceiver? Well a little I guess…

I bought a small selection of pixie kits from eBay, starting at the unbelievably low price of £2.30 including postage from China! If you spend twice that you can buy one that also has a perspex case and a side-tone buzzer.

The 40m versions seems to be the most popular, but come with a 7023 kHz crystal.

I'm not sure why just that frequency, but there must be a good supply of the crystals from somewhere.

Before anyone decides to build one but is unfamiliar with its performance, its very simple design has severe limitations. As long as you know that it's quite a fun little rig.

Limitations

The Pixie first appeared as a design called the **MICRO-80** originally published in *Sprat* issue 72 by **Oleg Borodin, RV3GM.** There have been many iterations of the circuit that has now evolved into the Pixie. But what else can be written or improved about this well-established little crystal-controlled QRP transceiver? Well let's see...

I'm not sure why the choice of suppled crystal frequency, but the eastern kit makers must have a good supply of those crystals from somewhere, although 7030 kHz crystals are available from GQRP club sales. Most versions of the project, as supplied have an RIT control so, the receiver can be tweaked by a couple of hundred Hertz.

For those readers who may still be unfamiliar with its performance, the Pixie's very simple design has severe limitations. But as long as you appreciate that it's quite a fun little rig.

Limitations of the supplied receiver:

As a direct-conversion receiver it's not very sensitive, although adequate if the band is lively. It will provide readable signals starting at about 4–5µV, depending on headphone sensitivity. The relatively poor sensitivity is due to the Pixie RF output transistor being used as a crude mixer. (Even my ancient Heathkit HW-8 gives clearly readable signals at about 0.2µV. Incidentally, theoretically, 50µV at an antenna - on HF - equates to S9.)

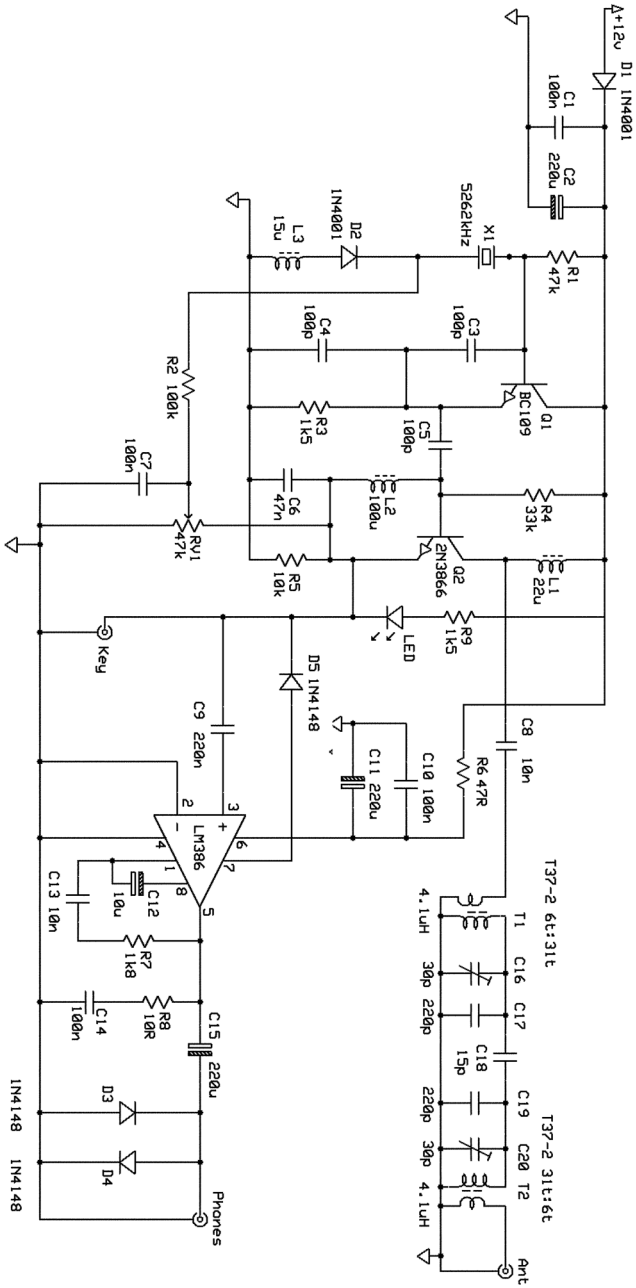
It has a very wide audio bandwidth of several kHz so you need a good ear to pick out the wanted signal. And it's also very vulnerable to broadcast station breakthrough.

A further problem is that it's very vulnerable to common-mode hum too. So no matter how

good your power supply is the performance of the Pixie will probably be improved if operated from a battery.

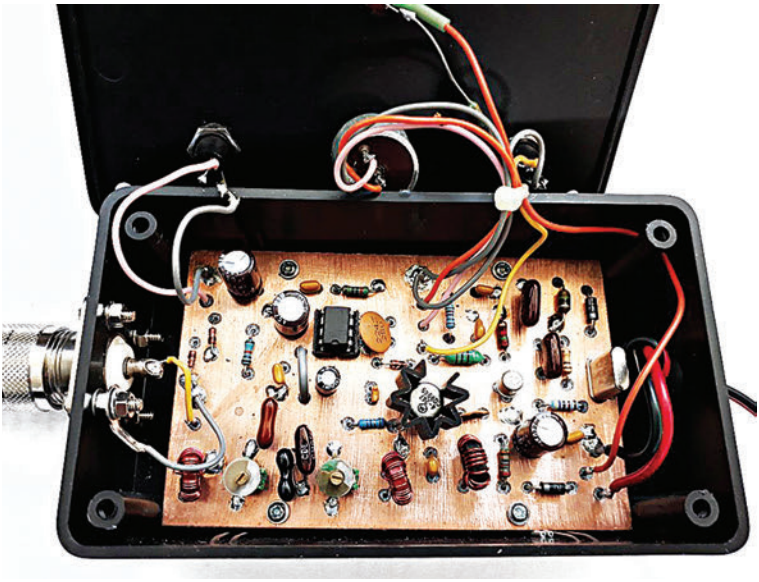
The transmitter:
It really is QRP. With a 13V supply you can tease about 300mW out of it. Some kit versions have a full-wave rectifier at the supply input so voltage polarity is irrelevant. But if you're using a 9-volt battery you've lost almost 1.4 volts and power output is then only about 150mW! The PA transistor is quite easily destroyed. It's a common type, but as supplied it doesn't take much to burn it out. And of course, the transmit frequency is fixed.

Improvements
The receive muting in the original design relies on shorting the voltage supply to the LM386 via a 1k resistor. This means the audio IC is supplied via a very high impedance which is liable to cause instability, low gain and non linearity. This was recognised by **LA3ZA** who used pin 7 of the LM386 to mute the chip, to get around this problem. This is a very worthwhile and obvious improvement which I have never seen in any kits.



The LM386 data sheet has a perfectly clear circuit showing how the frequency response can be altered, which significantly reduces the audio bandwidth if you tweak the values a little. This modification also seems to have been widely overlooked.

Rather than use a low pass filter, I used a band pass filter based on the values used by **Hans Summers** of **QRPLabs**. BPFs are not usually used on transmitter outputs due to their insertion loss, but I found that when peaked up just on the transmitter frequency rather than trying to have a flattish response across the whole band, losses are not too bad. But the main advantage is that it filters out strong signals above and below the band in use, so greatly reduces broadcast breakthrough.



My Pixie Max

I wanted to build a Pixie for 60m, and without any modifications other than a 5262kHz crystal (the UK 60m QRP centre of activity) I was soon on the band from my QTH in north Norfolk.

My first QSO was **GW3UEP, Roy** in Cardigan. Then followed **M0STN, Steve** in Northampton. This was in the late afternoon/early evening in June 2019.

But the Pixie limitations were soon obvious, so I set about building my own with as many modifications as I thought necessary for such a simple design. Below are those changes I made.

Main changes

- The LA3ZA muting mod (D5/R6).
- A 60m BPF.
- A choke (L3) in series with the RIT diode to give a frequency swing of about ±800Hz
- Treble cut (C13/R7).
- Improved supply decoupling (C1, C2, C10, C11).
- Reduced audio key clicks (D3, D4).
- A beefed-up output transistor with heat sink (Q2). A BFY50 is a robust replacement, but better still is one of the Club's 2N3866 equivalents which also gives slightly better receive sensitivity and about 500mW RF output at 13V.
- Back-to-back silicon diodes across headphones to reduce audio keying clicks (D3, D4).

I tried SM7UCZ's arrangement of adding a transistor in front of the LM386 to boost sensitivity. It did do that quite successfully, but the transmit/ receive changeover clicks were

deafening; I couldn't tame them, and reluctantly abandoned that idea.

Some of the kits come with a little buzzer wired between the voltage supply and the keying diode, with an on-off peg. Useful if you're using a straight key. I left it out on mine.

So, the Pixie is what it is. I don't think there is much point adding anything else, but a search around the internet for "Pixie modifications" will show that other home brewers don't necessarily don't share my view...

Acknowledgements

Pixie File:
http://www.gqrp.com/The_Sprat_Pixie_File.pdf

Hans Summers BPF:
https://www.qrp-labs.com/images/bpfkit/bpf.pdf

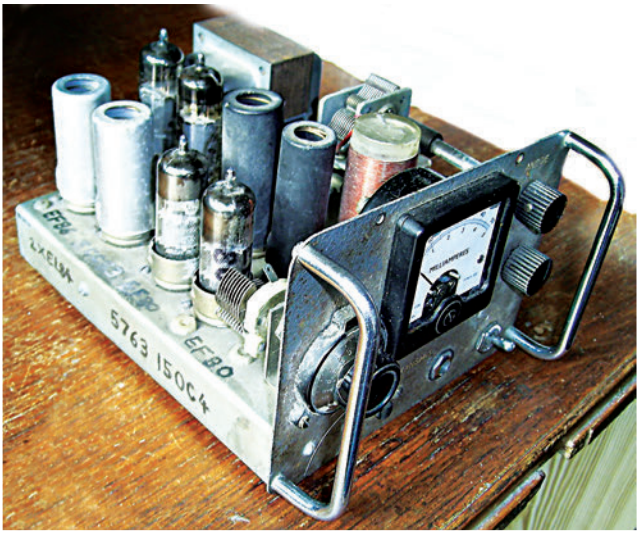
LA3ZA:
http://la3za.blogspot.com/2003/04/using-pin-7-of-lm386-to-reduce-bci-and.html

72/73 G4JQWT

Do you recognise the rig below?

Bill Kitchen G4GHB email: bill.kitchen1@ntlworld.com

Just wondering if any members could identify this Top Band TX which I bought at a rally. It's a well made job with all soldered joints painted with purple varnish, the front panel is engraved and everything inside a perforated steel cover but no name anywhere.



There have been some mods, the key socket at far right is now a Tx/Rx switch and key socket put in to the left of it.

There's a microphone input at the rear marked in pencil, along with three more Belling Lee TV style sockets pencilled as "Ae" and two as "Rx".

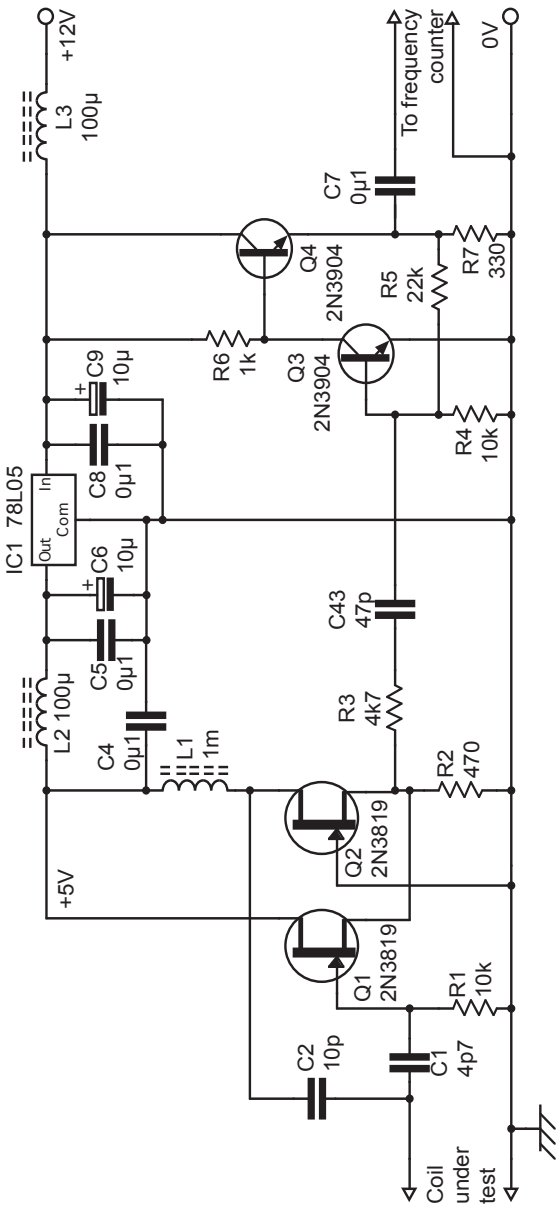
The power input is at the rear.

