SPRAT

THE JOURNAL OF THE G QRP CLUB

DEVOTED TO LOW POWER COMMUNICATION

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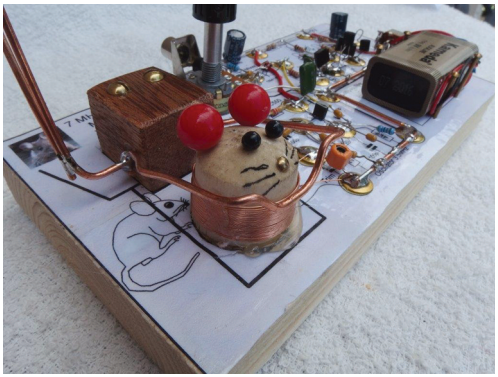
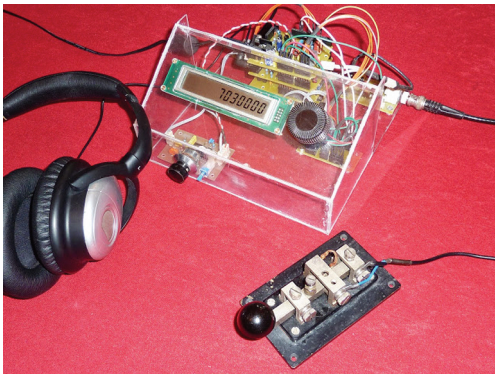


Mousetrap Receiver



Occam's Microcontroller

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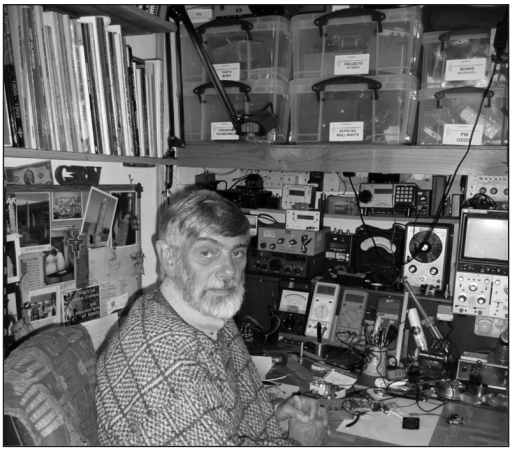

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A major article in this issue by Paul Darlington, M0XPD, introduces the idea of using microcontrollers with conventional QRP projects. Paul will back this article up with a talk at Rishworth and a demonstration at the Constructor's Evening; the evening before the convention. The theory will be backed up with practical kits and modules to introduce analogue devotees, like me, to simple digital circuitry.

Many of the ideas introduced in Paul's article are supported by a new "Shield" (i.e. "Expansion Board") for the Arduino, which has been produced by Dennis, g6ybc and Paul, m0xpd. This device interfaces a Direct Digital Synthesis module to the Arduino, making RF experiments very easy and supporting all the code examples accompanying Paul's article. The DDS Shield is available from Kanga-UK.
See you at Rishworth?

72/3

G3RJV

The W1FB Memorial Award 2011/2012

Off to a slow start, the W1FB challenge has suddenly taken-off with an influx of entries. So much so, that I am **extending the closing date to the end of November**. A simple theme: Beginner's Receiver. Please supply circuit diagram(s), full component values and brief notes. A SPRAT formatted page (MS Word) can be supplied on request but any format including hand written may be used. A special plaque is presented for the best design.

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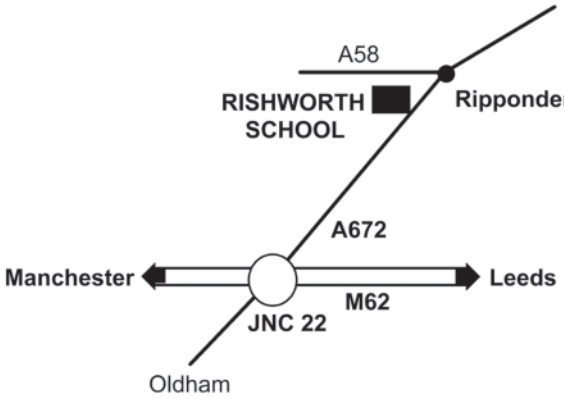
THE G QRP CLUB
MINI-CONVENTION

(in conjunction with the Halifax Radio Society)

Saturday 26th October 2013
The Rishworth School, Ripponden



OPENS AT 10.00am
ADMISSION £3
DOORS OPEN 10am
TALK-IN S22
LARGE SOCIAL AREA
LECTURES ON
QRP SUBJECTS
BRING & BUY - SURPLUS
JUNK - COMPONENTS
KIT TRADERS
FOOD & DRINK ALL DAY
WITH THE FAMOUS PIE AND PEAS

The Rishworth School is on the A672 (Ripponden) road from Junction 22 on the M62. [Postcode: HX6 4QA]

Look for the G QRP Sign on the left after you have passed all the sheep!

CONSTRUCTORS EVENING (Friday Evening before the convention) Including a Buildathon (see overpage for details) to be held at Premier Inn, Salterhebble Hill, Halifax, HX3 0QT. (Tel: 0871 527 8486) www.premierinn.com/en/hotel/HALPTI/halifax-south

Other suggestions for local accommodation:
The Premier Inn, Milnrow. Junc 21 on the M62 (Tel: 0871 527 8936) www.premierinn.com/en/hotel/ROCTHE/rochdale
The Malthouse, Rishworth. Almost next door to the school – only 5 rooms (Tel: 01422 822382) www.malthouserishworth.co.uk
The Turnpike Inn, Rishworth, excellent but quite expensive. (01422 822789) www.turnpikeinn.com

Radio Constructor's Evening
Friday 25th October from 7.30pm
(The evening before the Rishworth Convention)
Premier Inn, Salterhebble Hill, Huddersfield Road,
Halifax, West Yorkshire HX3 0QT

- **Buildathon**

Build the RSGB Centenary Receiver (20m PSK). Full kit with printed circuit board only £15. Note: although the RadCom version linked the receiver with the Raspberry Pi, our version will be used with a normal laptop or desktop PC. (Free software supplied) See article on opposite page. Book your place with G3RJV or G3MFJ as below.

- **QRP Show and Tell**

Bring along your favourite QRP projects – show them off and tell us about them.

- **A Free Buffet Supper. Free tea and coffee (Bar in hotel)**

If you are interested in being part of the Constructor's Evening let George, G3RJV, **(g3rjv@gqrp.co.uk)** or Graham, G3MFJ, **(g3mfj@gqrp.com)** know (postal addresses are also in SPRAT).

STELAR

2013 sees the 20th anniversary of STELAR (Science and Technology through Educational Links with Amateur Radio) an amateur radio charity which has over the years trained a significant number of school teachers to gain their amateur radio licence and support clubs in their institutions.

At our last AGM, STELAR charity trustees voted to use some of our financial resources in supporting an educational initiative to be launched in this anniversary year; its purpose, to re-connect with school clubs and support a number of defined activities.

Initially we are looking to sponsor 50 schools with a licensed member of staff (or member of a local club who runs amateur radio activity within the school) and provide them with membership of AMSAT-UK and access to the G-QRP magazine SPRAT. In addition, STELAR will fund an initial five FunCube dongles to selected schools and support their use in science and technology within the classroom.

If you are interested in applying on behalf of the school in which you teach or support, please send an e-mail with appropriate details and a brief description of your current activities to **mail@stelar.info**

It is with great regret, we announce the deaths of Margaret Keyser (wife of Ian G3ROO) and Marylen Clark (wife of Bill GM4XND). Many members will remember Margaret and Marylen from the help they gave at QRP Conventions at Rochdale and Rishworth. They had known each other for many years and, sadly, died on the same day.

Sudden PSK?

Steve Hartley, G0FUW, g0fuw@tiscali.co.uk

The Bath Buildathon Crew have been running construction events in Bath and helped out at the Club Convention at Rishworth for about 5 years now. We were asked to staff a Buildathon at the RSGB's Centenary Day at Bletchley with a project that would be attractive to youngsters. We thought about something in keeping with the venue, a spy set maybe, but in the end we went for a data receiver that could be used with a computer; something to reflect the more modern face of amateur radio and young folk love screens. The full details of the project are to be published in the September 2013 RadCom magazine together with opportunities to buy PCBs, crystals, etc, but I thought SPRAT readers might like to see the circuit and maybe have a go at building from scratch, or even by modifying a Club kit.

The idea came from Dave Benson's Warbler transceiver that used an 80m crystal filter ahead of a direct conversion receiver. That circuit did not work out for us and we dabbled with a circuit from the on-line magazine 'Nuts & Volts'. That led us to the conclusion that we were actually looking at a modified Sudden receiver, a circuit we had used in previous Buildathons. We modified the front end with a crystal filter, added an RF amp, and bingo! We added a small gain control on the LM386, but it is not critical. Club Sales have the crystals and the front end coil/FET parts for 80m. With the circuit below you could buy a Club Sudden 80m receiver kit and have it receiving PSK31 in no time; just trim the oscillator to 3.581MH, plug into the PC mic socket, run the software and peak the front end.

The RSGB decided that the Centenary Day project should be on 20m to demonstrate the international dimension of the hobby, so modifications had to be carried out. I tried a prototype with 14.060MHz crystals and soon had a neat little single channel CW receiver. The PSK frequency crystals (14.070MHz) were not readily available and a bespoke order was despatched to the Far East (I understand these will be available from the RSGB if you want to build a 20m version). It is still a modified Sudden and due credit was given in the construction manual, which should be available for download by the time you read this.

To decode the PSK signals we have used a Raspberry Pi running FLdigi, a laptop running Digipan, a PC running HRD/Digital Master 780 and a smart phone running a PSK app.

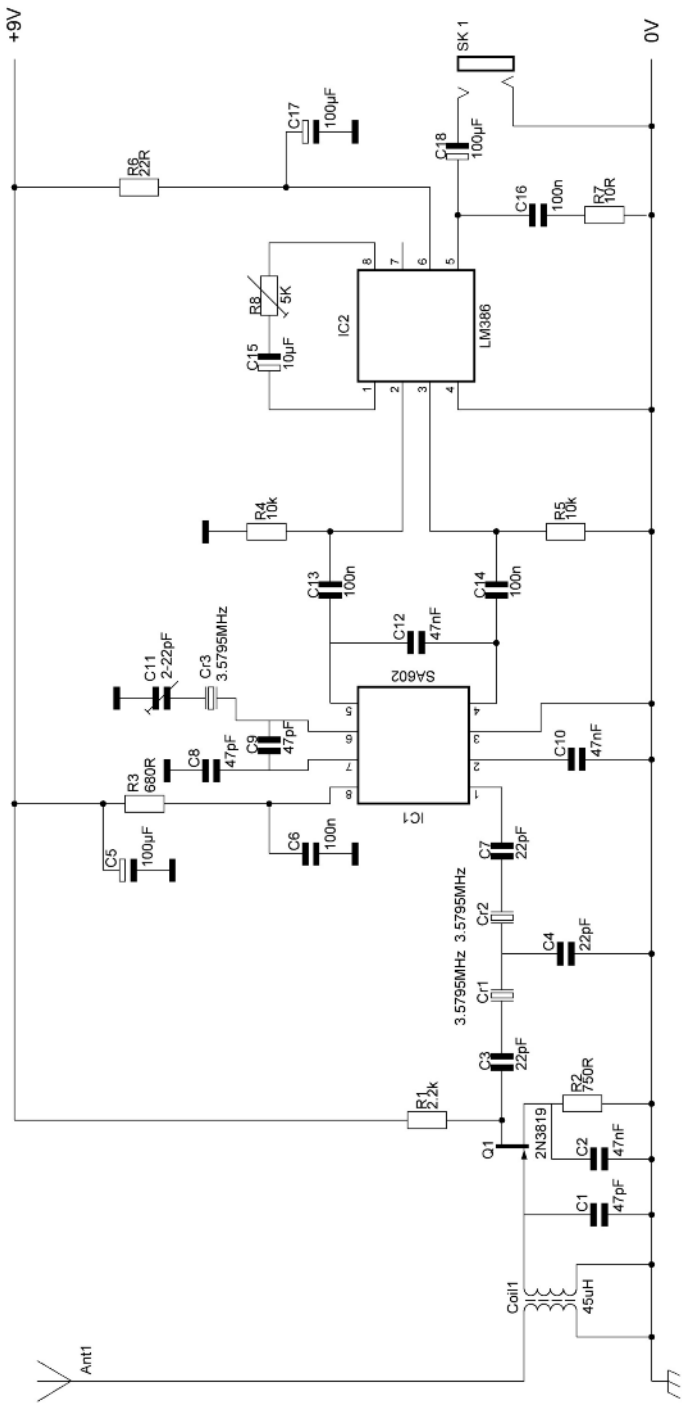
Twenty one receivers were built on the day and all worked, once a few solder bridges had been cleaned up, and the school children loved it (so did their science teachers). The youngsters that attended the Centenary Day were also given a Raspberry Pi computer each by RS Components. You can see a video of the Centenary Day on the RSGB website and that includes some good footage of the Buildathon.