The valves used are:
EF86, ECC83, 2 off EL84, 2 off EF80, 5763 and a 150C4.

73, Bill G4GHB

The Ossy box

David Smith. G4COE. GQRP 8621. davecoe@blueyonder.co.uk



An Ossybox is a test oscillator used for checking coils. I use a dip oscillator also known as a Grid Dip Oscillator from the valve era, a dipper can use transistors or valves, this would get me in the ball park, but I wanted greater accuracy.

Franklin circuit

So I built a Franklin circuit because of it's low capacitance loading on the test coil this not only gets me in the ball park it puts me right on the penalty spot. No more adding or removing turns or soldering and unsoldering.

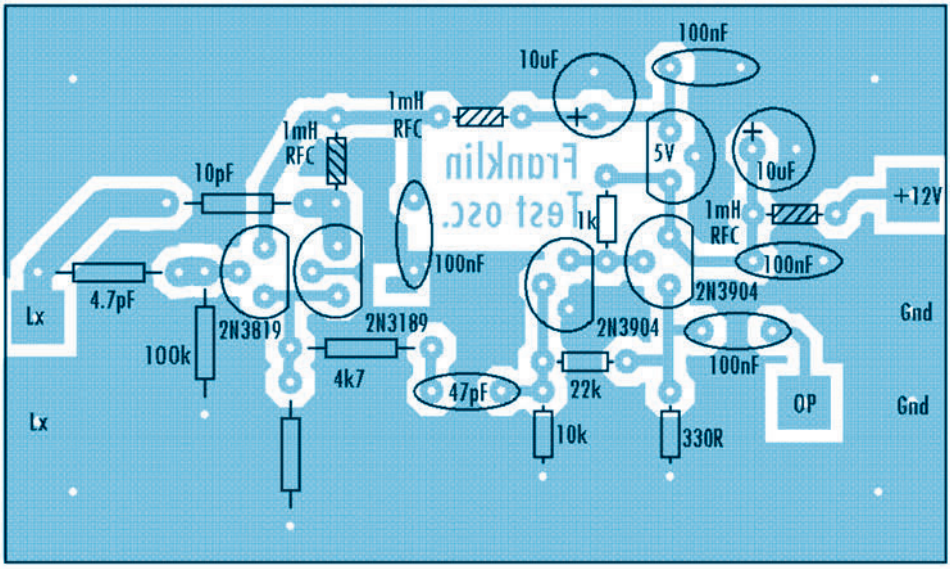
Although 12V is shown there is no reason why one can't use a 9V battery because the oscillator runs from a 5V stabilized supply.

The reason a buffer is used is so I can connect a frequency counter without causing it's frequency shifting, you could even connect a length of wire instead for loose coupling purposes into a receiver.

Not critical

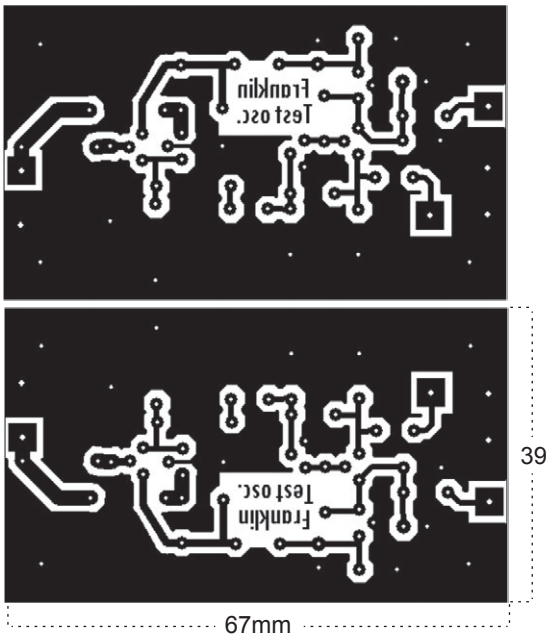
Its construction is not critical but wiring and rigidity should be considered and leads kept as short as possible, dead bug, PCB construction is up to you, a die cast box should obviously be used with suitable connections for the coil or tuned circuit under test.

The circuit adds about 15pF to the coil under test and must be kept in mind with VHF type coils, if you are calculating don't forget to add this 15pF loading to the tuned circuit and the tuning capacitor value.



The buffer including R3 and C3 onwards can be used in any oscillator or VFO circuits, how about adding your own coil and tuning capacitor for a VFO for the band required? The low value capacitors C1,2 &3 ought be ceramic NPO (COG) types.

Above is the component positioning layout at about twice size for clarity.

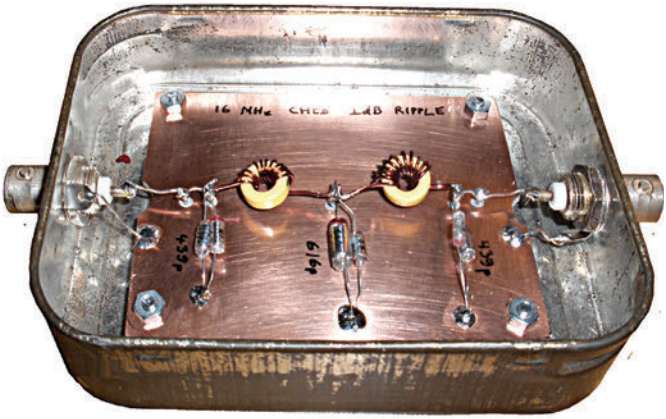


Shown left is a reversed copy of the track pattern.
Use a photocopy of this pattern to make a PCB on a piece of photosensitive PCB material.
The image should then be placed face down on the board before exposure.

And here left, is the track as it would appear from the copper side of the board.

Octave Low Pass Filters

Phil Stevens (philg3ses@gmail.com)



For the experimental radio amateur having a source of stable signals covering both the amateur bands and the rest of the spectrum could be considered essential.

In the G3SES shack there are a number of elderly but perfectly functional signal generators but recently I have added a Feeltech 6800 DDS 0-60 MHz function generator and very recently a nanoVNA vector network analyser.

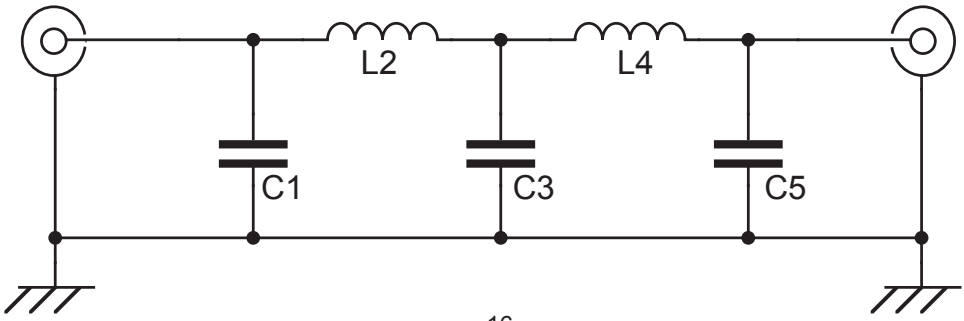
All signal sources, including transmitters, do not produce perfect sinusoidal, single frequency outputs. The errors can consist of frequency drift, jitter, phase noise and harmonics.

The filters described in this article are designed to remove the harmonics of signals radiating from about 1.5 MHz to 30 MHz but there is no reason why similar low pass filters cannot be designed for VHF and UHF applications.

An ideal low pass filter passes all frequencies up to the cut-off frequency but above this there is an infinite attenuation of all signals. In practice, this is impossible so a compromise is necessary.

Five-pole Chebychev

I decided that a 5-pole Chebyshev 1dB ripple low pass filter would give adequate flatness in the pass band but a very steep roll off into the stop band. Only five components are needed and two BNC sockets to connect to the signal source and the load. The circuit board was



a simple piece of single-sided copper board with insulated pins supporting the components. The container was an old tobacco tin and the included diagram shows the 16 MHz filter.

Fc MHz	C1 pF	L2 µH	C3 pF	L4 µH	C5 pF
2	3513	4.49	4939	4.49	3513
4	1756	2.24	2469	2.24	1756
8	878	1.12	1235	1.12	878
16	439	0.56	617	0.56	439
32	220	0.28	309	0.28	220

Five filters were constructed with cut-off frequencies of 2, 4, 8, 16 and 32 MHz and the component values determine from filter tables and scaled for 50 ohms and a particularly design frequency. The values are tabled below.

For the capacitors I used polystyrenes, making up the strange values by connecting them in parallel. For example, 3513 consisted of a 3300 pF in parallel with 220 pF. The values were measured on a Peak LCR45 but using capacitors of good tolerance would suffice. As alternatives, ceramic or silvered- micas would do the job.

Amidon Cores

All inductors were wound on Amidon toroids and the number of turns can be determined from the usual tables. I checked my inductors on a Q meter.

The finished filters were checked on my old Marconi spectrum analyser / tracking generator and gave results as expected. For interest the 4 MHz filter was also measured on the nanoVNA to obtain the s-parameter S21, the attenuation properties.

Running a nanoVNA spectrum plot of the filter revealed there were three peaks and two troughs of ripple which indicates that the filter has five poles. Attenuation at the second harmonic of the cut-off frequency, at 8 MHz, is about 50 dB. The nanoVNA can also display S11, the input reflection coefficient, phase response.

There is no reason why the filters cannot be designed for other cut-off frequencies such as the amateur bands.

The included diagrams show the simple circuit which is symmetrical. Therefore either BNC connector can be used for the input or output. Should you want a steeper roll-off, then a 7-pole filter could be constructed but an extra inductor and capacitor would have to added and the component values would be different, so needing recalculating.

The numbers following the C and L are component numbers as usually shown in filter tables. The number represents the compoent's position rather than a simple reference. So, component two is an inductor then component three is a capacitor labelled "C3". And so on.

Remember, low pass filters can only remove harmonics, not noise, jitter or drift.

I hope you find this article of interest. Happy soldering.

Phil

The Paesano-A Left Coast SSB Transceiver

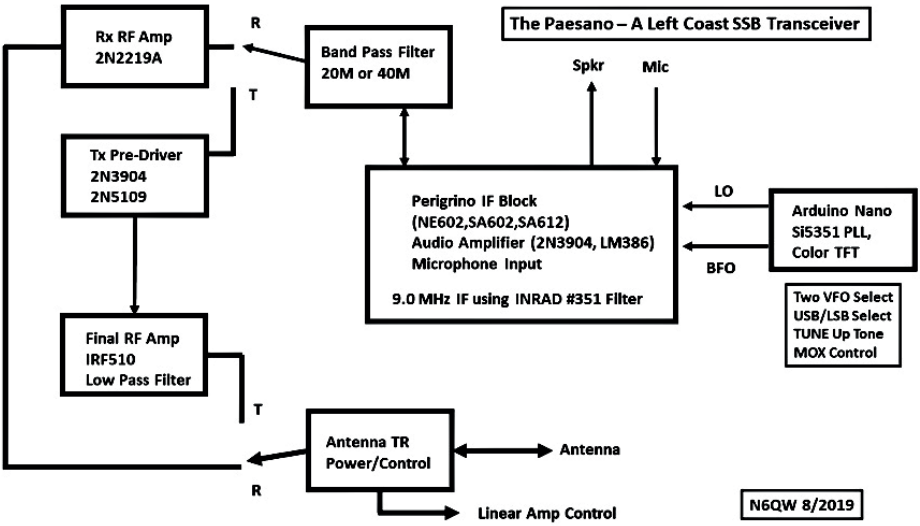
Pete Juliano N6QW email: n6qwham@gmail.com

In the Summer 2019 Issue (#179) of the GQRP Club SPRAT publication there appeared an amazing project called the Perigrino, a complete 17M SSB Transceiver using a total of 84 parts installed on a very small board.

Nigel, G0EBQ did a yeoman's job in covering this project in that issue.

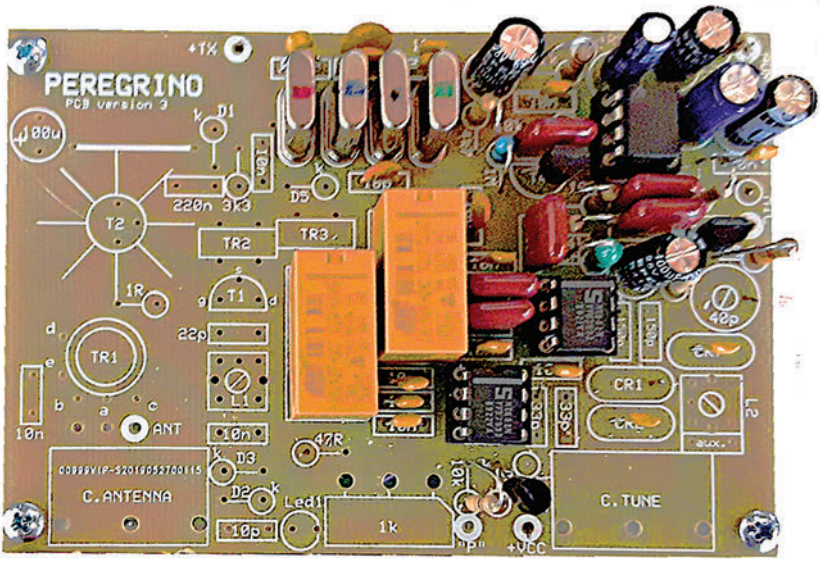
The concept of switching the SSB filter between the input and output sections of the NE602's for receive and transmit certainly caught my attention.

This launched a project using this same concept. Thus, the idea was born to fabricate The Paesano – A Left Coast SSB Transceiver. Paesano in Italian means Buddy or Pal. It is with this idea of being a Pal that I embarked on modifying the Perigrino design to add func-



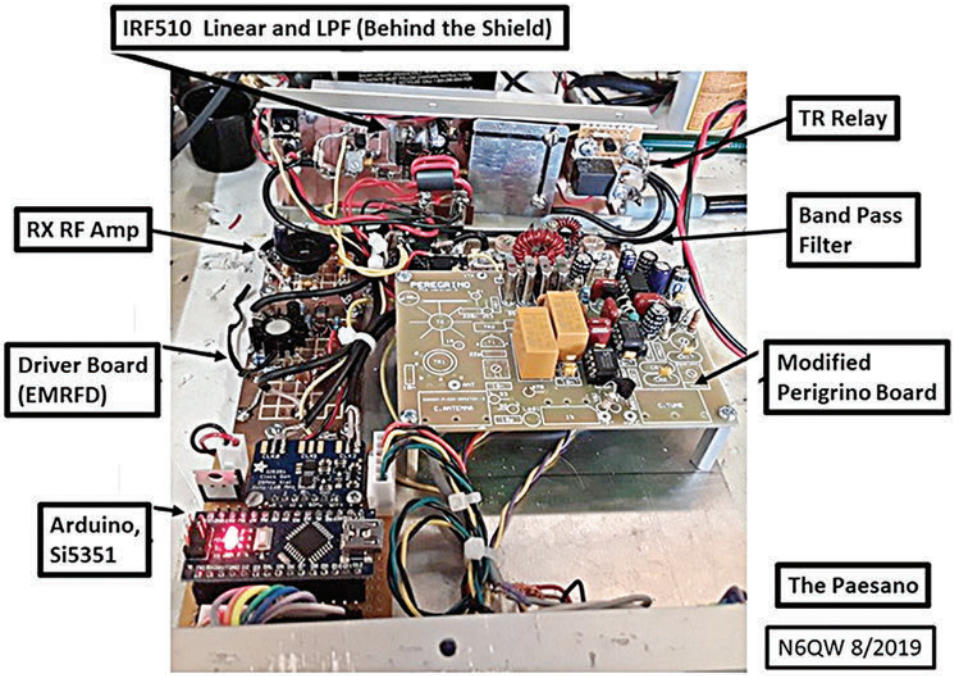
tions and features I typically incorporate in my designs. Only this time with a huge change of switching the filter for receive and transmit.

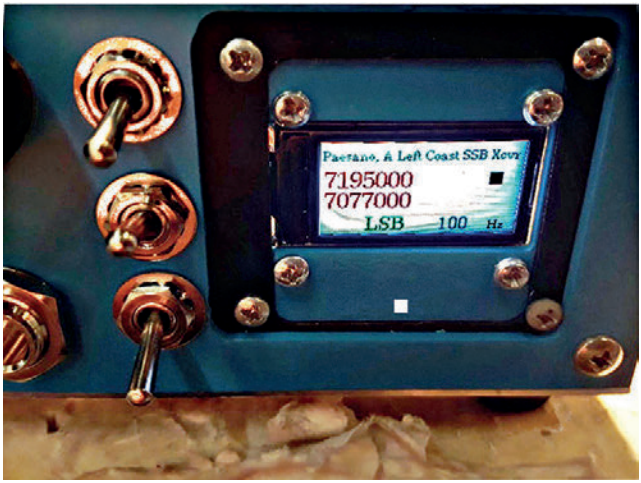
This article will only cover the highlights of what I did, to build The Paesano; but the complete project details are on my website **[1]** should you want to build this very fine transceiver.



The pcb with the modifications desctibe in text

Starting with the Perigrino PC board I decided to keep about half of the circuitry and the rest of the board remains unpopulated. The original designers had a solid design and so I kept the IF block with the relay switching along with the audio amplifier stages and the





microphone amp (an electret mic with a direct input into the NE602). From there on it got the typical N6QW "treatment".

I've shown a photo taken with the additional modifications described later. As I stated earlier maybe 50% of the original parts are kept 'as is".

The use of a circuit board takes the drudgery out of building this FB rig and sure eases trying to figure out how to cram all of the hardware into a small space.

Let us first start with a block diagram of The Paesano. My build runs QRP whereas the Perigrino is QRppp. But also, noteworthy The Paesano has run 600+ watts with outboard amps –so your choice QRP or QRO.

Basically, the Paesano adds a Receiver RF Amp, a 5 watt Transmit chain and all importantly the change over to a 9 MHz Commercial Filter (INRAD Model #351) and of course the Arduino/Si5351 with the enormously appealing Color OLED Display. Along the way we have added two VFO's, selectable USB/LSB, a TUNE UP Tone and MOX control. Initial testing was done with a Color TFT and the final configuration uses the ST7735 65K Color OLED. Should a builder want to home brew a filter (not recommended) the use of the Si5351 easily facilitates any IF frequency that may be chosen.

Additionally, we have modified the Perigrino PC Board to add matching transformers (FT-23-43 cores located on the board underside) from the SSB Filter (Zin/out is 200Ω) to the NE602s, (Zin/out is 1500Ω).

Two other board modifications include adding a volume control to the Audio Amp stage and replacing the eight volt Zener diode. with a three terminal 78L08 regulator.

The PC Board mods involve cutting some board traces and removing two resistors (10k and 180Ω). The 78L08 can be fitted right to the holes where the 180Ω and 8V Zener would have been installed.

Adding the LO and BFO signal lines is done using RG174/U coax and the signals are fed into Pin 6 of the NE602s via 10nF ceramic caps.

Two crystal sockets, CR2 and CR7 provide the hole locations for the caps. The website details these change including photos of the changes and their locations on the board.

The Paesano has been air-tested and the website includes several embedded videos of on the air-contacts and one of the transmitted signal patterns.

Web references [1]: ***www.n6qw.com/The _Paesano.html***

73s, Pete N6QW n6qwham@gmail.com

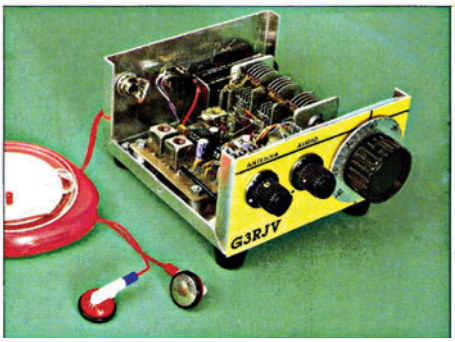
The 'Super Sudden' receiver

A multi-band direct conversion receiver with AGC

G1TEX 5631

Ever since I first encountered the Sudden 3.5MHz receiver, presented by the late **George Dobbs G3RJV** in *PW* magazine back in March 1991, I've been fascinated by the simplicity of the receiver.

George was one of the first to link together, a rather novel oscillator/mixer integrated circuit (IC) to the simple LM386 audio IC, But they'd been around for a while in commercial designs of cord-free house phones and VHF television circuits. He named the project after the parish of Sudden where he worked at the time,



George's Sudden on the cover of Practical Wireless March 1991

The Sudden was a simple 3.5MHz direct conversion unit, followed by an audio amplifier IC the LM386. The simplicity of the Sudden does, however, have its drawbacks, in that most of the gain has to be in the audio stages. Pushing the LM386 audio amplifier to greater gain, makes it rather noisy. A noise level that cannot be controlled by the low-pass filter stage. Couple that with a rather wide receive bandwidth due to the very limited audio rolloff, can make using the rig rather tiring over longer periods on noisy bands.

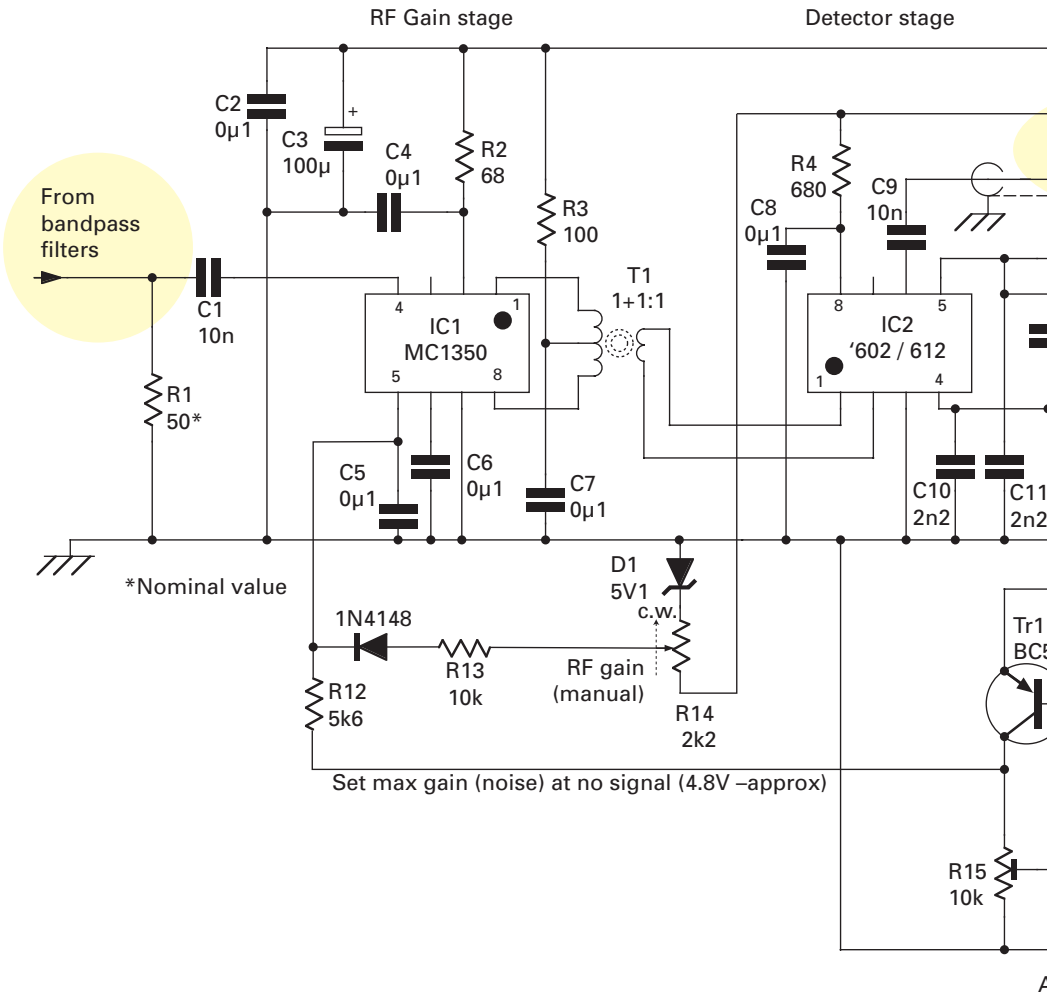
The original '602 IC and the up-rated '612 version (though I've been unable to find any verifiable differences between these two), is capable of being used up well into the VHF bands with little or no loss of capability. The '602 mixer IC also contains an oscillator stage that can be configured as either an 'ordinary' LC version or as a crystal controlled oscillator. The balanced inputs and outputs pins give a very useful through gain, unlike most other types of mixer.