The circuit diagram here is for the 80m version. For 20m the following component changes are required:

Crystals 1 to 3 = 14.070MHz (trim to 14.071MHz)

Capacitors C3, C4 & C7 = 10pF

Coil 1 = Spectrum 10K 2μ6H


+9V
0V
SK 1
C17
100µF
C18
100µF
R6
22R
C16
100n
R7
10R
R8
5K
C15
10µF
IC2
LM386
R4
10k
R5
10k
C13
100n
C14
100n
C12
47nF
C11
2-22pF
Cr3
3.5795MHz
SA602
IC1
C8
47pF
C9
47pF
C10
47nF
R3
680R
C5
100µF
C6
100n
C7
22pF
Cr2
3.5795MHz
C4
22pF
Cr1
3.5795MHz
C3
22pF
R1
2.2k
R2
750R
Q1
2N3819
C2
47nF
C1
47pF
Coil1
45uH
Ant1

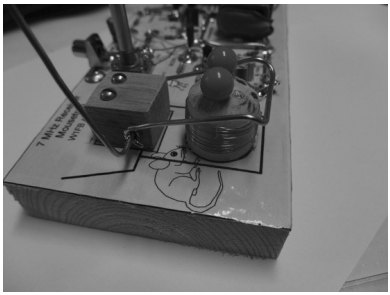
WIFB MEMORIAL ENTRY

The Mousetrap Receiver

Johnny Apell SM7UCZ, Ekedalsvägen 11, S-373 00 Jämjö. Sweden

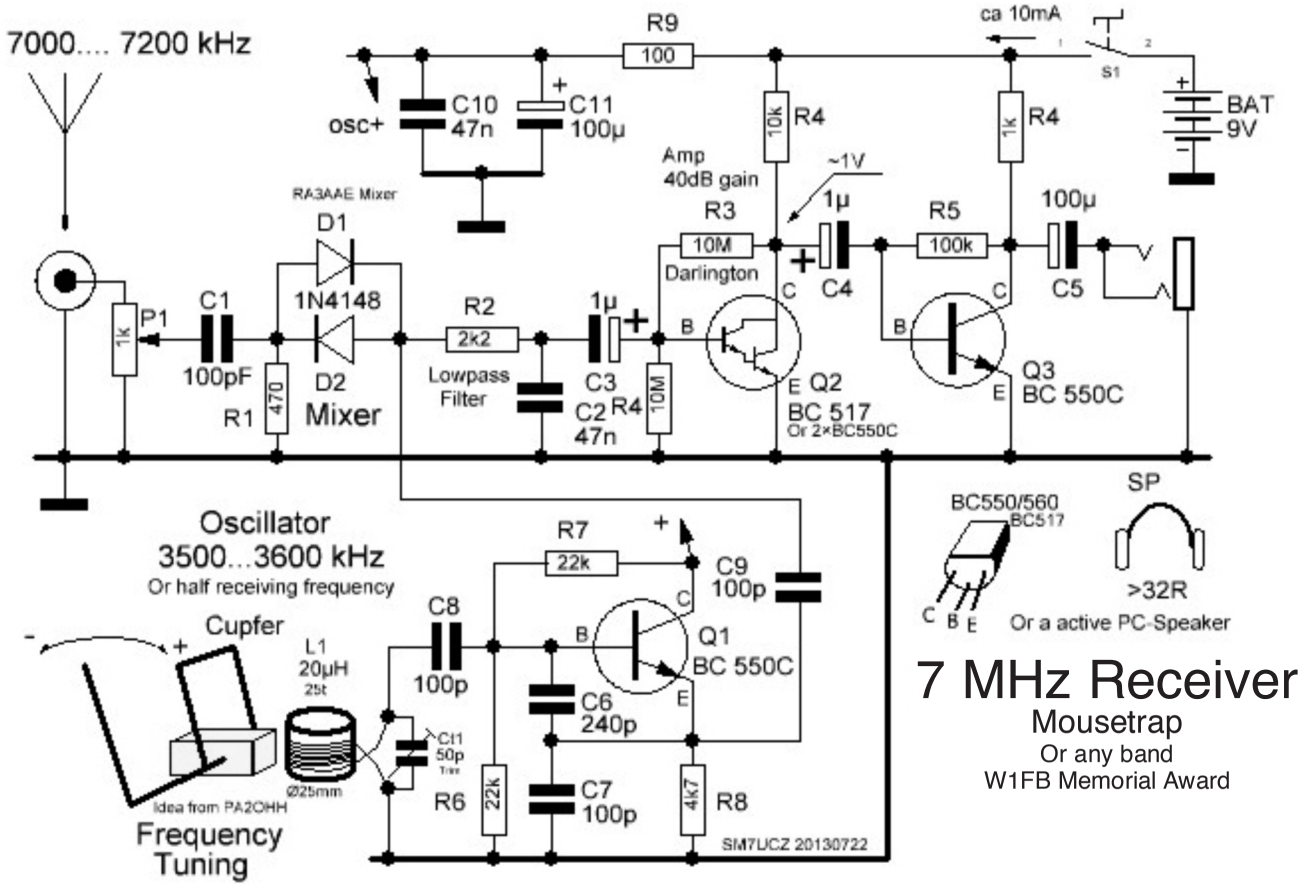
The Mousetrap is an SMD project... But on wood with drawing pins! It was a test to see how simple it is to build a CW/SSB receiver with 3 transistors (one Darlington) and one coil. To keep the costs down, the receiver uses permeability tuning with a moveable single turn of Ø1.7mm copper wire from 2,5mm² installation cable. The single turn forms a mouse trap moving in relation to one coil, wounded on 25mm broom shaft and fashioned as a mouse's head! The permeability tuning is based on an idea by PA2OHH. The oscillator is running at half frequency, and is doubled in the mixer by the 2 diodes following the popular RA3AAE mixer doubler circuit.

Naturally, BC station can be a problem with the lack of input tuning; there is room for for improvements... but it is only meant to be a basic design. Output is enough for 32R headset. Most of the gain is from the Darlington pair. I build my Darlington pair from 2×BC550C with the power gain from the last transistor.



Above: The Mousetrap Receiver showing the "SMT" construction using drawing pins

Left: The mousetrap and mouse permeability tuning. A lever on the "trap" does the tuning. A slight kink in the wire going through the wood maintains the tuning position.

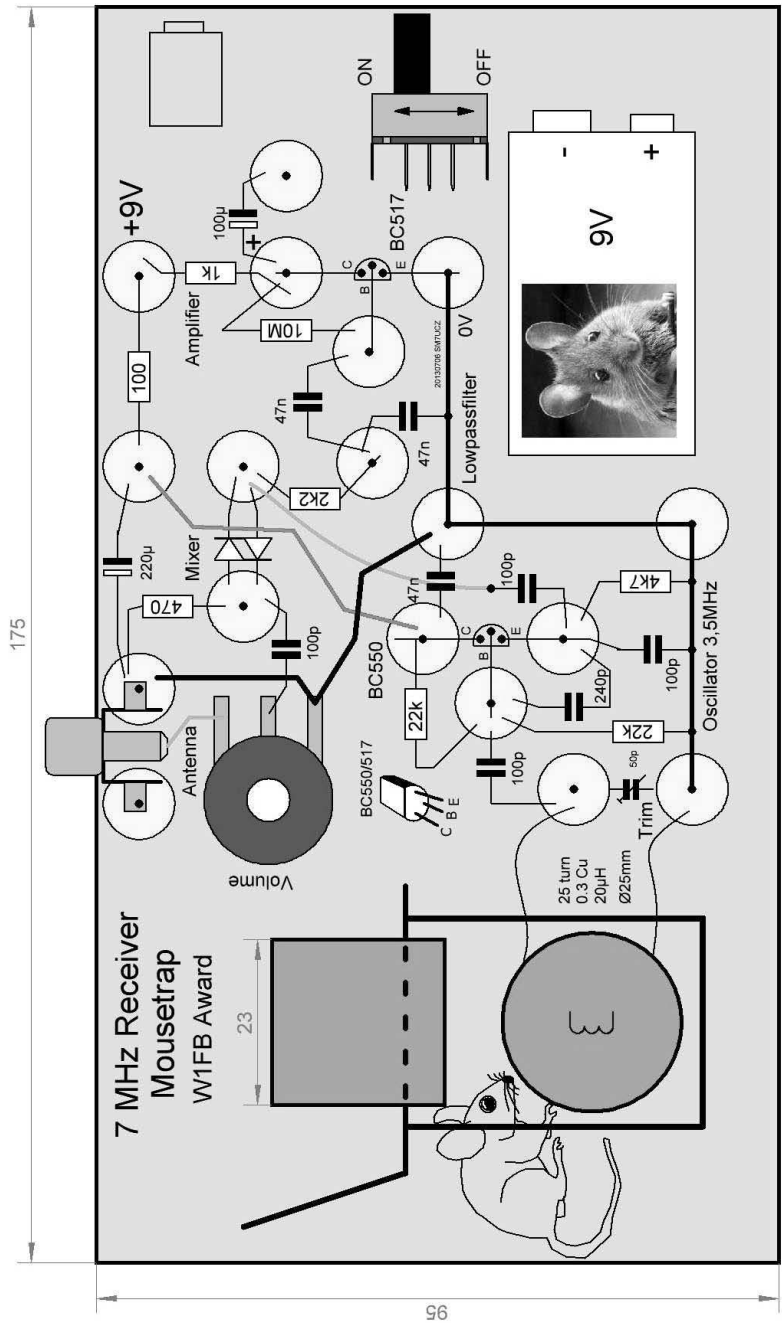


7 MHz Receiver

Mousetrap

Or any band

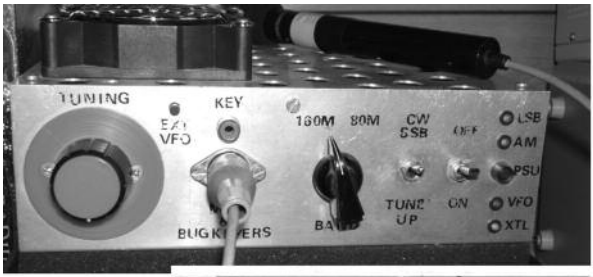
W1FB Memorial Award


7 MHz Receiver
Mousetrap
W1FB Award
+9V
ON
OFF
9V
-
+
Amplifier
1K
100µ
BC517
10M
100
220µ
Mixer
470
2K2
47n
Lowpassfilter
0V
Antenna
Volume
100p
BC550
22k
BC550/517
240p
4K7
22K
Oscillator 3,5MHz
Trim
50p
25 turn
0,3 Cu
20µH
Ø25mm
23
175
95

Labelling Projects

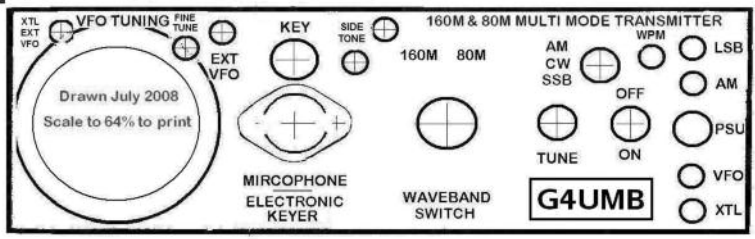
Peter Howard G4UMB 63 West Bradford Rd Waddington Lancs

If you are like me and finish a project and put it in a cheap aluminium box. Although it works it still looks homemade because it's plain. I used to label my projects with transfers but found it was difficult to do when the controls were in the way. Getting the lettering level was tedious too. Painting boxes was awkward as well because I'm not artistic. So I experimented with using a computer program to do the drawing for me. Microsoft Paint which is part of Windows is what I use now. First draw the panel using circles and text. then the tedious bit is by trail and error by printing and scaling to get the right dimensions to fit over the controls. It took considerable patience to get this right. Once you are happy with the fitting choose a coloured paper and then laminate it. I made several hole punches out of steel tubes which in conjunction with a hammer and a rubber mat cut the panel mask to size. This is then glued on to the box with double-sided tape. As you can see by the pictures the before and after shows the difference in appearance to be very effective.