Direct conversion receiver

A direct conversion receiver, mixes a signal close in frequency to the desired one, to produce heterodyne (whistles) in the audio band, which are then amplified for a loud speaker or headphones. The downside of this type of receiver is that it can be somewhat less sensitive than other more complex ones. Not to mention that the received bandwidth, is dependent on the capability of the audio filter.

In an effort to answer some of the above perceived limitations, I felt that a more effective receiver needed at least an RF amplifier before the 602's input pins. The amplifier should ideally be controlled via some form of automatic gain control to ensure a fairly even audio output level, in spite of what can be relatively huge changes of RF input signals. By adding gain before the mixer stage, this would also allow the audio stage gain to be reduced, and thereby reducing the overall noise of the system.

Any added RF amplifier should, ideally, have good gain and bandwidth, along with the ability to regulate the gain easily. Luckily for this purpose. There is such an IC, in the shape of the MC1350. It's also a little 'long-in the tooth' as it was originally created for VHF television IF stage designs. The MC1350 IC works well up to at least 50MHz, and is capable of having

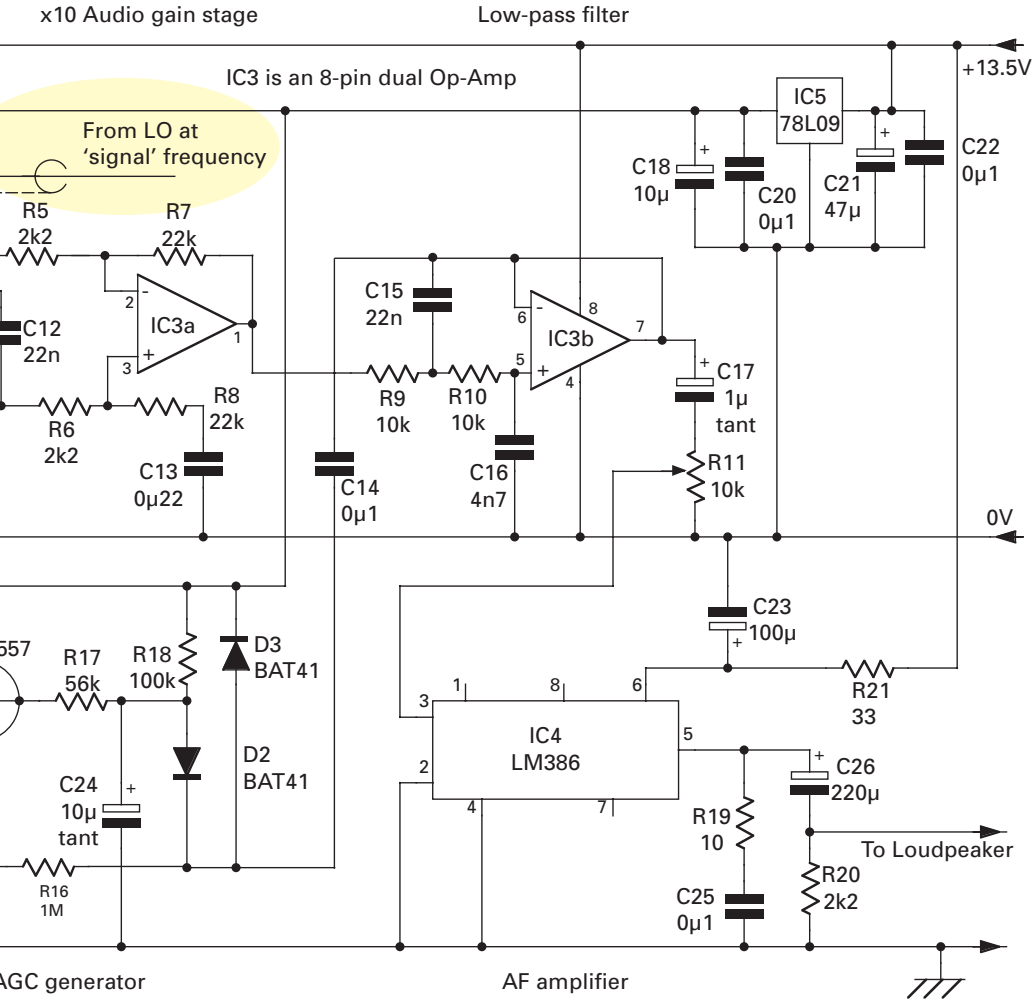


the gain varied over a wide range with a simple voltage signal.

Now all that's needed is some way of recreating that suitable gain control signal. Unlike the more usual superhet receiver, where the incoming RF signal itself, (or the IF derivative) can be sampled to create the AGC signal, a direct conversion, type has no useable RF path to sample. An alternative is to use the recovered audio level to create a suitable AGC control signal.

In the circuit of the Super Sudden, IC1 is the RF amplifying IC, used in an unbalanced input mode, with only one of the input pins (pin 4) used. The output of the IC is balanced, with two 'free' connections fed to the primary windings of a balanced wide-band RF transformer T1 *[1]*. The secondary of this transformer feeds the two balanced input pins of IC2 the mixer. You don't have to use the same transformer as I used, merely one that covers the bands of interest, and has three similar windings, suitably arranged as depicted.

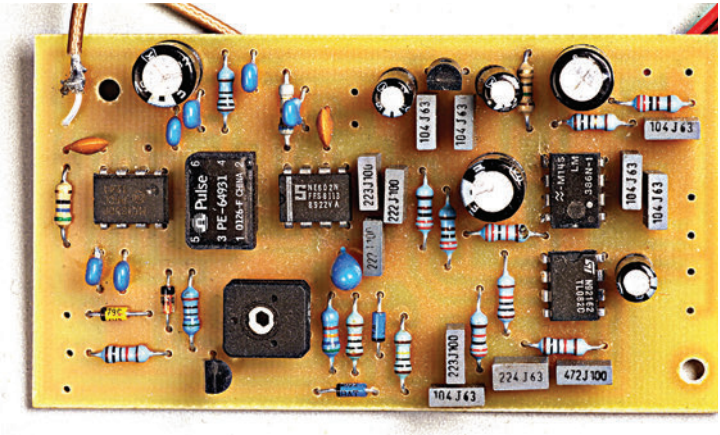
The oscillator section of the mixer IC is just being just used as a buffer amplifier for an externally provided local oscillator signal fed in on pin 6. In my design idea this local



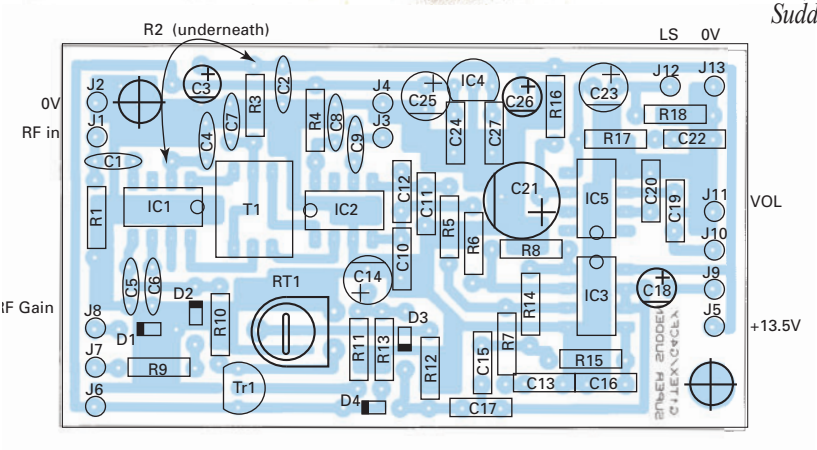
oscillator signal is to be provided by an Arduino controlled direct digital synthesizer module. Any external oscillator should be able to provide a reasonably 'clean' signal at around 100-150mV level for pin 6 of the IC.

I decided to supply IC2 from a +9V regulator, which also supplies the AGC amplifier (more later). The balanced outputs of IC2 then 'sit' at around 6V, a voltage level ideal to bias the following dual operation amplifier, that give a ten times audio voltage gain (IC3a), before the following low-pass audio filter circuit of IC3b.

The audio, from the low-pass filter, as well as passing via the volume control to the audio stage, is rectified via diodes D2 and 3 to drive the AGC amplifier transistor Tr1. This uses a *pnp* transistor as the amplifier, so that the level on the collector rises as the rectified audio level increases. The preset resistor R15 sets the collector 'no-signal' AGC point at around 4.8-5V. The MC1350 IC has maximum gain when the AGC control pin is around 5V, and needs a rising AGC signal to reduce overall gain.



The PCB created for my version of the Super Sudden receiver, by Tony G4CFY



Manual gain control

A manual gain control can also be fitted if desired in the position shown. Although this change of voltage level could be used to drive a relative signal strength meter, I've not included that into the design at this stage.

The audio output from LM386 audio amplifier IC4, produces around 500mW of audio output. This is more than adequate for headphones or for a loudspeaker in a relatively quiet room.

For the front-end band-pass filtering, my design was visualized as just using switched filters at the input, driven along from the Arduino controlling the DDS generator as the local oscillator signal. I'm in the process of working on this variant to electronically select the appropriate bandpass filter, suitable for the LO frequency.

However, to prove that the system actually worked, in my prototype 'lash up' I used one of the five-band electronically switched bandpass filters from Spectrum Communications, which was separately switched. As I find time and opportunity, I'll develop the interfacing of the Arduino's 5V output and the 12V needed to switch the filters.

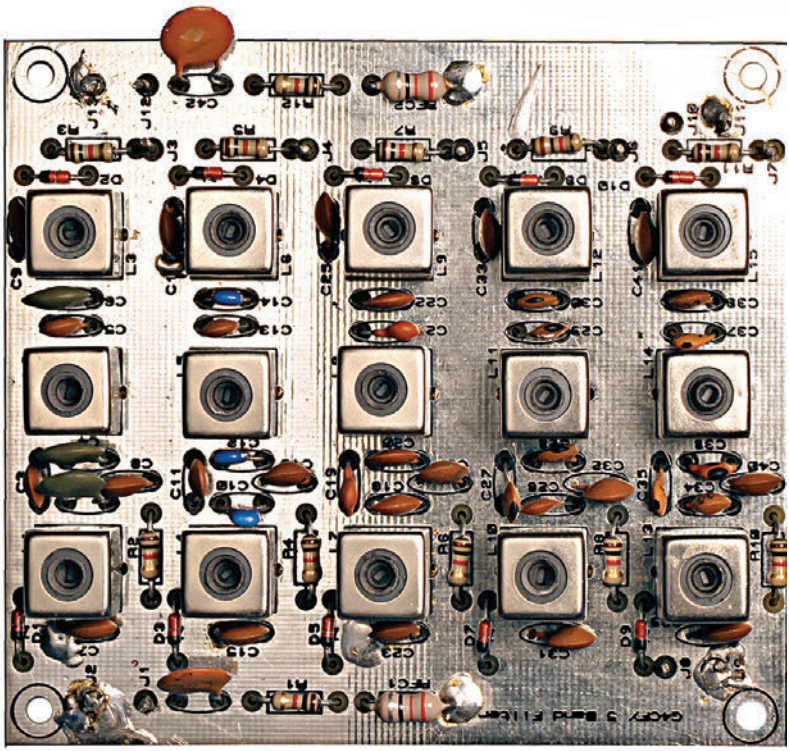
In spite of my original ideas being rather ambitious, there's absolutely no reason why a simpler version shouldn't be built for just one band of operation. In the past there have been suitable broader bandwidth input filters described for most of the common bands, chose the values for your band.