The project to be re-labelled.

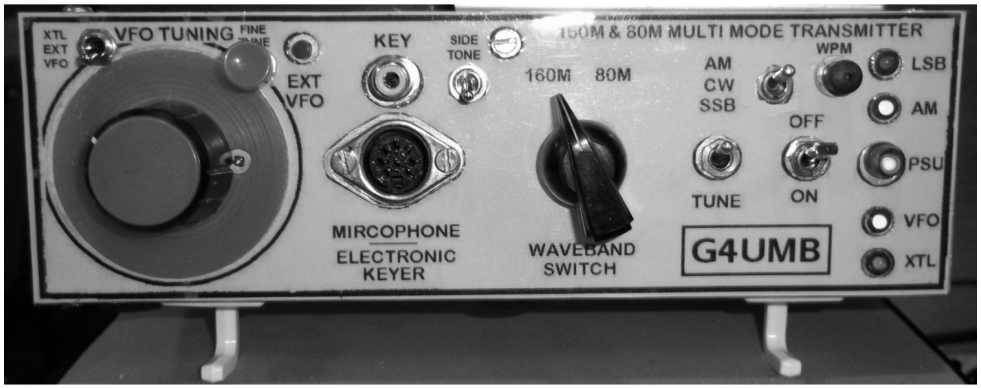
Microsoft Paint image



The finished mask

Homemade Hole Punches

Below – The completed project with new front panel.

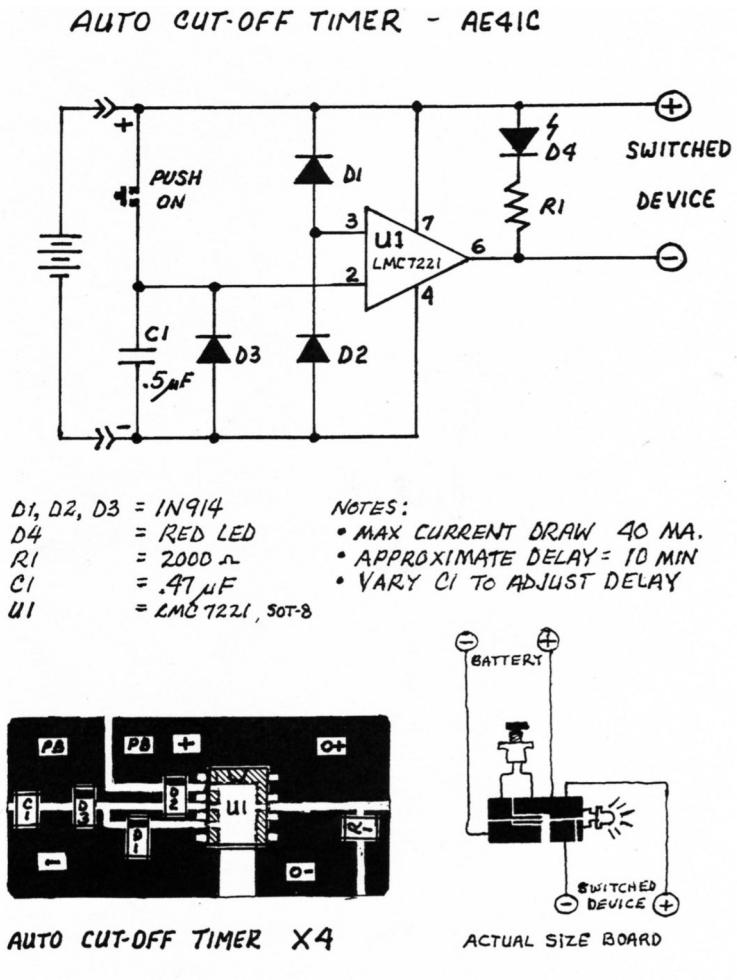


NEW VALVE TRANSMITTER KIT

Mike, DL3ECN, has made a replica of a 1960 Ameco AC-1 CW Transmitter available in kit form. The kit is 189 Euro. Further details can be found at www.tuberig.com or dl3ecn@darc.de

Auto Cut Off Circuit

Bob Kellogg, AE4IC, Greensboro, NC (ae4ic@att.netemail)



I was very frustrated, using my power meter, because it had no pilot light, and every time it was used, I would invariably leave it turned on. So, when I went to use it again, the battery would be down and have to be replaced. After many batteries, I ran across the LMC7221 chip which can be configured as a timed switch. Digi-Key had the chips, so the attached was built on a tiny board, inserted in the power meter, and worked like a charm. The meter turns on with a push button and it shuts itself off after about 10 minutes. Your readers may have other devices which could use the auto shut off circuit.

Occam's Microcontroller

Paul Darlington - m0xpd - 8 Uplands Rd, Flixton, Manchester

It might be supposed that the internal complexity of microcontrollers, digital synthesizers and similar devices places them somewhat at odds with our guiding principal of "*economy of means allied with richness of result*" [1]. It is, however, the purpose of this article to argue that recent developments in microcontroller technology and the ready availability of other digital subsystems have made these resources an efficient foundation for the development of minimalist radios. Further, these developments have been such that potential benefits are accessible to all experimenters, rather than just those who have special interest or expertise in digital methods.

Microcontrollers are "small computers on a single integrated circuit containing a processor core, memory, and programmable input/output peripherals". They are intended for *embedding* into larger systems, where they serve as controllers and communication channels. They have been used in peripherals of the rigs featured in these pages for several years, serving in roles such as keyers, frequency displays, power & SWR displays, etc. However, this article will explore by example the idea of embedding the microcontroller right into the heart of a QRP rig, rather than being content to leave it on the periphery.

To date, two important obstacles have limited penetration of embedded computing into the working vocabulary of home-brew QRP enthusiasts; complexity (real or perceived) and inflexibility (especially those designs presented in "closed-source" format). We have seen laudable attempts to demystify microcontrollers, including in these pages [2], but those initiatives have not yet overcome the barriers to widespread adoption.

Winds of Change

Fortunately, a quiet revolution has been taking place in the world of microcontrollers, embedded systems and "physical computing". This revolution was not targeted at technically sophisticated beneficiaries – rather it was intended for artists, hobbyists and schoolchildren. Radio amateurs, with their explicit technical skills proven by licensing, are well equipped to thrive in this post-revolutionary "new world".

The quiet revolution has not been achieved through change in the microcontroller devices themselves – they still express the same internal architecture and still offer the same features as before, albeit at continually falling cost/performance ratio. Rather, the devices have been presented in different contexts, designed to make it easy for users to exploit their power through accessible, intuitive programming languages, easy to use (and usually free) development environments and powerful, flexible, inexpensive and standardized hardware platforms. All of these make it easy to get a microcontroller to do a useful job of work – like form the backbone of a QRP rig.

The opening steps in this revolution have been played out in full sight of G-QPR members, who saw the original PIC microcontroller [2] "re-cast" as the "PIC-AXE", which was featured at a recent G-QRP mini-convention [3] and is available through club sales. The

PIC-AXE *is* a PIC - but a PIC that has been tamed by the provision of new, simpler means to interact with it and exploit its features. There is a clearer (*and much more successful*) embodiment of this revolution in the world of the AVR brand of microcontrollers, in which the ATMega device has been "re-cast" as the "Arduino".

Arduino is more than a subset of the AVR microcontroller, underpinned by software resources. It also has physical expression as a family of boards, making it truly an "electronics prototyping platform". These boards bring the resources of the microcontroller into easy reach, making it laughably easy to connect to systems such as our radios – as we shall see. A board-level device called the "Pinguino" is an analogous system for the PIC microcontroller.

Most importantly of all, the revolution in microcontroller accessibility is open–source, both in software AND hardware. This makes it not just possible but actively encouraged to share and build on the efforts and experience of a vast community of users.

The argument of this article is agnostic to the particular brand and family of microcontroller used. However, we shall present all subsequent examples in the context of the Arduino platform.

Manna from Heaven

In addition to developments in the way microcontrollers are supported, described above, an interesting crumb has fallen from the table of high-tech electronics. Opportunistic QRP enthusiasts have been quick to pick up this crumb – which takes the shape of a "Direct Digital Synthesis" Signal Generator Module, today widely available for less than the price of the (AD9850) chip it contains. With this module it is possible to generate stable, controllable sinusoids "from dc to light" (or, at least, to beyond the top of the HF band). All that is required is some means to control the module and communicate with it – a perfect application for a microcontroller.

Commenting on his QRO power and SWR meter, [4], Ray, g4fon, observed "*that meters have become expensive, whereas an LCD display might ... actually be less expensive and more robust*", fully justifying the use of digital building blocks. Similarly, we should notice that a microcontroller and a DDS module is cheaper than a decent quality variable capacitor and reduction drive, such that a digital VFO is now not just a feasible technology but also a literal "economy of means". However, controlling either a SWR meter or a VFO will leave a microcontroller twiddling its thumbs for most of the time. It could undertake both tasks - and more...

If we assemble a partial list of the features within a practical HF CW transceiver that could be managed by a microcontroller, the possibilities are impressive:

<table>
<tr><td>Keying
Iambic Keyer
Automated “CQ” calls
Beacon Operation</td><td>Display
Frequency
SWR/Power
Field Strength</td></tr>
<tr><td>Frequency Input
from dial / keyboard / memory</td><td rowspan="2">Tx/Rx Switching
Tx Keying
Rx Muting
QSK / Semi break-in delay</td></tr>
<tr><td>Frequency Control
DDS Control
Tx/Rx Offset and “RIT”</td></tr>
</table>

Notice that some items of this list are possible only because of the use of a digital device (*management of a DDS chip or module for the local oscillator, digital frequency input and display, etc*). Other items of the list might previously have been interpreted as functionality normally residing outside the rig (*such as the keyer*). Use of the microcontroller allows us to extend the scope and ambition of our homebrewed rigs and make them more complete as self-contained communication systems - like commercial rigs. However, there are items on our list that are “logical” (i.e. essentially DIGITAL) tasks, which would have been required in the rig whatever technology was used. This is particularly seen in the management of transmit and receive switching. QRP rigs have always included such switching functions and their implementation in a microcontroller will be found to add considerable flexibility.

Obviously, we could extend the list to add any number of “higher” functions (such as automatic adjustment of an ATU) – but we shall deliberately stay well clear of the slippery slope that leads towards software defined radios and similar complexity. Our interpretation of “economy of means” requires that we “keep it simple”.