Simple stable LO

Getting a simple, but stable local oscillator can be a little more problematic, Not only is the stability, but also in some form of showing the actual frequency itself. That was why I settled on an Arduino driven DDS, as that option creates a crystal stability signal along with the ability to display the frequency with a great deal of accuracy.

Tony Nailer G4CFY of Spectrum Communications created the PCB shown and readers interested in building the project, should contact him via his website for avalability. Tony's electronically selected, five-band filter board project is shown in the picture above.

[1] I found these transformers on a club stand at a local rally and obtained some to experiment with. With three identical windings they're suitable for full HF coverage at low impedance. They are available through the club special sales page on the internet.



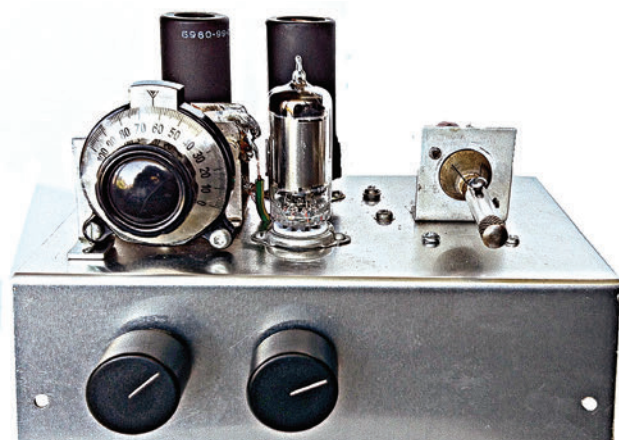
spectrum Comms 5-band filter projectå

There probably will be some members who think that the 602/386 Sudden style receiver is rather 'Old Hat' and in some ways they may be right. To these members I offer my apologies, but there may be many newer amateurs who haven't had the opportunity to see the project. I hope that this not only introduces the original project, and shows how it is possible to adapt and improve. After all the hobby is about 'Self-Instruction'.

G1TEX

Low voltage valved hybrid DC receiver

John Seager G0UCP



This receiver takes ideas from **G4DHV** and **G3VTT** in *Sprat*, **G3OOU's** valve pages and the excellent technical website of **Olivier Ernst, F5LVG[1]**

The oscillator is based on the venerable 'Kallirotron' and like the RF amplifier, uses miniature battery valves. After a diode mixer the signal passes to a transistor amplifier suggested for the purpose by **G3RJV** in 'COPTW' in October 2005.

Valve and transistor stages get power from the same 12V. lead acid battery. Special features when using valves at low plate voltage include a positive bias on the control grids. The tuned circuit in the anode supply of the RF amplifier provides a high impedance load. Ra and Ca values were found by trial and error to give best gain without self-oscillation.

I run the valve heater circuits via a LM317 regulator from a separate battery as, for optimal bias, the positive ('LT') filament supply of 1.4 volts has to be connected to the negative 'H.T.' ground line. Using a negative voltage dropper would be a way round this but if the supply is 12 volts the large drop at high current is somewhat inefficient, and a 6 volt source is preferable for battery use.

A 'Cromwell' or Q-Max 15mm hole-punch makes easy work of mounting the valves on the upper part of an aluminium box.

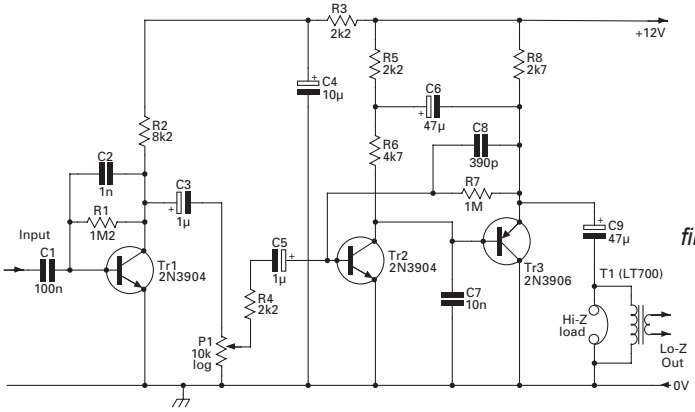
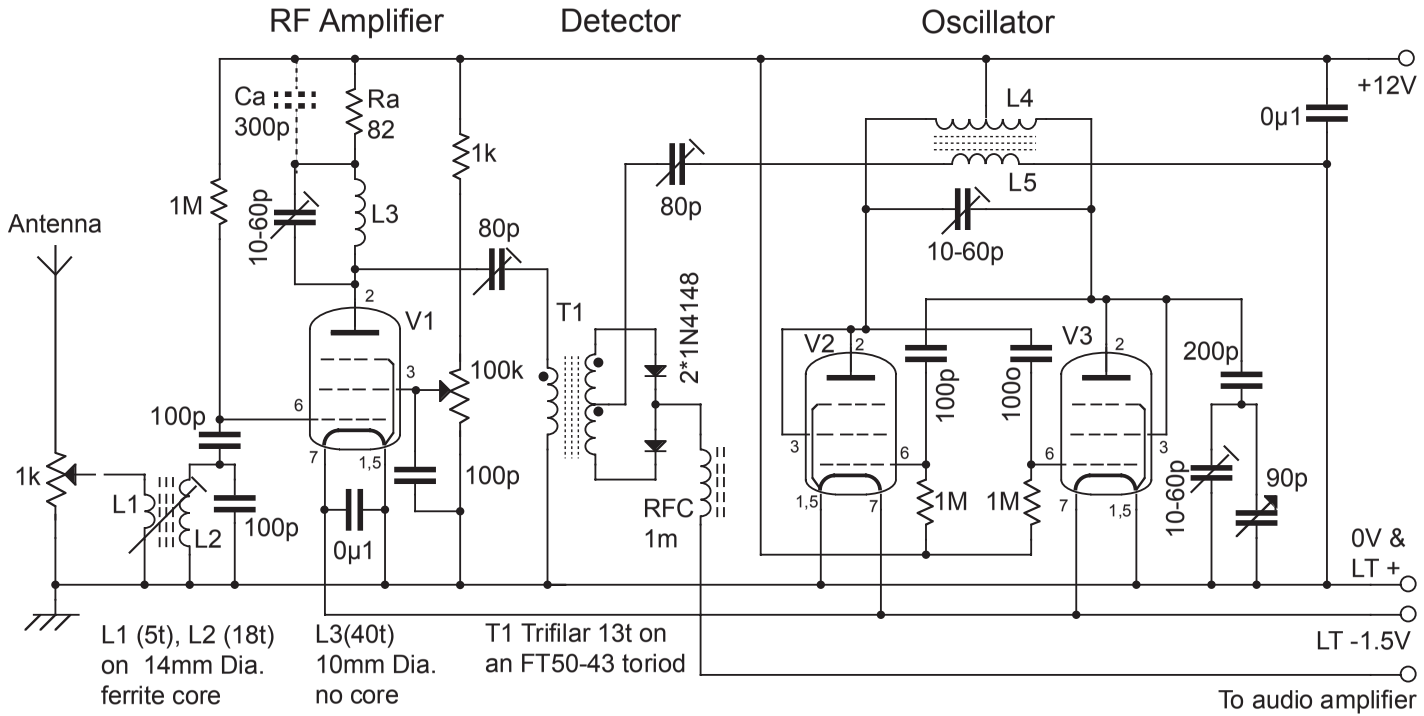
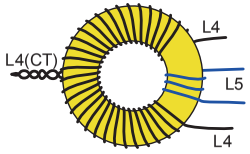


Figure 1: The audio amplifier is from Practical Wireless October 2005. (George Dobbs, G3RJV: 'Carrying on the Practical Way'). The circuit works fine into 25Ω 'phones without a transformer.





L4 (16+16t) on T68-6 Toroid
L5(3t) as shown

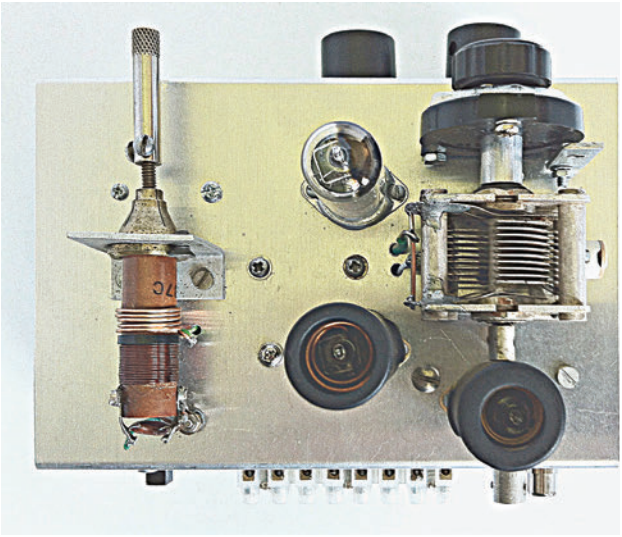
Figure 2
Valves: 1T4 (DF91).
HT = 12v.
LT = 1.4v., derived from 6 or 12v. SLA battery via LM317.

Note: LT+ and HT- go to ground. Grid bias is from the positive line via 1MOhm resistors.

Two 1T4s strapped as triodes worked well in the oscillator, but a single envelope double triode such as the 3A5 should perform at least as well (with one less hole!). I see Langrex have a stock of them at a reasonable price, along with their vast range of valve holders, screening cans etc.

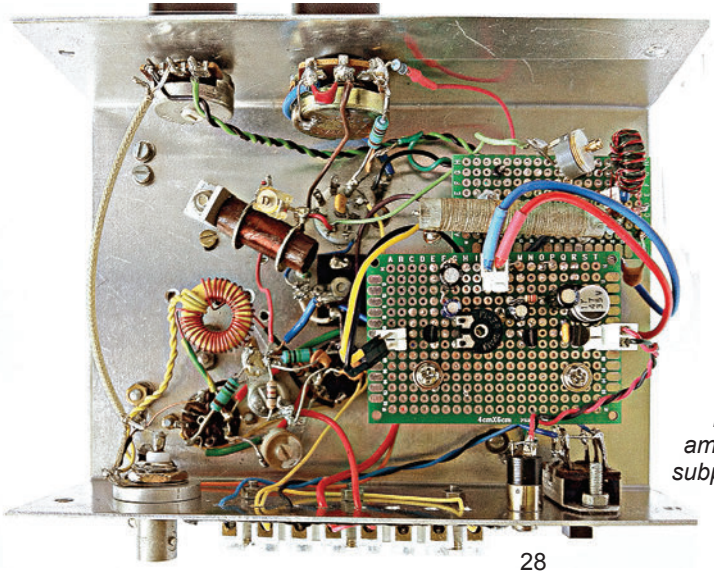
Valves are available from many sources as 'new old stock'. Widespread use in audio amplifiers puts up the price of some types, but many cheap equivalents will work at a plate voltage of just 12 volts. Olivier Ernst explains how to select them and if there is any doubt, slope characteristics can be checked using a simple test set-up.

The L/C values shown here are for 7MHz. The receiver is intended to be a 'companion' to a QRP valve transmitter for 5MHz. Increasing L4 to 24 + 24 turns makes it possible to tune from 5.2 to 5.5MHz. It should make for easier netting than would be the case with a regenerative detector. With unselected ceramic capacitors in the grid-anode circuit, the oscillator is stable enough to follow long CW contacts but has yet to be tried as a transmitter VFO.



References

[1] http://oernst.org/hamradio/tubes/bassetension/lowHT.html



Underside view. The toroid inductor for the Kallirotron is on the left. The transistor amplifier, built on a removable subpanel is shown on the right.

Antennas Valve and Vintage

Colin Turner G3VTT 182 Station Road Rainham Kent ME8 7PR
g3vtt@aol.com

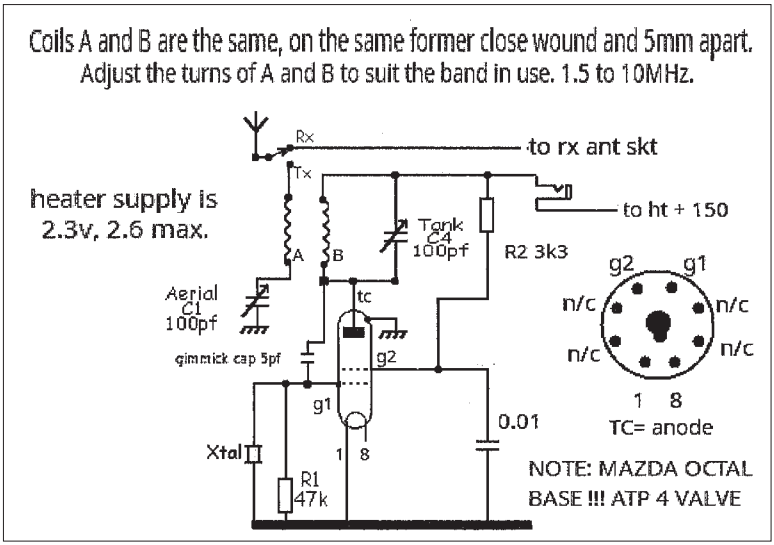
Welcome to the Sprat Winter AVV. Band conditions are still poor but we had some contacts during the November Valve QRP event and my thanks go to all of you who came on the air. It is a great pity that mainstream amateur radio is centered on contests these days with the original ethos of personal meaningful communication being ignored. Why is everything so competitive? If you made something and put it on the air you are maintaining the original ethos of the hobby.

G0UCP has written to give me some feedback on the Kalitron oscillator described in Sprat 164. 'Hello Colin in Sprat 164 you mentioned DJ5IL's work on the Kalitron oscillator" Well the results of John's building project can be read elsewhere in this issue. But he went on to say "Stability seems good but not measured. I note that Pat Hawker advised against recreating the 1930s Evan Nepean circuit for a barefoot transmitting oscillator, at least on the higher frequencies 'even from Tibet..'

Thanks John! How interesting and thanks to John for outlining how low dissipation, such as you have with battery valves, can aid oscillator stability. Incidentally the reference to Tibet refers to the station set up at the British Mission in Lhasa and the contacts made by AC5YN and it was the operator at AC5RF, Bob Ford, who wrote about his activities on 20m from there that was one factor that stimulated my own interest in Amateur Radio. The other was the Kon Tiki expedition using the call LI2B, using QRP, but that's for another time. Take a look at the website ***www.vk6fh.com/vk6fh/kalitron.htm*** for details of more Kalitron ideas which can be used as a basis for more circuits.

The ATP4 battery pentode is still available, (watch out for the special 'Mazda' valve base though!), and is capable of 5 watts output. **G3YVF** has been an exponent of this valve and has produced a CO/PA but recently he made a single valve transmitter using the type. He has made breadboard style transmitter with relatively few parts and modest power requirements. The data shows the type needing 2V for the filament and up to 150V for the HT. Geoff reports he got 1.25 watts out with 130V but more could be obtained if you put the full 150V on it. The anode dissipation is 5W for this type. Incidentally the type was designed for British Army equipment and was used in the 18 sets for infantry use plus a number of other sets. The only problem is sourcing the valve base and in the photograph you can see a base made from a piece of printed circuit board and the metal

connectors from a 'chocolate–block' as we call them here is the UK. Two light bulbs are used for tuning up, one in the tank circuit and the other in the link, but it is advisable to short them out once they've been used for tuning as they consume precious power. The tank circuit is wound on a one inch diameter former. Now that's a pretty little project for a wet afternoon.



Peter G4LEG is another renowned constructor and comments on the supergainer receiver published in the last Sprat. "Greetings Colin, The column contained month contained an item from **Wim PA0WDW** regarding his crystal controlled convertor/regen. detector. I was going to write but it took too long! I'll summarise here. The receiver Wim describes is referred to as a 'supergainer' and has indeed been built many times from the 1920s to the present day. The main problem with regenerative receivers is getting the regeneration controllable over a wide frequency range. Making the detector fixed tuned on the 'IF' of a tunable or crystal converter eliminates it. Furthermore the gain of a regenerative detector is considerable so demands of stability, detector radiation and loading of the detector are all considerably eased. The detector bandwidth also narrows as the regeneration is increased.

"The only coil range I know which successfully implemented a general coverage regenerative receiver was the old Denco range and I have the technical bulletins. The other way I saw, (decades ago!) was using an Electroniques front end coil pack (HB166 or GC166) with a regenerative detector. I could go into more details on that but I'll leave it there and just say I have a number of references and circuits in my archives which can be applied in various combinations.

The one common feature is that most of them will easily outperform any direct conversion, and some will outperform a regular superhet. In that context, I'm afraid the usual NE602/LM386 combination is, by comparison, a nonstarter, though the '602 would serve as the front end convertor with one of **Charles Kitchen's** high performance regens. You can find those in *QST* back numbers: just look up '*N1TEV regenerative receivers*'. Hope that's of some use to the experimenters . . .!" I agree Peter and I remember **Pat Hawker G3VA** telling me his favourite receiver was a broadcast TRF receiver and a pre-war front end coil pack and associated mixer. I wonder where they went to when he passed away?

If you want to hear a well-designed TRF receiver in action try this YouTube clip from ON6WJ: ***https://www.youtube.com/watch?v=1_yBh_B2z_Q***

November Valve QRP Reports

Valve QRP Days November 2019 Reports

+ G5LOW Activity

"Hi Colin, Using valve equipment I had a total of thirteen QSOs, of which nine were on 80m, and four on Top Band. Of these, eight were two way QRP valve contacts and three were on Top band. I was particularly pleased to give G4LUO (who running 1watt from a TS-590) his first Top Band CW QSO. My gear was an Eddystone 830/9 receiver (passed its best now) and either a Mk119 spy set or a homebrew vfo/ 807 pa transmitter with a 200ft doublet antenna. Conditions on Saturday seemed good with lots of activity heard on 80m with 40m blocked with the usual contest and even some contest activity interfering with Top Band." **John G3TYB**.

"Hi Colin, here is my short report from my activity in Valve Day. I used my old valve transmitter (my first transmitter from 1984) with an EF80 and two EL84 and a 1625 in PA. To adjust the power I installed a simple FET regulator of Ug2 screen voltage in PA stage. Power is adjustable from about 0.5–25/30W. The frequency has a slight drift but this is a 60 years old radio. In the two day of activity I worked 17 QSO, (11 on 80m and 6 on 20m) , with 11 DXCC. The power was 4-5W into a Windom or inverted vee antenna. I had a problem on 80m with a strong noise level, always around S8, and the receiver was a Yaesu FT817nd with 350Hz filter and a Timewave DSP-599zx audio filter. **Karolj YU7AE**.

"Hi Colin, thanks to **Paul, G3VCN** who kindly answered my wanted advertisement in *RadCom* for a Codar AT5, I was able to join in on 80m for GQRP Valve Weekend this year. It's a long time since I used valves, and after sorting out an intermittent high resistance issue with the heater supply, I then realised that there was over 200V on my old straight key! I attempted to cover the offending screw terminals on the WT8 Amp Key which was partly successful. The weekend was divided into two halves, because at 1500 on Saturday I had to take down my 80m dipole to erect a 160m dipole for the RSGB Club Calls contest, and then on Sunday morning take down the Topband dipole and re-erect the 80m dipole so I could continue with Weekend. Great fun, and I can't wait for the next time" **Tim G4ARI**

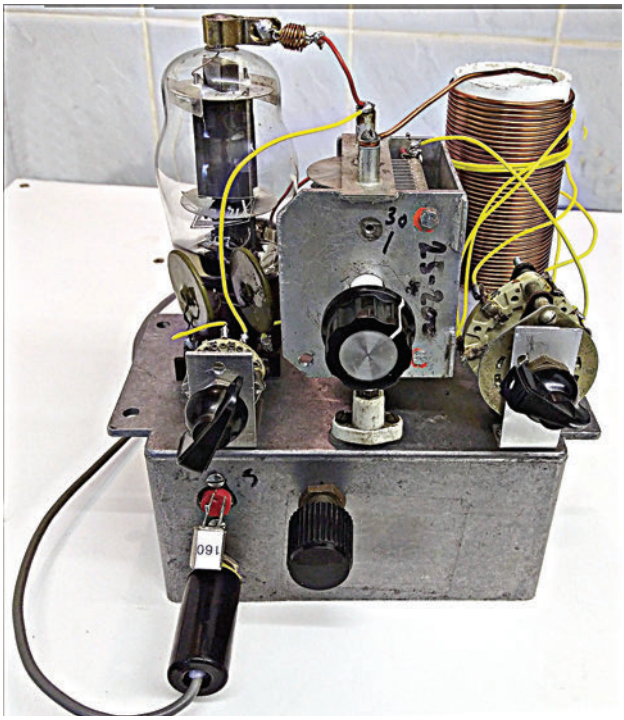
"Hello Colin OM, a few notes for your consideration. I heard you a couple of times, both on 80m, but was unable to raise you. I know you encourage rag-chewing but on several occasions quite long QSOs were evident on the QRP calling channel. Some operators only have 80m crystal control so of course they could not get QRV during these periods. Maybe I could suggest, (as you have before), a time limit of say 10 mins. per QSO then clear the channel for 5 mins. unless called? Obviously when off the QRP channel you can chat as long as you like. I'm trying very hard not to be negative!" **Chris G3XIZ**

"Hello and thanks to all who listened out on 5262kHz and made whole or partial contacts with the 0.7 - 1Watt from the CO/PA. I heard M0ECS call me at 1158. He was 599 but I think he was looking for me rather than hearing my sigs. Phil, G3SES, was the first contact at 1214 and we had a brief 3-way QSO with Steve G3ILO across in Lincoln who gave me 559. At 130 **Colin** at **G5LOW** briefly heard my reply to his call. I didn't catch the report he gave me but my strength was 2 and I think he lost me after that. Then at 1329 an excellent QRP contact with Chris G4CWS. It was dodgy at first but with tenacity on his part we kept going and he upped the report from 449 to 559 as conditions improved. An enjoyable 'Valve 3 Hours' and a unique chance to assess problems which were mainly the Tx/Rx changeover

and breakthrough of the master oscillator during receive. All should be easy enough to put right. I'm looking forward to the next one. (Used two 3A4 in parallel as a PA and a 3S4 crystal oscillator)"**John G0UCP**. **Derek G3NKS** writes, "I had planned to spend much of the weekend in the QRP shack but I was 'hi-jacked' by last minute family and social events! So I had just 7 QSOs all on 80m. Stations declaring valve TXs were G5LOW (aka G3VTT) G3XJS and G4BLI. I was using my usual 6V6 CO/PA at 5W, a Drake R4C receiver and a G5RV up at 15ft. Hope to do better during the Winter Sports. Many thanks to Colin for organising and promoting these valve QRP sessions, they are much enjoyed."