Example: A QRP CW Transceiver

We now present an example of a practical and successful CW rig, built on the principles outlined above. The rig has made CW QSOs on the 80, 40 and 30 metre bands and has operated as a beacon in QRSS and various FSK modes. It is not the purpose of this article to be proscriptive, so the details of the rig are not important. Instead, we shall focus only on those points of connection and interaction between the microcontroller and the rig. The building blocks of the rig are typical of ordinary QRP practice and so these “points of connection” may provide inspiration for readers to modify their own favourite circuits for micro-control.

The overall architecture of the example rig is seen in the figure over the centre pages, which includes details of the interface between the rig’s sub-systems and the microcontroller, discussed below.

Keyer

It is useful to start with the iambic keyer – for two practical reasons. Firstly, a keyer is a very useful "first project" for those new to microcontrollers, expanding on the traditional "press a button and light an LED" application, common to most microcontroller training courses. Secondly, the keyer actually will form the "backbone" of the software for our example rig.

The keyer's hardware is trivial. One side of each switch of the key and/or paddle is connected to an input pin of the microcontroller, with the other side of the switches commoned to ground. Most microcontrollers feature internal pull-up resistors, which can be enabled on certain inputs. These pull-ups hold the input "high" until the key is pressed, which action will short the input down to the alternative "low" logic state. The key's state is sensed by sampling the voltage on the input pin repeatedly in the main operating loop of the software and watching for a change between input voltages on two successive observations. A change from "high" to "low" voltage indicates a key press and the opposite transition indicates a key release. The time taken between observations of the input (time during which the microcontroller is attending to other tasks) creates a switch de-bouncing delay.

It has been found possible to build not only the keyer but also the entire transceiver without using the "interrupt" facilities of a micro-controller, thus keeping it simple. The resulting rig does not have any noticeable latency between operating the key or paddle and hearing the sidetone (which itself is generated by a native function of the Arduino language).

The same code which implements an iambic keyer can easily be expanded to read a message saved as text, one character at a time, look up the Morse equivalent of each character and send it at a pre-determined speed, making possible automated CQ calls and beacon operation.

Local Oscillator

The combination of a DDS chip (or module) and a microcontroller make possible a flexible RF generator with range, stability and accuracy that matches or surpasses conventional analog oscillators traditionally used in our rigs. We shall examine the hard- and soft-ware required to make a flexible VFO in a moment but, for now, we shall consider what is required just to set the local oscillator running at one frequency. The DDS chip typically will expect to receive configuration information from a controlling device in 'serial' format. This is to be preferred over the 'parallel' alternative as the number of available pins on any microcontroller is limited.

In the case of the Silicon Labs' Si570 device (used in the excellent USB synthesizer [5] and pa0klt VFO [6]) translation between the desired frequency of operation and the configuration code required to produce this is not simple. However, the AD9850 device accepts a numerical input proportional to the desired frequency, making programming very easy...

Here's the Arduino code (developed from [7]) required to calculate the configuration data and send it to the AD9850...

```
// calculate and send frequency code to DDS Module...
void sendFrequency(double frequency) {             // 'frequency' is the desired f
  int32_t freq = frequency * 4294967296/125000000; // module has 125MHz xtal
  for (int b=0; b<4; b++, freq>>=8) {              // 'freq' has 4 bytes...
    shiftOut(DATA, W_CLK, LSBFIRST, freq & 0xFF);  // sent one at a time
  }
  shiftOut(DATA, W_CLK, LSBFIRST, 0x00);           // final "0" control byte
  pulseHigh(FQ_UD);                                // and a pulse on FQ_UD
}
```

The DDS module hosting the AD9850 offers both a parallel and a serial interface – of course, we choose to use the serial interface, which corresponds to the pins named "DATA" and "W_CLK" in the code segment above. Other connections (for power and two control lines, FQ_UD and RESET) are shown in the main figure. All connections to the module are through an easy-to-use 0.1 inch header – which strongly differentiates this module from the rather less user-friendly physical interface to surface-mount DDS chips.

Keying the Tx

With a local oscillator generating a stable source of RF and means to generate the timed sequences of Morse code, all that is required to transmit CW is means for the microcontroller to key the transmitter. A single transistor, in open collector configuration, replacing the physical "key" in a conventional QRP transmitter design, easily achieves this. The Tx detail in the main Figure shows an example of this approach applied to an early stage of the "Ugly Weekender" [8] transmitter.

The building blocks described to this point - keyer, oscillator and means of keying the power stage - add up to a simple CW transmitter or a QRSS beacon. This transmitter or QRSS beacon is more flexible than the traditional rock-bound alternative, as it can QSY to any frequency with a simple re-flashing of the microcontroller' program. However, the full potential of the microcontroller-based rig only begins to be unleashed once we exploit some of the dynamics of the DDS module and add a receiver…

Varying the Oscillator

The DDS module reacts very quickly to a command to change frequency, with negligible disturbance of the output waveform at the instant of transition (indeed, the transition is phase-continuous). This, coupled with the speed of the microcontroller, makes the oscillator frequency-agile, facilitating FSK modes (such as WSPR [8]), the transmit/receive offset inherent in CW operation and frequency changes to tune across bands and switch between them.

The simplest means to control the frequency of a DDS local oscillator is to read the voltage on a potentiometer wiper, configured as a potential divider between Vcc and ground. Most microcontrollers feature integral analog-to-digital converters. These are capable of directly reading such a voltage to (typically) 10-bit resolution (*i.e. they are able to resolve to ~ 0.1% of full-scale-value*). Thus, with the addition of a single, simple potentiometer, we can make the previously rock-bound transmitter described above able to

tune over useful segments of a single band. For example, a 5kHz section of the 40m band can be covered with tuning that sounds and feels continuous in "pitch". This is sufficient to cover both the QRP and FISTS frequencies of interest to many readers.

Such a simple means of adjusting the frequency of the local oscillator will be entirely familiar to QRP enthusiasts, who are used to VFOs with single-knob tuning from a variable capacitor (or potentiometer biasing a varactor diode). The knob provides not only the means to adjust frequency but also a visual indication of the frequency setting. If we wish to fully exploit the flexibility of the DDS module, we must be able to monitor the frequency setting with greater resolution. This can be achieved by a link from the rig to a PC, as the Arduino offers a pair of pins dedicated to such a link and the software tools to send the current frequency to a PC with a single line of code…

However, in requiring the presence of a PC, such an approach is neither minimalist nor always convenient. Fortunately, the microcontroller can easily drive a display…

Display

A numeric or alphanumeric display can provide useful information about the state of a rig, such as the power / SWR monitoring function already mentioned. However, we shall consider the display of frequency as the only necessary function and use it as sufficient example of the integration of a display into a micro-controlled rig. As Ray, g4fon, observed [4], LCD displays are robust and inexpensive and entirely suitable for monitoring the frequency of our DDS module's emissions. There is, however, one obstacle to their use.

Many alphanumeric displays are built using an interface associated with Hitachi, which has an 8-bit data bus and some further control lines to latch data into and out of the device. As already has been mentioned, microcontrollers have only a limited number of input/output pins and this Hitachi interface is expensive in these important resources. Fortunately, there are a number of means by which we can overcome this potential obstacle.

First, it is always possible to upgrade the choice of microcontroller or microcontroller system to increase the number of available I/O pins (e.g. changing from Arduino UNO to Arduino MEGA) – but this approach is the antithesis of minimalism! Second, it is possible to add simple shift registers to make serial-to-parallel converters, by which a small number of I/O pins (on the microcontroller side) may be connected to a large number of peripheral pins – but this approach only really starts to deliver benefits for a large numbers of pins. Third, we can use the Hitachi interface in an alternative "4-bit" mode, in which commands and data are transferred a "nibble" (i.e. half a byte) at a time, saving 4 pins. Fourth, we can use (or, better still, make) a serial-to-parallel converter module, which accepts a two-wire input, such as I2C, from two pins of the microcontroller and connects to the Hitachi interface. Such modules are now widely available for a few pounds.

A fifth approach was used in the development of the rig used as example in this article, which exploits a 12-character numeric LCD display with serial input, found in the junk

box! The data line is actually shared with the data line to the DDS module, further reducing the load on microcontroller I/O pins.

Rotary Encoder for QSYs

The finite range of adjustment available from a potentiometer is radically expanded by use of a rotary encoder, which generates digital outputs on rotation of a familiar "knob". These digital outputs can be interpreted by the microcontroller to produce a very flexible means of frequency input, allowing adjustment over a wide range at controllable sweep rates or resolutions. Rotary encoders have two internal switches, which switch in quadrature as the shaft is rotated. The resulting two-bit sequence encodes direction and (if required) speed of rotation. The sequence can be read by very simple logic, as demonstrated by this Arduino code segment…

```
// (as part of the main loop structure…)
RotEncA = digitalRead(RotEncAPin);         // read the two rotary encoder pins…
RotEncB = digitalRead(RotEncBPin);

                                           // if there's a state change on input A…
if ((RotEncA == HIGH)&&(OldRotEncA == LOW)){
                                           // AND input B is LOW…
if (RotEncB == LOW) {
                                           // then knob was moved clockwise…
  Frequency = Frequency + df;}
else {
                                           // otherwise, moved anti-clockwise…
  Frequency = Frequency - df;}
}
OldRotEncA=RotEncA; // save the input A value for next time round the loop
```

We can change the frequency increment *("df" in the code above*) to give an appropriate rate of frequency control; df=10Hz is small enough for "continuous pitch" tuning of CW, whilst df=1kHz gives a reasonably quick sweep across the entire band. Many rotary encoders feature a third internal switch, operated by a push on the knob. This can be used to toggle through a set of different values for the frequency increment, df. The example rig uses 10, 100 and 1000 Hz.

With frequency inputs passed from a rotary encoder to the DDS and monitored by an LCD display, the oscillator becomes a truly flexible VFO, which can tune the transmitter described above over multiple bands.

Transmit Muting and Break-In

The same logic signal used to key a CW transmitter can be used to simultaneously mute a receiver, making an entire transceiver. The interface between a microcontroller I/O line and a practical Rx mute is shown, in the example rig, in the context of the FET passgate used in the receiver of Roy Lewallen, w7el's "Optimised Transceiver" [9]. Although it is possible to share the Tx keying and Rx muting on a single I/O line, having these functions separated allows greater flexibility in managing break-in delays.

In the example rig supporting this article, keying the transmitter initiates a counter, which implements a fixed delay. The receiver is muted for the whole of this delay period. The same delay manages the frequency offset required between Tx and Rx. If the transmitter is

keyed again during the delay interval, the count is re-started. The start value of the count determines the mute interval – a very small count value gives full break-in, whilst a larger value holds the receiver muted over individual Morse characters or words.

The potentiometer used for simple "analog" frequency input can be exploited as a "Receive Incremental Tuning" input to vary the transmit offset, where main frequency input is via a rotary encoder.

Code Samples, Schematics and a Note of Caution

Although the example rig supporting this article was intended to illustrate methods and inspire others to experiment with their own microcontroller-based QRP systems, there may be further details of its construction and code of interest to readers. A full schematic and a series of Arduino programs ("sketches") are available for download at: http://www.gqrp.com/sprat.htm

To date, only one downside of the example rig has emerged; the DDS module draws 200mA, which clearly limits its usefulness for /p operation.

Whilst many QRP enthusiasts enjoy using anachronistic or even obsolete technologies in their h/b rigs, the microcontrollers and other digital resources used in commercial transceivers are now available and accessible for widespread exploitation. This digital technology can offer "economy of means allied with richness of result".

Notes and References

[1] D L Sayers paraphrases Occam's Razor in these words in her novel "The Five Red Herrings", 1931

[2] "Starting with PIC", P Debono, 9h1fq, SPRAT 138, p17

[3] "A Maine Yankee in Rishworth Court", R Harper, w1rex, SPRAT 141, p34

[4] "QRP Wattmeter", R Goff, g4fon, downloaded from: http://www.g4fon.net/wattmeter.htm

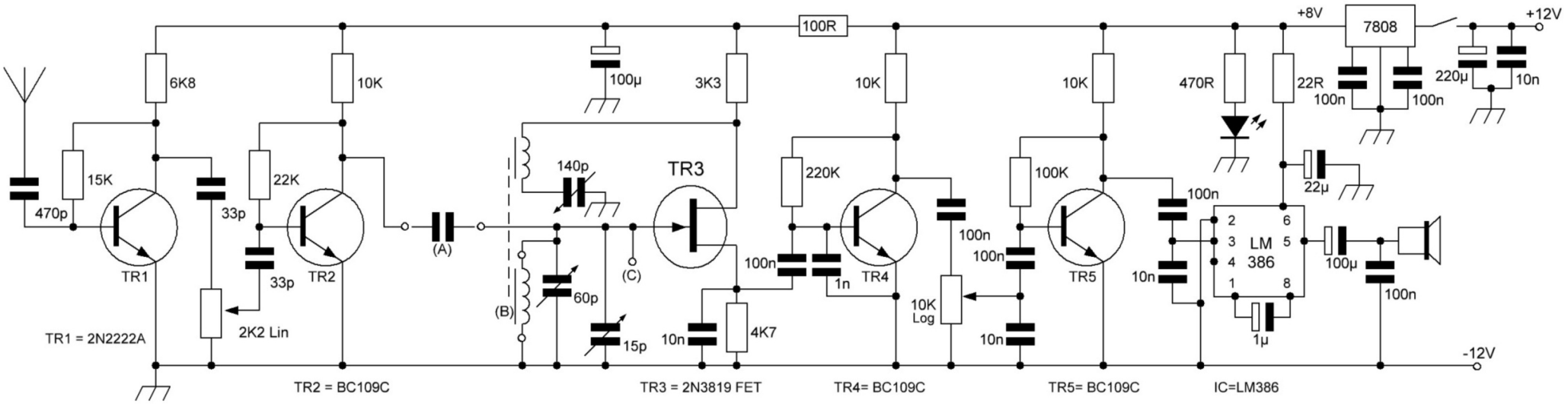
[5] QRP2000 USB Controlled Synthesizer Kit: http://sdr-kits.net/QRP2000_Description.html

[6] pa0klt "Low Noise VFO Synthesized Kit": http://sdr-kits.net/PA0KLT_Description.html

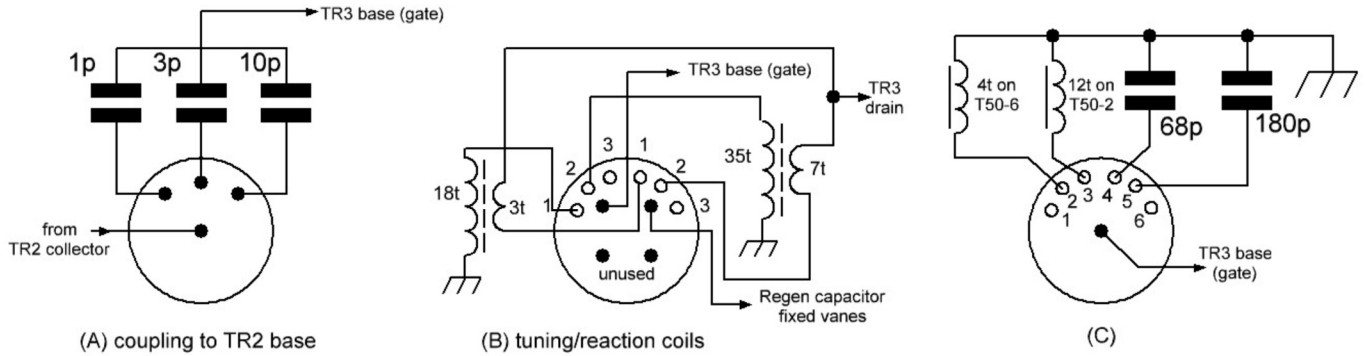
[7] Testing an eBay AD9850 DDS module with Arduino Uno, R Rollinson, nr8o: http://nr8o.dhlpilotcentral.com/?p=83

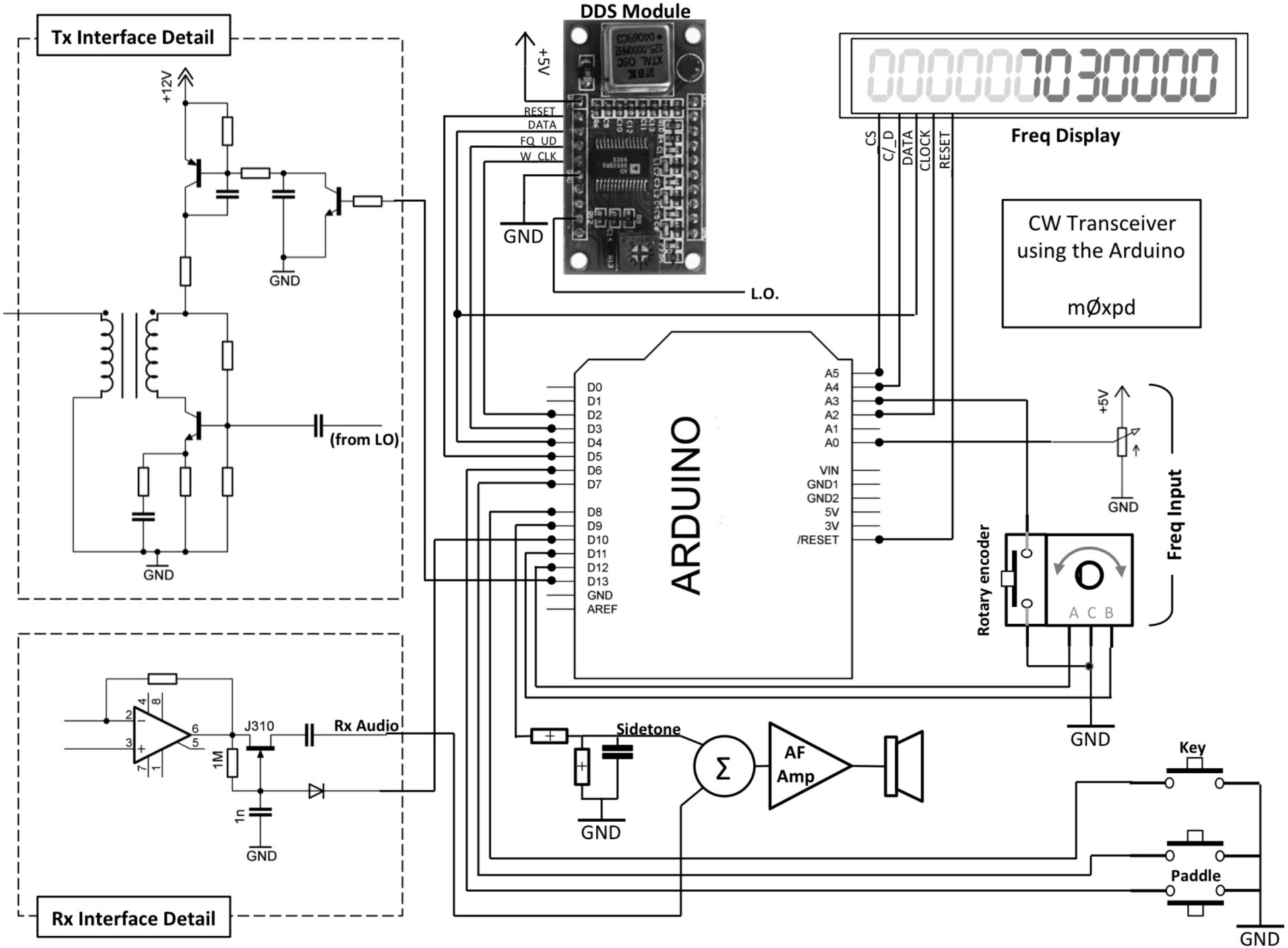
[8] "Ugly Weekender", R Hayward, ka7exm & W Hayward, w7zoi, QST, August 1981 – see also Todd Gale, ve7bpo's notes at: http://www.qrp.pops.net/transmit.asp

[9] "An Optimised QRP Transceiver for 7 MHz", R Lewallen, w7el. QST, August 1980 – now available at: http://www.arrl.org/files/file/Technology/tis/info/pdf/93hb3037.pdf



The RR9 Receiver – G0KJK




Tx Interface Detail
+12V
GND
(from LO)
GND
DDS Module
+5V
RESET
DATA
FQ_UD
W_CLK
GND
L.O.
Freq Display
CS
C/_D
DATA
CLOCK
RESET
CW Transceiver
using the Arduino
mØxpd
ARDUINO
D0
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
D13
GND
AREF
A5
A4
A3
A2
A1
A0
VIN
GND1
GND2
5V
3V
/RESET
+5V
GND
Freq Input
Rotary encoder
A C B
GND
Rx Audio
J310
1M
1n
GND
Sidetone
Σ
AF
Amp
GND
Key
Paddle
GND
Rx Interface Detail

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(iv) request beneficiary's banker to advise beneficiary or receipt

The RR9 Short-wave Receiver

Rev. Keith Ranger, G0KJK. keithcath@ranger144.fsnet.co.uk

For all too long now I have been QRT! My XYL Catherine and I are living in temporary accommodation owing to urgent house repairs but should shortly be moving back. No outside aerials can be erected here so I have been an SWL during recent months using self-built direct conversion or regenerative receivers and a one metre- long desk-mounted telescopic aerial. The RFI in this block of flats is horrendous but good results on nine amateur bands have proved available on the design to be described. I offer it to fellow-experimenters in the hope that it will give hours of listening pleasure at relatively low construction cost, both in terms of time and money.

What is perhaps slightly unusual about this particular home-brew regenerative receiver is that it covers all the major amateur bands, both CW and SSB, from 80 to 6 metres. Many published designs cover just one, or from one to three, bands but these almost always do not include 6 metres. In any case, restriction to just three or so bands can be frustrating if conditions are unfavourable, one needs versatility. The satisfying thing about the VHF 50MHZ band, with all its varied propagation possibilities, is that just 4 turns of insulated wire on a T-50-6 toroid core placed in the tuning circuitry are necessary for its coverage by this receiver! I have left out Top Band as I seldom hear much activity on it and have gone for the other end of the spectrum instead!

I must emphasise that you must be prepared to “cut and try” to get accurate band coverage but the circuit details I give represent a sound starting-point. Very probably you’ll hit most bands first time with the inductor and/or capacitor values specified. However, stray capacitances from the layout style you adopt could change coverage a bit but it should not be by all that much. Keep at it and you will win! For these reasons no point to point wiring instructions are given, especially as I am rather old fashioned and prefer using tag strips rather than printed circuit or perf boards.