From **Peter G3XJS**, |The equipment used throughout the weekend was a Drake T4XC transmitter at 3W output, (I used 5W to work G5LOW on 80m on the 9th), Drake R4B Rx and a Doublet for 160/80m and Hexbeam for 20m. Top Band on Saturday evening was tough going because of yet another contest and warbly digital signals. Propagation was quite good but the contest stations did their usual trick of walking all over other QSOs. I found 80m daytime propagation to be good with generally good levels of activity with most QRP stations entering into the spirit of the event by running valve equipment even if it was a 6146 in the output of older commercial gear! How nice it was to hear so many homebrew CO/PA transmitters. Many thanks for organising the event which I'm sure we all enjoyed very much indeed.".

A great weekend of activity. At the last moment (a week before the weekend) I decided to make a multi band CO/PA using one of my spare 19 Set 807s. The usual junk bits and pieces were gathered and the results can be seen in the attached photo. It is the same as the 'Vandals Valve TX' by GM4BQA published in *SPRAT* 61 p16, with the tuned circuit in the anode sconfigured as parallel and a six-way switch has been used to tap the anode coil to allow operating on 160 through 20m. QSOs for the activity weekend were the best for me so far with 28 total QSOs, 17 unique calls. I'm looking forward to the next one." **Ian G4GIR**.



That wraps it up for this time. I hope you had a great time in the Winter Sports and that you have plenty of construction projects for those cold dark winter evenings. The years just fly by and I hope you have a very Happy Christmas and a Healthy New Year. This year has been a dreadful year for QRP with the loss of a number of prominent operators and constructors.

As **G3FXB** used to say "Let's keep the show on the road!"

COMMUNICATIONS AND CONTESTS

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

Hi I hope everyone has had an interesting time on the air this Autumn and are looking forward to the Christmas holiday period. I note the conditions have been varied between downright dreadful and barely passible but managed to hear qrp ops on the bands most of the time. I will be on the air as I am sure several others will be for the annual:

G QRP Club Winter Sports

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

The Winter Sports is not a contest, although the G4DQP Trophy is awarded to the operator thought to have made the best overall contribution to the event. It is usual for operators to exchange their G QRP Club membership number. Those taking part are invited to submit logs and comments to the G QRP Club Communications Manager, Dominic Baines, M1KTA, email at m1kta@gqrp.co.uk, Alternatively at the address in the heading.

I thought I should also mention the RSGB Foundation Award, by its very nature is QRP. If you are a new licencee please be active and bag the award, it might help show the RSGB are not just about 400W and beam activity!

http://rsgb.org/main/operating/amateur-radio-awards/foundation-award/

Please do not forget to start to collate logs for the CHELMSLEY TROPHY for DXCC worked in 2019. It will be interesting to see how some have performed.

GQRP Will be needing a new Communications Manager.

After a few years in the role it is time to allow someone else to take over so Steve Hartley will be looking for applications for the role. Perhaps you might have ideas of how to do things a bit differently and how to take the club forward.

If you think you might like to apply or to even discuss what is involved please drop either Steve or myself an email.

Spectrum Forum Issues

The meeting has not taken place at the time to writing but I'll update in the next SPRAT.

Operating for all these activities should take place on and around the International QRP Calling Frequencies of:

CW: 1836, 3560, 5262, 7030, 10116, 14060, 18086, 21060, 24906, 28060 kHz
SSB: 3690, 7090, 14285, 21285, 18130, 24950, 28360 kHz

I recommend if there are a few stations on frequency please spread out a bit if you can.

Reducing the resonant frequency of a quartz crystal by electroplating

Philip Miller Tate M1GWZ – Email: m1gwz@icloud.com.

While the benefit of a quartz crystal oscillator is its stability, the compensating downside is that its oscillation frequency is nearly fixed. Although it is possible to "pull" the frequency by a small amount with a capacitor and/or inductor, the range of available crystal frequencies nowadays is limited and rarely do they meet the criterion of falling within the amateur radio bands.

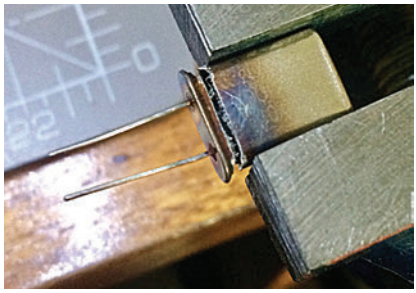


Fig 1: Removing crystal from its case

In days of old, amateurs would open up their crystals, extract the quartz plate and gently grind it down in order to raise the frequency to a more convenient one. But this technique, which is more of an art than an exact science, has always been problematic.

Modern crystals do not readily lend themselves to this technique as they have their metal contact electrodes directly evaporated onto the crystal surface, and these would have to be removed before grinding could be carried out, leaving the problem of re-establishing contact afterwards.

Fig 2: Not to be touched by hand

It recently occurred to the me that in contrast to grinding (which increases the resonant frequency), the frequency might be usefully reduced by adding mass to the quartz plate. While this has been done in the past by adding pencil graphite or Indian ink to the surface. This is a "hit-or-miss" method though, with little control, but a much better prospect might be to electroplate additional metal onto the existing evaporated electrodes.

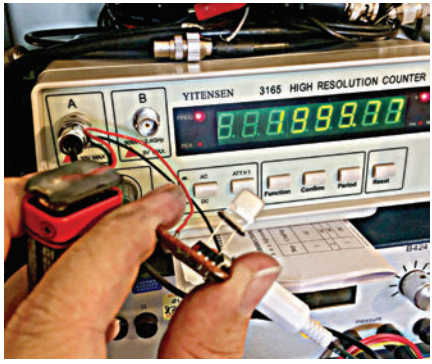


Fig 3: Checking its start frequency

The mass of metal deposited by electroplating depends only on the total electric charge passing. This is the product of plating current and time only, thus allowing a much greater degree of control and reproducibility with simple apparatus than other methods.

The metal chosen was copper, as copper sulphate is cheap and readily available and dissolves easily in water. Around 12.5g of hydrated (deep blue) copper sulphate, $CuSO_4.5H_2O$, dissolved in 100ml of water is all that's required. (A chemist would call this a 0.5M {"molar"} solution.) Copper sulphate is mildly toxic to fish and aquatic life, but quantities used are small, require no special handling precautions. It don't even come close to the unpleasantness of the ferric chloride used to etch printed circuit boards!

Firstly, it is necessary to break into the protective can of the crystal. In the case of a modern HC49U crystal, this requires the careful use of a sharp junior hacksaw blade, needle file, or similar. A break is scored all the way around the base of the package (**Fig. 1**) and the crystal carefully lifted out (**Fig. 2**). The crystal and its mounting wires are tougher than might be expected, and you have to be very heavy-handed or plain unlucky to damage the crystal in this way. You will need a suitable test oscillator and a frequency meter (**Fig. 3**) to check and record the crystal frequency at this stage. Do not touch or otherwise contaminate the crystal surfaces.

The plating process will require a stable, low-voltage power supply of only 2–2.5V, preferably current limited to about 50–100mA. Both crystal wires are connected to the negative side of the supply (a crocodile clip lead is convenient). The positive side is connected to a suitable counter-electrode (a piece of double-sided copper PCB about 1x5cm is ideal) via a suitably accurate ammeter. The counter-electrode is immersed in the plating solution. On immersing the crystal in the solution, a current should flow. Adjust this to about 50mA if possible and start by timing immersion in 30s increments (**Fig. 4**). At each stage, remove the crystal from the plating solution and rinse immediately in clean tap water. Dry thoroughly with a small hair dryer and check that the crystal is still oscillating and note the frequency.

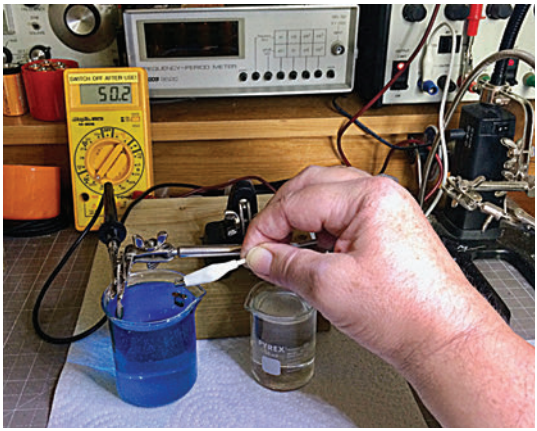


Fig 4: Plating progress, it doesn't need long

Once the current is reasonably stable, the change in frequency is directly proportional to the mass deposited and that mass is directly proportional to the plating time. In this way it is possible to calculate / estimate the time required to achieve a desired frequency to within a few hundred hertz.

The Top Band net of the Echelford Amateur Radio Society meets on Sunday mornings on 1.979MHz. After one initial attempt, I was able to meet this requirement using nominal 2MHz (G-QRP club) crystals to better than ±400Hz on three attempts.

I've also managed to push the resonant frequency of one such crystal down to 1.850 MHz before it ceased to oscillate. Crystals thus prepared seem to be stable over time in spite of slight oxidation of the copper.

Provided the crystal is kept in a clean and mechanically-protected environment it should not be necessary to re-encapsulate it, but this can be achieved with a modicum of ingenuity.A detailed description of the process described above is available as a video on the Echelford ARS YouTube channel at:

https://youtu.be/CtkP40V4oC4.

Postscript: Today I managed to cut open an HC49J low-profile can and extract the (still functioning) tiny 10MHz crystal inside (not a useful radio frequency to lower but I have a bunch of them). 30s plating at 28mA shifted the frequency down 195kHz.

Further plating killed the crystal altogether. Playing with these higher-frequency crystals is going to need significant care and attention! Please feel free to direct any other enquiries to me

MEMBERS' NEWS

by Chris Page, G4BUE

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gc4bue@gmail.com

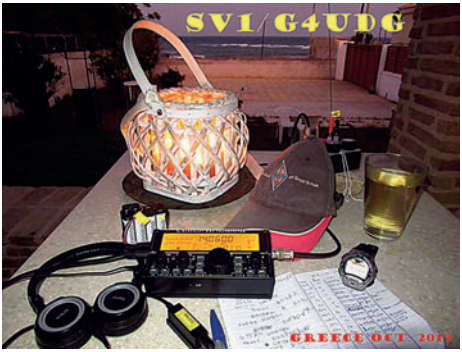
M6BOY, the founding editor of the ICQ Podcast <http://www.icqpodcast.com> reports the first winner of the Homebrew Hereos Award, **GØUPL** (left). Colin says, "This annual award recognises persons, groups or organisations who help define the frontiers in amateur radio technology through the long-standing tradition of 'home brew' construction. This is the first of the annual awards given by the new program, housed at the website address, homebre wheroes.org". Hans said, "To be the honouree for the first of these Homebrew Hero Awards is quite significant for me. I am humbled and, frankly, just blown away by it all. I've been sharing my homebrew work through my personal website at hanssummers.com for years now and my company, QRP Labs (qrp-labs.com), for just a few years. But the latter is my full time work these days. To have these efforts publicly recognised in this way is so personally gratifying".

Don't get disheartened if you can only use an indoor antynna. Using his Xiegu G90 (right) with only 1W on 20m CW to an indoor Crown Loop antenna, **GWØVSW** had QSOs with 9A, CT3, DK, two-way QRP with **EA1KC/P** running 3W, F, G, HA, HB9, I, LY, OK and S5. Carl's furthest contact was **EG8SDC** at 1700 miles.

G4EHT is now using only indoor antennas, rotatable homebrew Moxons in the loft for 2, 4 and 6m and says they work remarkably well. Bill has also made a doublet, 25 feet each leg in a Z shape to fit the loft, for 10-80m. He uses an IC-7300, which he says is great for running QRP, and recently got another Codar AT-5 and an Eddystone EC-10 RX that he has got working for 80m AM. On 29 October **2EØFRU** ran 200mW on 20m through his loft loop antenna for an hour and got many WSPR 'hits' in North America.

Heli, **DDØVR** operated as **3D2VR** in September (right) and found conditions to Europe very poor. **GØXAR** mentions the AliExpress website <http://s.aliexpress.com/yMvI7BZN> offering a three valve TCVR for 40m that Steve suggests might suit those wanting something for valve day. **MØNDE** and wife Michele, **M3WAH**, have retired onto a narrowboat. Nigel says downsizing was a challenge but they have a shack with HF to UHF antennas.