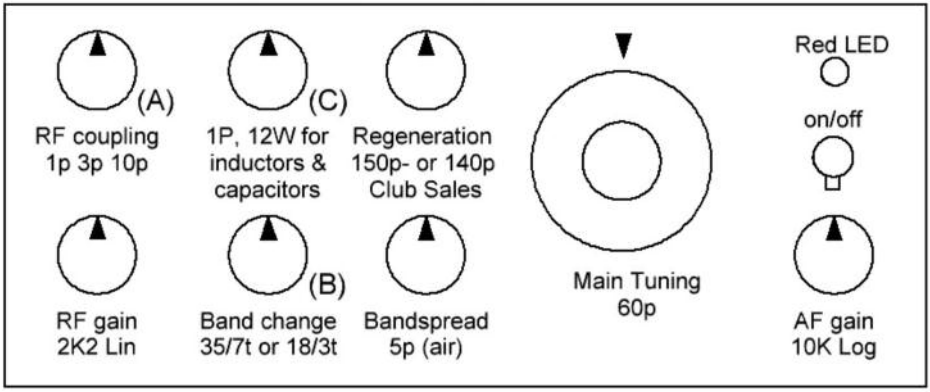
I am assuming that G QRP Club builders of this circuit will not be making it a first project because you will already have some basic construction experience and be aware of the principles that need attention, especially the necessity of keeping RF and AF wiring well apart to avoid annoying instability problems. My prototype is stable, selective and sensitive and even on 6 metres there are virtually no hand capacitance effects. This problem is avoided by using just a loosely coupled telescopic aerial but the sensitivity of the circuit is reflected by the powerful SSB signal received from VK3MO on 20 metres and some eleven entities logged to date on 6 metres SSB or CW including OH, EA, S5 and 9A, nothing as yet outside Europe but still not bad for a telescopic aerial, actually fully retracted to reduce the dreadful RFI!

I have given special attention to the front-end circuitry of this design because one criticism frequently levelled at regenerative receivers is that they are too subject to blocking and

overloading by strong signals to make them viable on our crowded amateur bands (although activity on these recently seems to have been low, conditions have not been good!). This receiver is not easily overloaded. It has three levels of basic aerial coupling, an active aerial principle before the RF gain control and variable resistor signal control. The AF gain control can be left quite well advanced and the strength of the desired signal governed by the RF gain knob. This latter will need to be kept well retarded when incoming signals are especially loud, typically during contests. Eight ohm loud speaker volume is such that the long-suffering XYL frequently exclaims – "Keith, can't you turn it down a bit?"! (or is my hearing not what it was?!!)

Please peruse the picture I give of the position of my own front panel controls. The receiver is built in an 8 by 6 by 4 inch aluminium box I acquired from Maplin Electronics. The block of four controls at left include the RF gain potentiometer and three rotary switches, one giving three coupling levels into the tuning coils, 1p 3p and 10p; another (4p 3w, only 2w used) choosing one of two tuning coils, 35t overlaid with 7t on a T-80-2 toroid and 18t overlaid with 3t on a T-50-2 toroid, which with a 60p tuning capacitor give the 40, 20 and 17m bands, and a third 1p 12w switch giving all the remaining six bands by the selection of different inductors and capacitors – including a 4t T-50-6 inductor for 6 metres, a 68p cap for 30m, approx. 180p for 80m and a 12t inductor on a T-50-2 toroid for 10, 12 and 15m. Experiment, experiment, experiment! Remember what you learnt for the RAE – that a capacitor across a capacitor lowers the frequency and an inductor across an inductor raises the frequency. Coverage possibilities are therefore endless! (If all this is as clear as mud, please blame my poor communication skills and send me an e-mail, to which I promise an attempt at an intelligent answer!).

RR9 prototype front panel controls



Rear panel has 3 sockets: antenna input, power 12v & speaker
Tip - Look out for airspaced variable capacitors at rallies!

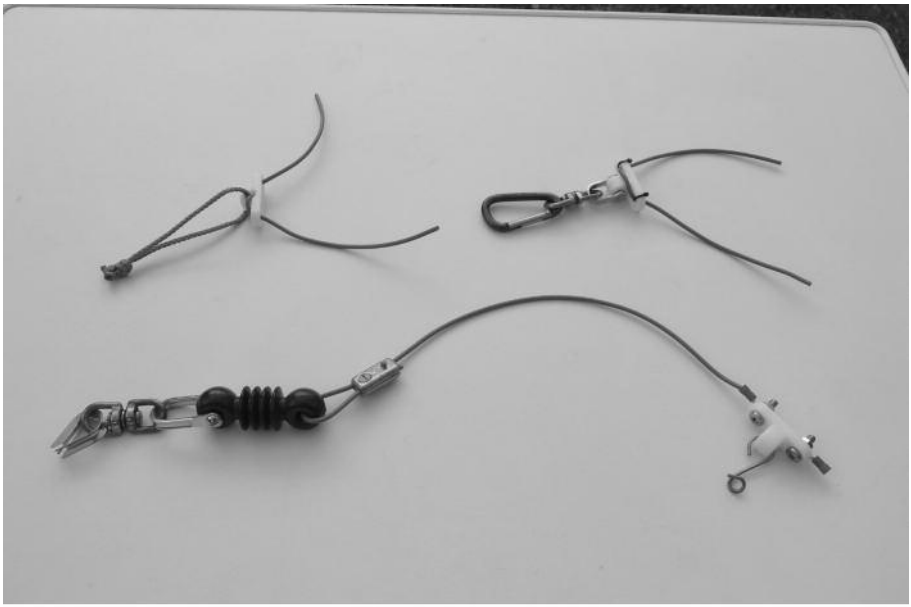
Antenna hardware components and ideas

Jesper Fogh Bang OZ1XB, Elmevej 10, DK-3500 Vaerloese, Denmark
[fogh.bang@gmail.com]

A lot of cheap and good components for antenna projects can be found in well-equipped boat and camping accessory stores such as stainless steel shackles, thimbles, swivels and wire locks together with a variety of nylon devices. I have used the two types of nylon wall-eyelet pieces shown on the picture for corner insulator supports for delta loop antennas for a number of years. They are very rigid and will last for long even when exposed to UV light.

The unit to the left automatically locks the antenna wire by the zigzag route through the centre hole where the unit to the right will need a cable tie to fix the wire. Another usage could be a centre piece for a lightweight dipole. I have purchased my eyelets at Fritz Berger in Germany [1] but many other camping accessory stores elsewhere will have similar devices because they are standard equipment in caravans.

[1] www.fritz-berger.de, items 25062-13 and 25063-13



G-QRP Club at rallies - Graham Firth G3MFJ

When we go to rallies to represent the club, we get made very welcome. At the moment, George & I manage to get to 3 or 4 a year – all around the north of England, and we have Roy, GM4VKI, who goes to most of the rallies in Scotland. We all take a good selection of club sales items. I have attended a few much more southern rallies, but only if I happened to be in the area on holiday. (I have a very understanding XYL!)

We could do with few other people who will cover the rest of the UK, and set up a club stall at one or more of their local rallies. We will, of course, cover table, entry & fuel costs, and I will supply a good selection of club sales items. If you fancy the idea – it is an annual(ish) commitment – not just a one-off of course. We would like people who could cover, say, at least a couple of rallies every year. If a chat with me would help, then give me a call on 0113 267 1070 and I can give more explanations.

Any offers? Thanks

MEMBERS ADS - MEMBERS ADS - MEMBERS ADS - MEMBERS ADS - MEMBERS ADS

OFFERS INVITED: SHIMIZU DENSHI SS-105S All Mode HF Transceiver. Covers 80, 40, 20, 15, 10, Mtrs SSB/CW Plus 29MHz FM. Power Varies 4 to 12 watts depending on band in use. Prefer Buyer Collects. MFJ CUB 40 Mtrs 1 Watt output. £35.00 including U.K. postage. Morris Chapman G0BQI 020 7359 8885. morrischapman@hotmail.co.uk

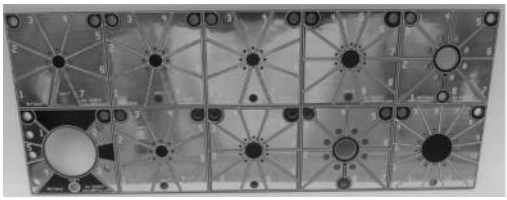
FOR SALE: Yaesu FT7b with YC-7B Yaesu digital display £300, Icom IC-R71A receiver £300, Eddystone 840c HF valve receiver £100, SGC SG-2020 HF 20w transceiver £600, Ten-Tec Scout 555 with noise blanker and all the band modules £500, Norcal 20m qrp transceiver £95. FlexRadio Flex1500 £450. LG 20MHz oscilloscope £75. G7VFY 07956544202. N. London. Stephen Walters.

G-QRP Club Sales and another new deal!

Graham Firth G3MFJ

Firstly, the last issue's deal of MePads/MeSquares is still available – but it will stop at the end of the year – then they will go back to their old price of £6.50 each. The 5.262MHz crystals are now on the list of parts – still at 50p each.

Rex W1REX, QRPme.com, has a new board – MeTubes. This is in the same form at MePads, but these are valve socket pads – for B7G (3 off), B9A (3 off), Octal, (2 off), plus one of each of Acorn & Compactron. When fully available, these will be £10 each, but I have obtained a few of the protypes and can sell them at £7 each. This early version has a small error – the pin numbering is reversed, but for a saving of £3 – I think we can cope. I have only a few so if you fancy one be quick!



Talking of Rex, he is hoping to come over for Rishworth in October 26th, and, as the Galashiels Rally is just a week before (20th October) he is hoping to be there as well. He will have a good selection of his kits with him.

Finally, this issue's special offer is Minicircuits RF transformers – TMOT-2.5.6 – they are 50 Ohm input, 0.1 to 100MHz Secondary/Primary ratio 2.5:1. I have a few only of these at £5 each. (I still have a few of the TFM-2 mixers left – still at £5 each).
The data sheet for the transformer is available here – www.gqrp.com/tmot256.pdf
Members who don't have access to the internet can get a copy from me – send me a stamped self-addressed (DL sized) envelope. Address on the back page.

All the above are plus postage per order – UK £1.20, EU £2.60, DX £3.80

Antennas Anecdotes and Awards

Colin Turner G3VTT 17 Century Road, Rainham Gillingham, Kent ME3 8TJ
G3VTT@aol.com

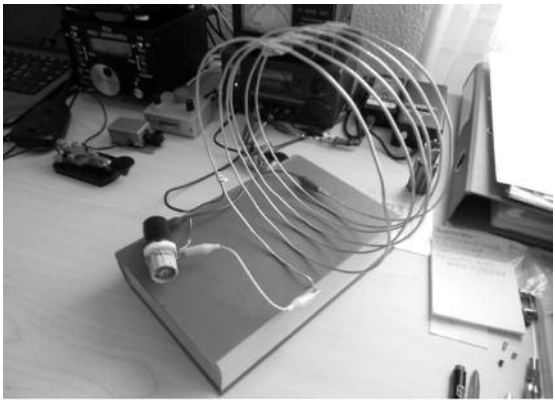
I've received a few articles this summer but there's always room for a few more. Please note I ***moved house*** *nine months ago and I'm still receiving post to my old address! After October there will be no post redirection. Radio conditions have been poor to awful but contacts are still being made on QRP CW. Straight on with some ideas for small size antennas. Our thanks go to the contributors who have sent in articles this season.*

A Small Size Antenna System for HF by HB9BWY (Norbert Litz, Pappelweg 7 6072 Sachseln)

About 25 years ago when I changed QTH to this flat and there was no space for any normal antenna system of any kind but after some experiments playing with coils and tuning capacitors I found some dimensions for a tuned circuit small antenna enabling me to receive other stations and later to start transmissions with a small loop.

The coil dimensions I used were diameter 17 cm, windings 6 turns with 2cm spacing. I used 0.2 cm wire with a tap about a quarter of a winding from ground depending on frequency. I used an air spaced variable capacitor with about 150pFd maximum for the 40, 30, 20 and 17 meter bands. For the 15 meter band the inductance was too high and it was not possible to find resonance with the capacity used.