In addition to operating from his home in Paris, **F5NZY** has a holiday QTH in Normandy where he uses the hexbeam (above). If you want to see it in a storm, see <https://www.youtube.com/watch?v=d4va_sv19Xc&feature=youtu.be&rel=0&autoplay=1>. Since 26 October Steph has been QRV from Normandy on VHF with a Big-Wheel and, despite skeds with **G4HVC**, hasn't crossed the English Channel yet . For a few days he was QRV WSPR with 5W and the picture above right shows where his signal was heard. Steph updated his QRZ page at <https://www.qrz.com/db/F5NZY >.



G4UDG was QRV for two weeks recently as **SV1/G4UDG** at Loutsa Artemida, Greece (right). Using EFHW antennas at 20ft with counterpoise wires for 30 and 20m and his KX-2 mostly at 2.8W with an Emtech ZM-2 ATU, Chris made 150 QSOs in 33 DXCC, including 34 with two-way QRP. His best DX was **WA1FCN** (5800 miles) and his best QRP DX with **RX3G** (1270 miles). His 'most amazing QSO' was cracking a pile-up with 1W to **A71A**, and his 'most amazing QRP QSO' with **RA7RA** who was running just 72mW. Chris says, "Once again this was an amazing experience to operate with a little QRP station running off batteries (no PSU or trailing mains leads needed), and really good fun working my QRP friends. The station performed very well, even with very simple wire antennas'

N2CQR has reduced the transistor count in his Fish Soup 10 rig from 10 to just two in his new ET-2 (above). Bill attempted to replicate the success of **W2UW**'s ET-1 as described in *SPRAT* 108. Glen built a 40m TCVR that used just one transistor! Bill didn't switch his transistor, instead he used one transistor for the regen RX and one for the 80mW TX. With an assist from the *DXSummit* spotting network, Bill worked **K4MQG** in South Carolina from Virginia, using his dipole while Gary had three elements at 115 feet!

Pictured top of the next page is **G3TPV**'s latest 160m AM hybrid hand-held TCVR running 300mW out. The TX is crystal control with series mod using a single 12AT7 double triode, and the RX a NE602 mixer oscillator, a MK484 chip IF detector, 1st audio with ceramic filter and a LM386 audio out. The mic is a 64 ohm. The internal battery pack is 24

series wired PP3s for the TX HT, five AA cells for the heaters and six AA cells for the RX and modulator pre amp. Allan uses it with a six feet loaded whip, with a 90 feet wire for ground plane (*thanks **G6MNL***).

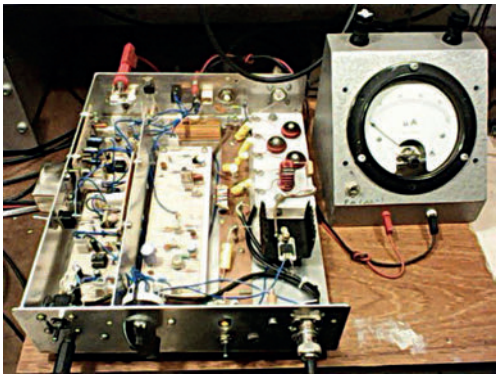
G3OTK wonders why home-made equipment is not used more by entrants in UK CW contests. "Perhaps constructors are not contest operators and vice versa" he writes. Richard likes to do both because contests are a useful way of assessing performance of newly constructed or modified equipment, providing the 599 signal reports are not believed! This year he operated in the six spring series RSGB 80m Club Contests using his home-made 3W CW TCVR and 80m dipole only ten feet high, and appears to be the only one using home-made equipment. The contests last 90 minutes and his best score was 87 contacts, but more usually he makes 50-60 contacts. Richard was pleased to make 8th position (out of 59) in the 10W QRP section of the contest series. He also entered the 3W Fixed Location section of the RSGB Low Power Contest in July with the same equipment, and despite poor conditions made 33 contacts for third place.

Pictured above are the smiling faces of members on the Club stand at the recent Telford Rally (l to r) Colin, **G3VTT**; Tex, **G1TEX**; Graham, **G3MFJ**; Trevor, **G6PSZ**; Mark, **G6PVF** and Lewis, **G4YTN** (*thanks **G4EDX***). **GØUCP** writes, "Congratulations to the club team who organised the QRP part of the Hamfestand to the Telford club. The new venue is ideal, the Buildathon, talks and the lively Club sales table all carried on the enthusiasm of **G3RJV**".

GØEBQ is building the 'Paesano', developed by **N6QW** from the Pererino, a 5W SSB rig for 20m. Nigel says, "Pete's version is 'posh' and uses Arduinos and digital displays, but mine is more basic with a VFO as I'm not that technically gifted. Mine is working as far as the TX driver which gives a clean 500mW out, and the RX is perfect, but I'm still having problems getting the linear right. Pete is a true technical genius and is giving me lots of

help". Most of **G4TGJ**'s operating has been a few SOTA activations with highlights being Elidir Fawr (GW/NW-005) and Y Garn (GW/NW-004) on the same day. From home Richard had plenty of QRP QSOs with his 40m homebrew TCVR but has spent most of his time enhancing the Arduino software or tinkering with the hardware. His current project is to make it multi-band, experimenting with MOSFET drivers, class D and class E amplifiers. After adding a 60m LPF to the new class D amplifier, on 10 November Richard had his first two 60m CW QSOs with **G3JFS** and **G3SES**, the IRF510 PA outputting about 8W.

G3XIZ was so impressed with the elegant simplicity of **ZL2BMI**'s SSB TRX in the last *SPRAT* that he made himself one (pictured right). Chris already had a 'prototype' AM TRX so was able to incorporate some of the existing circuitry into the new SSB rig. It generates 5W on 160m and as our regular AM net has now gone over to SSB (due to increasing QRM), it gets regular use. His closest op, **MØPLT**, is only 150 yards away so Chris has added a simple AGC and S-meter circuit. All reports are favourable and during the CQWW Contest he managed to get contacts as far as GM and ON.



KA9P was QRV as **MU/KA9P** for two days in mid-September and enjoyed some great 20, 30 and 40m hand-held CW QRP contacts from St Peter Port. Scott says, "Of potential interest may be the homebrew 3/8-24 female thread mounting plate fitted to the KX2 for the trip (pictured right). The plate allows easy use of any 3/8-24 stud antenna, in this case a single 12 inch Buddistick rod section, standard coil and whip resonated on 10 through 40m, yielding an effective five-band antenna (pictured far right). Though not as cute as an AX1, and bigger, the proof was in the pudding, and I enjoyed several nice rag-chew contacts. While the 30 knot wind gusts provided a bit of a challenge to holding the radio steady enough to send CW with the side-mounted paddle, leaning on a wooden fence made it all very doable, and the set up time was only about two minutes".

Thanks to all the contributors of this column. Please tell me how your winter goes for the Spring 2020 edition of *SPRAT*; what you have been building, who you have been working, and any other information about QRP, by 12 February. 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 spring and summer months, so I can let members know to listen out for you.

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HC49U (wire) crystals for all **CW** calling freqs – 1.836, 3,560*, 7.015, 7.028, 7.030* 7.040, 7.045 7.122, 10.106, 10.116*, 14,060*, 18.086, 21.060, 24.906 & 28.060 all are **£2 each** } plus **postage** } **(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 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 26.0, 27.0, 28.0, 28.224, 30.0, 32.0, 33, 40, 48MHz – **all 35p each** (Some of these are low profile) } £1.20p (UK), or } £3.50p (EU) or } £4.00 (DX)

Ceramic resonators – 455, 480kHz, 2.0, 3.58, 3.68, 4.00, 7.37, 14.32 & 20.00MHz **– 50p ea.** }

Diodes - Shottky signal diode – 1N5711- 20p each; 1N4148 GP Si – 10 for 10p } Post free

Varicap diodes - MVAM109 – 40pF @ 9v, 500pF @ 1v. **50p each** } if ordered

- BB204 – twin diodes, common cathode, 15pF @ 20v, 50pF @ 1v **50p** } with heavier

SA602AN - £1.50 (note – I may supply NE or SA, 602 or 612 as available. **SA612AD – SMD SOIC-8 £1.40** } things

MC1350 - £2.00 These are getting in short supply now so max of 2 per member } like binders,

LM386N-1 - 4 to 15v, 300mW, 8pin **DIL** - **£0.45, LM386M-1 SMD SOIC-8 – 35p** } toroids,

TDA7052A - 4.5 to 18v, 1W 8pin **DIL** low noise & DC volume control – **£0.60 each** } polyvaricons,

TDA2003 - 10w audio amp – 5 pin **£0.25 each** } or filters

TDA2822 - 1.8 to 5v stereo amp – can be bridged. 0.5WAudio amp 8pin DIL – **£0.20 each** } Use just

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

2SC536 transistors (npn) fT - 100MHz, hFE-320, VCBO +40V **- 5 for 50p** }

MPSH10 transistors (npn) fT - 650MHz, hFE 60, 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 } postage

Pad cutter - 2mm shaft: 7mm o/s, 5mm i/s diam, gives a 5mm pad with 1mm gap **£6.00** } as books

10K 10mm coils – 0.6uH, 1u2H, 1u7L, 2u6L, 5u3L, 11u0L, 45u0L, 90u0L, 125uL – all 80p each } or DVDs

Magnet Wire – 18SWG – 2 metres – 60p; 20 & 22 SWG – 3 metres - 60p; } do not

24, 25 & 27SWG – 4 metres - 40p; 30, 33 & 35SWG – 5 metres - 30p. } travel well

Bifilar wire – 2 strands - red & green bonded together. Solderable enamel. } with parts.

21SWG (0.8mm dia) – 2metres - £1; 26SWG (0.45mm dia) – 3metres – 70p }

Litz wire – double silk covered multi-strand wire 7/.04mm -12p, 14/.04mm. 25p. Both for 3 metres. }

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

QRP heatsinks - TO92 – 30p; TO39/TO5 – 40p; TO18/TO72 – 60p (pics in Sprat 148) }

Axial lead inductors (they look like fat ¼W resistors) these are low current }

3.3, 4.7, 6.8, 10, 15, 18, 22, 33, 39, 47, 56, 100, 150, 220, 470 and 1000 - all uH, all 20p each. }

Toroid Cores – priced per pack of 5 – max of 2 packs of each per member

T25-2 – 50p, T25-6 – 60p, T30-2 – 70p; T30-6 – 80p ; T37-2 – 80p; T37-6 – 80p; T50-1 - £1.00; T50-2 – 90p; 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 FT50-43 - £1.20 ; FT37-61 - £1.20 ; FT50-61 - £2.40; Ferrite beads – FB43-101 (3.5mm dia x 3.2mm long, 1.2mm dia hole) – 40p for 5: BN43-2402 - £1.20; BN43-202 - £2.00; BN43-302 - £2.40; BN61-202 - £3.40. } **Postage for toroids includes postage for all small parts**

All toroids are plus postage – up to 5 packs = £1.20 (UK), £3.50 (EU), £4.50 (DX). Each additional 5 packs, please add 50%

**** Except** **item** – these are heavy and each counts as a pack (ask for quote if you want more than 2 of the large toroids)

MeSquares & MePads * - £6.50 each plus post (UK & EU as parts for up to 4) : will DX please order direct from Rex)

STIX board * – 3" x 1", 80 x 0.15 square pads plus 2 x SOIC pads. £3.75 each. Will post with parts for no extra postage.

*** these items from Rex's stock are pictured on the website.**

Limerick Sudden kits RX & TX both single band (160 through 20m); **ATU** (80 through 10m) **£40.00 each plus post** UK - £3.50, EU - £5.40, DX - £8.00

Sprat-on-DVD – 1 to 172. Only £5 each to members plus postage, UK - £1, EU - £3, DX - £4.00

Sprat Binders – nylon string type – Black with club logo on spine -16 issues per binder – **new stock** - £6.00 each plus postage (one: UK - £2.00, EU – £4.00, DX - £5.00. More - add £1.10, £1.50, £2.50 each)

Cheques (UK) and payable to G-QRP Club. MINIMUM ORDER for cheque or PayPal payments is £5

You can also pay by BACS. The numbers you will need to do that are - sort: 01-07-44 and a/c: 54738210

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