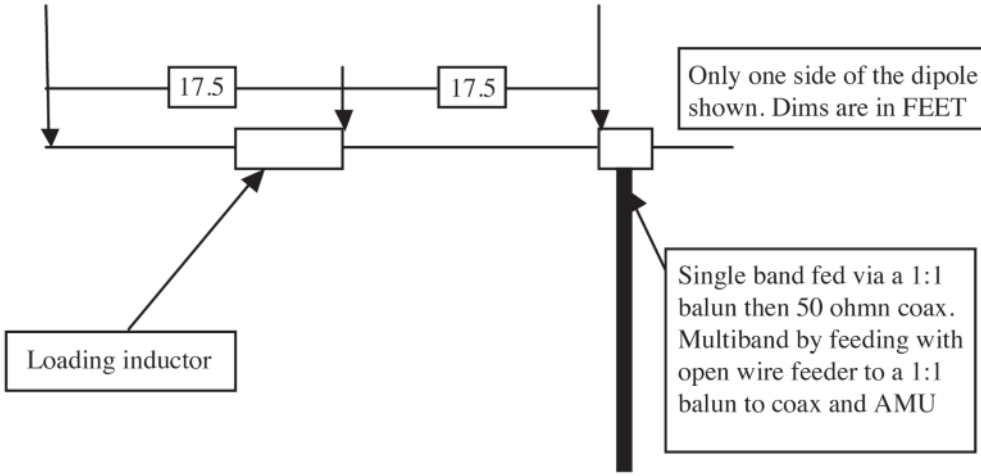
It seems Norbert has made a large tuned circuit with the feed point tapped up the winding. Although a small antenna with perhaps limited range it will work on receive allowing reception in noisy circumstances by virtue of antenna orientation.



In transmit the tap point must be carefully changed on really low power to give lowest SWR. Although efficiency is low contacts are possible and Norbert has provided an extensive log of results of European contact. Good work.

A Short Dipole for 80m from Chris G4LDS

Chris has been busy again with a further short antenna. Note the dimensions are in feet, (always better for antennas by miles!).



This is a simple short aerial for 3.7 Mhz. The idea came from the short GM4JMU dipole I used on 40m successfully in the past and I wondered about a short 80m dipole. There is a great web site for calculating the details of a short aerial at:
http://www.k7mem.com/Electronic_Notebook/antennas/shortant.html

I then calculated the equivalent inductance for winding on off cuts of PTFE/Plastic drain pipe! I used: uH = (a^2) x (n^2) / 18a + (40l) (Where a = dia of coil, n = number of turns, l = length of coil). I set up a very simple Excel spread sheet to calculate the coils by simply punching in numbers by trial and error until I got the right inductance. Although this is really for mono band short dipoles by replacing the coax with open wire or ribbon to a 1:1 current balun then short coax run to AMU it would give a short multi band aerial.

John Midgley G3SAO has recently obtained his '100 Countries Worked with QRP' award. He has put in a remarkable amount of work with a loft antenna and is to be congratulated on his efforts. If you have limited space then this idea could be for you.

Experiences with a Loft Antenna by G3SAO

Two and a half years ago I returned to the HF bands after an interval of 17 years with 4 to 5W from a FT817 and an MFJ-971 ATU. For various reasons I felt restricted to a loft antenna but I wanted to be able to work as many bands as possible. I decided to use a doublet fed with 300 ohm line and an ATU. This has the advantage that the top does not have to be a resonant length. The resulting impedance, inductive or capacitive, is dealt with by the ATU.

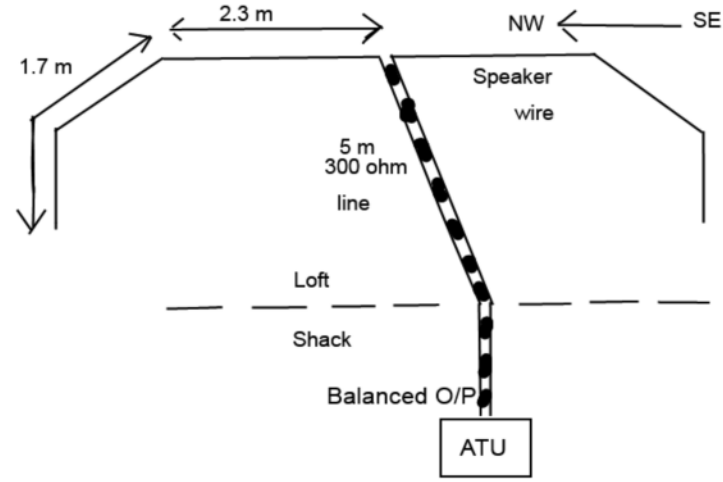
The critical length for a doublet is the total length (L) of each leg, that is, the feeder length plus the half the top. As in the case of end-fed wires it is necessary to keep clear of multiples of a half wavelength because here the impedance is large and complex and is probably beyond what the ATU can cope with. A useful chart is in (2: p35/36). This shows which bands should be suitable for a particular value of L. Alternatively a table of lengths which are to be avoided is given in (1: p87).

To fit my loft and the run to the shack I chose L = 9 m, made up of 5 m of 300 ohm slotted line + 4 m of insulated speaker wire for each leg. The doublet therefore had an 8 m top. To fit the roof geometry, 1.7 m of each leg hangs down, giving the antenna some inverted-V character which possibly makes it less directional. The wire was fixed to the timbers with small cable clips.

I had some reservations about using the balanced line indoors. I had read all the warnings that it should be kept well away from metal and wiring which would unbalance it. Unbalanced lines are likely to pick up electrical noise. I did my best to locate cables under the loft insulation and chose a route for the feeder as far away as possible from these and the shack light switch. Where I could not avoid going near one cable this was done at right angles to minimise coupling.

Results? Much to my surprise in just over 2 years I have achieved WAC and worked over 100 countries. Prefixes include CP, JL, HK (CW), PS, EY, VY (SSB), VR2, VU (RTTY), HI, PJ2 (PSK31), VK, LU, DV (JT65). Using the charts referred to above, I expected the antenna to load satisfactorily on 14 MHz and above except for 18 MHz. The SWR is 1.3 or less except on 18 MHz (1.9). The matching/tuning is quite sharp except on 18 MHz where it is fairly flat but still usable. Surprisingly it loads on 10 and 7 MHz but is clearly inefficient, although I have had CW QSOs within the UK and to ON and LY. Better still my 3.5-28 MHz ATU matches the antenna well on 50MHz, providing QSOs all over Europe during Es openings.

For me the antenna has been successful. I put this down to its being non-resonant and relying on the ATU to achieve a good match and hence efficient transfer of energy. On 14 MHz my noise level varies from S4 to S8 but on the higher bands it is usually S0-3 on the meter although I feel that signals have a noisy background. This does not seem to be worse than other reports of urban electrical noise.



References: 1) Successful wire antennas. I.Poole G3YWX & S.Telenius-Lowe 9M6DXX, RSGB
2) Building successful HF antennas. P.Dodd G3LDO, RSGB

*I've had a letter from **F8EAI** in which he describes the use of an UNUN, (unbalanced to unbalanced transformer), to achieve matching between 50 ohm and 75 ohms coaxial cable. He uses Satellite TV 75 ohm coaxial cable to enable lower losses from the long cable run to a 50 MHz dipole changing to the lower impedance cable nearer to his transceiver. The antenna is an inverted vee dipole under his roof using 7mm square wire for the radiating elements. He's experimented with a 1.5 to 1 balun and suggests a search is done on the Internet for F1FYY and his articles on balun construction. A further suggestion for VHF work is to wind a balun without a ferrite core but a Teflon ring, available from plumbers suppliers, and rely on the capacity between the wires for wideband coupling and not ferrite. This allows operation at higher (VHF) frequencies. An added bonus is that using a balun has reduced the local RFI level. Does anybody have any comments on this?*

And finally……**Valve QRP Day November 2013**

The next Valve/Tube QRP day will be on Sunday November 17th. It's not a contest, there are no serial numbers sent - just pass information about your equipment to encourage others to come on the air or maybe construct something using old style valve technology. Please send brief comments and perhaps a photo of your transmitter, transceiver or receiver to g3vtt@aol.com for inclusion in the Winter Sprat. Even photos of restored old equipment would be of interest……..*and black cat Doris has watched me making antennas in the garden all summer from under her favourite bush.*

COMMUNICATIONS AND CONTESTS

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

Sweden was interesting and thanks to all GQRP members for the contacts. I returned to Utlagnan EU-138 for the RSGB IOTA contest as well and I am sure I heard a few other members on air.
Just before I that weekend I was asked to take part in a local G100RSGB station and I operated on 80m and 40m SSB for a few hours. Was on the understanding I didn't turn the power down though. Quite a few of the contacts were using their Notice of Variation (NoV) 'V' prefix.

Summer Sizzler
As I write this the August Bank Holiday has arrived and I will be operating as I am able to this weekend, although I read there has been yet another solar flare which will make things interesting. I plan on activating the WARC bands (12m, 17m and 24m) althought they seem to be fine right now. This will be in addition to the more usual HF (20m, 30m, 40m and 80m) frequencies. A Sudden RX and TX are up and running on 60m and the entry with the most contacts on 60m will be awarded the sets at Rishworth.
There is a rally at MKARS Sunday and HARS Monday and I'll be taking some kit to one or other.

Winter Sports
Christmas and the New Year are months away and operating from a freezing shack might seem very distant as we have a mini heat wave and you are probably operating from the beach. However, when this copy of SPRAT arrives you will probably be ready to start to think about Winter Sports. The dates as always are between Boxing Day and New Year... 26th December to 1st January.

EUCW Chairman Election
GQRP is a member society of EUCW and by now a new chairman has been elected. http://www.eucw.org/elections.html Colin G3VTT has been acting as returns officer. As the GQRP representative I have to vote for a candidate on your behalf so I voted for Chris, G5VZ. This was on the basis that I emailed the GQRP yahoo group asking for comments and I was contacted by 84 members who provided 79 votes for Chris, G5VZ and 5 for Robert, ON4LDL

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

CW: 1810, 3560, 7030, 10116, 14060, 18096, 21060, 24906, 28060

SSB: 3690, 7090, 14285, 21285, 18130, 24950, 28360 kHz

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

It is usual for operators to exchange their G QRP Club membership number when making QSO but it is not essential. 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, Dom Baines, M1KTA, 34 Bury Road, Stapleford, CAMBRIDGE. CB22 5BP.

Review – SOTA Beams voltage monitor

Graham Firth G3MFJ

Richard at SOTA Beams sent one of these to George for his comments. He was busy, so I got it to play with.

It is a very simple looking device – 34 x 49 x 20mm box with 6 LEDs (3 colours – 2 each of red, orange & green), and a single button that operates it. It is intended to monitor the voltage on rechargeable batteries, but it also covers a PP3 and a standard 13.8v mains supply.

The profiles are – PP3 9volt; Lead acid 12 volt; LiPO 3 cell pack; LiPO 4 cell pack, AA 12v 8 cell alkaline pack; and 13.8v power pack.

To set the range you require, you hold the button pressed for a couple of seconds, then one of the LEDs lights to show you the profile it is set for. You can change the profile by one or more short presses of the button, and the lit LED moves on to show you are set for the further ranges. Then you hold the button for a further 2 seconds and it stores the setting. This setting is remembered after a power down.

In use, the top (green) LED shows if the voltage is 100%, the second green if the voltage is 95 to 99% etc. The last red LED will flash, and a beeper will sound if the voltage is very low.

The monitor comes set for a PP3 and I did wonder if it would flatten these small batteries, but it operates for 10 seconds, then goes to sleep, a quick tap on the button wakes it up for another 10 seconds. The current drawn when it was awake was 7.3mA on the supplied unit, and it dropped to 0.25mA when it slept.

I found the operating instructions on the SOTA website () – I couldn't actually download these – I had to print the webpage, but maybe a purchaser would get them supplied with the unit.

The third function of the button was to stop the unit sleeping, and as such would indicate all the time. I had difficulty with this – I only managed to make it happen on the one occasion – I did try many times though. This could be useful if you were operating portable. Altogether a very useful unit – especially for SOTA or similar field activities. I am now hoping that Richard at SOTA won't want it back!

Correction

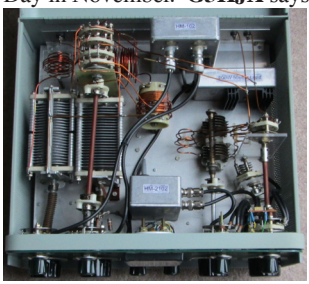
Issue 155, Summer 2013 – **NANO -The Traveller's Transceiver** (pages 22 & 23)
Choke L4 was mistakenly published as15u instead of 150u.

MEMBERS' NEWS

by Chris Page, G4BUE

Highcroft Farmhouse, Gay Street,
Pulborough, West Sussex RH20 2HJ
chris@g4bue.com

G3XIZ has been QRV on the 60m QRP frequency (5262kHz) and had several enjoyable QSOs. Chris says, "Despite a slow start there are now a number of QRP stations frequenting the frequency and hopefully more will soon join us. It is a great band for inter-UK rag-chewing with none of the '599 QSL PSE' type of QSOs. A big advantage is there are no contests which may spoil some operators' weekend activity". After a two-way QRP QSO on 13 August with **G4XRV** on 5262kHz, **GM4XQJ** says the frequency "appears to be the accepted QRP spot now as there is an increasing amount of activity". After obtaining a 5260kHz crystal from **G3MFJ**, **G3JFS** revamped a 40m 1W solid-state TX to operate on 60m, where he has had some good CW contacts, including several two-way QRP. Peter has also cleared the cobwebs and dust from an old single-valve 5W TX that he plans to use on LF in the next Valve QRP Day in November. **G3KJX** says 5262kHz is ok for QRP, the band being much quieter noise wise.



G3OOU has completed a rebuild of his 2-160m dual Z-match with 'added functionality and improved maintainability' (photo left) <http://www.qsl.net/g3oou/aerialmatchingunit.html> for more information. Bob has also repackaged a prototype HF dummy load in a fully screened enclosure, see <http://www.qsl.net/g3oou/hf100wdummyload.html>, and says, "This is cheap to make as the resistors are around £3 each but only usable on the HF bands due to the self capacity of the resistors. There are some TO-220 style resistors available, but I have not tried those yet".

On 9 August **GØFTD**'s 200mW QRSS 10m signal was 'grabbed' by **CT2IWW** via SpE. **GM4VKI** is 'going to heaven' in August with a visit to the Elecraft Factory in California". Roy will collect an XG3 signal generator whilst visiting his son in San Jose; photographs and report in the next *SPRAT*, that is if he decides to return to the UK! The *Ohio/Penn DX Bulletin* reported **EO15QRP** was QRV 12 July/12 August from the Ukraine QRP Club marking their 15th anniversary, QSL via **UT2AB**. Your scribe QSO'd them on 1 August when they were running 7W. **IKØIXI** had 18 two-way QRP QSOs on 27 July in the 1° QRP Respect Day. **ZL4TE** 'picked up' a nice little Galbraith key on *Trade Me* (New Zealand's *eBay*) and says, "It is nice to use and sits nicely with the 817".

New member **K5WMS** has built the MST400 40m SZSB TCVR, <www.ozqrp.com> (photo right). Paul has also built the 80m version. **GM4UBJ** has started building a binaurial DC receiver for 80m, a **VK3XU** version, using easily available parts. Bill says, "I enjoy Drew's easy going style and well illustrated diagrams.

IKØIXI will be QRV 1/7 September while camping at Lake Trasimeno 10-40m with a homebrew FortIXI 3W TCVR. Fabio may also use **IQØKT/M**, his club's new call. **G3KJX** will be QRV for several weeks at the beginning of September as **CT7/G3KJX** with his FT-817, FT-450, and vertical and loop antennas. Brian has been going there for 29 years and is hoping for better conditions this year. On 2 October **MMØIMC** (**MM6ISM**) and **MM6GTJ** will set up a QRP special event station **GB1BOL** near the Largs Pencil Monument to commemorare the 750th anniversary of the Battle of Largs. More ino on *QRZ.com*. **GØHUZ** will be QRV 7 January to end of February /MM CW QRP on 10-20m while sailing down the west coast of Africa to Cape Town and back to the UK. Tony will use his FT-817 into a centre loaded whip mounted as high as possible on the ship's superstructure, assuming he can get the Captain's approval.

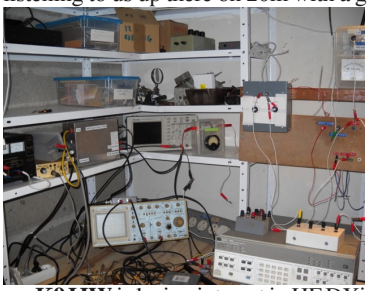
At 0446z on 29 July I QSO'd **G4GIY** operating on 20m as **9H4RH/P** on Ta'Dbiegi with a KX1 at 3W and inverted-vee (photo left), sadly I was QRO! Robin said, "I wanted to acti-

vate Ta'Biegi (9H/GO-001) but it is too hot during the day now. Today was a slightly crazy idea to do it before work. I had fun watching the sun rise and had 18 contacts in less than an hour". The photograph on the previous page shows his portable set up on Ta'Biegi. Robin lives on Gozo in the summer and in Yorkshire in the winter. **M1KTA** was QRV CW/SSB in the QRP class of the IOTA Contest as **SM7/M1KTA/P** from Utlagnan EU-138. Dom used his KX3 with HF vertical dipoles "right by the sea", a quarter-wave 40m GP and a G5RV for 80m.

G3YMC made 264 QSOs in the IARU HF Championship with QRP, mainly Europeans but **5V7S** on 15 and 20m and some USA stations on 40m. Dave says, "If you enter the QRP sections of these events you usually win the G certificate even with a lowly score". **GM4HQF** made 150 QSOs and commented on the poor conditions. Dave says, "I have won dozens of certificates for top QRP in GM by employing my secret weapon - be the only one to enter!". **IZ5ZCO**'s best QSOs with his FT-817ND (5W) and 16.5ft whip antenna were **BY4IB/4**, **VK2XH** and **ZL2RVW** on 20m SSB LP, **8J1MTD** on 20m CW LP and **KH6MB** on 15m CW.

The intrepid duo of **GM4VKI** and **GM3WIL** took the G-QRP stand to the Crianlarich Rally on 4 August (photo right) and had a great day meeting the 18 Club members signing in. Roy said, "Sales were good with the Sudden range of kits 'flying out of the door'". Roy and Dave hope to be at the Galasheilds Rally on 20 October when **G3MFJ** and **W1REX** have hinted they will join them. The RSGB are considering a new rally at Avimore and Roy asks members from the area to let him know if they would attend a rally there, <*RKavampsev@aol.com*>.

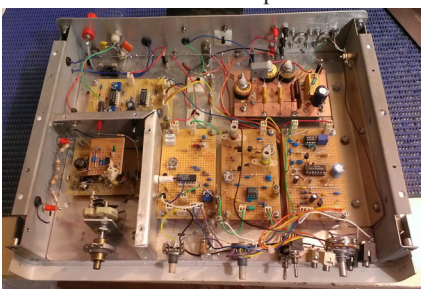
G4AKC passed the sad news that **G6UOI** suddenly became a Silent Key following a major heart attack in July aged just 53. Dave says, "Pete was a very keen HF pedestrian mobile operator here in the northwest of the UK and could be heard most days working VK and ZL using his back-pack set-up. He will be more than missed by all of us, he was our rock, and many of us looked forward to getting out on the beach and working alongside him, his enthusiasm for our side of the hobby was amazing and infectious. No matter what the weather or the band conditions, Pete would be there always with a cheery voice and lots of humour, making the whole experience for everyone something really special. He was one in a million and a very special friend to all of us, we will remember him always and I am sure he will be listening to us up there on 20m with a golden aerial".



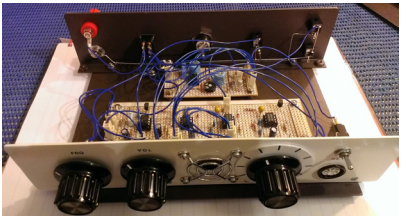
The photograph left shows **F5VLF**'s 136kHz set-up, which is his principle interest, and although TX powers are usually above 10W, the EIRP is usually limited by licence to 1W (thus qualifying for QRP?). John's TX consists of a HP function generator which feeds a 24V 30W Class E amplifier based on the **G3NYK** spreadsheet. This feeds a 26ft vertical with two 98ft top wires fed against several earth spikes. For a nominal 30W to the antenna, the ERP is about 1 to 2mW. The HP should soon be replaced by an Ultimate2 unit to provide greater flexibility of modulation modes. John's best DX last year was from Burgundy (France) to Hertfordshire (UK) in QRSS30.

K9JJW is losing interest in HF DXing and contesting but gaining appreciation for operating more on 160 and 80m, so is adding a low noise Delta Loop receive antenna for 160m as he wants to be more competitive in the upcoming contest season and increase his QRP DXCC count which, currently, is at 16. Jim is adding a set of relays so he can switch direction from east to west. If anyone is interested in the antenna, it is described at <http://www.eham.net/articles/806> or he will send a Powerpoint or PDF file to email requests, <rodenkirch_llc@msn.com>.

The photo right is **G3XUZ**'s new 40m QRP TCVR (less front panel, being spray painted and legend added). It has a DC RX comprising cascode front-end the 'ubiquitous' 612 mixer and AGC, S-meter and an audio filter. The TX uses a Clapp VFO running at signal frequency, CMOS buffers and the PA has a single IRF510 giving 5W RF output. There is full QSK which Chris says is most useful when working contest QRQ stations. Chris's old keyer, built about 1990, had given him extremely reliable service for decades, but was looking a



bit shabby. It was a **G4JXX** design and used four 555 timers; a nice simple circuit to understand and fault find. The photo right shows a new duplicate unit he has built in an old PC printer switch box. Chris says it works equally as well but looks a lot better!



Early morning (0600z) on 17 August **M3KXZ** was QRV from Rottingdean Beach with his FT-817 running 2.5W SSB and 16.5ft Clansman whip antenna. Pete worked **VK3VTH/7** on King Island, followed by **VK3OLS** and **VK5CE/P** on Flinders Island, who he had unsuccessfully called when he first arrived on the beach. **G3YMC** has 132 QRP DXCC during 2013 with 572 band slots and **G3JFS** has 42 DXCC. Highlights for your scribe this summer included two-way QRP QSOs with **R11QRP/9** (15 and 20m) and **R11QRP/3**, **KH6AT** and **Z35M** on 20m.

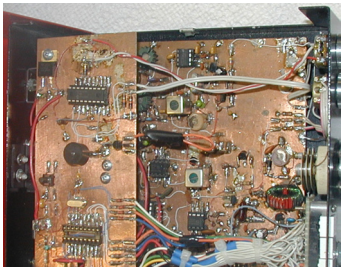
AA2JZ has been busy building (photos below). Carl says he survives on solder fumes!

An 80m Reflex RX (above) and a variable voltage transformer with digital display, showing input AC voltage and variable output voltage.

A Tube (valve) type transmitter for 3579lHz about 4W output.

Interior of the EL-84 transmitter.

A 40m CW TCVR with digital display and keyer.



Interior of the 40m CW TCVR, all Manhattan Style construction, mostly salvaged parts. The case is a re-used AB Switch.

A 40m TCVR (top left) with ATU (right) and power supply with 12V DC battery with charger. The digital display shows the voltage available and/or the charging voltage.

On 5 May **M5AML** heard **TM2K** calling CQ in a French contest on 2m SSB and tried to call using 5W, but had to switch to his TR751-E to 25W to get a response - his first non-UK QSO on 2m but not QRP! However on 7 May in the RSGB UK Activity Contest, John QSO'd **F1VNR/P** with 5W, 53 reports both ways, and they QSO'd again in the June UKAC, also with 5W. John says, "Finally done it! I also took part using 5W in the WAB 2m QRP Phone Contest which was very quiet, made one contact and managed to come second (out of two entrants!) in the Fixed Section - a shame it isn't better supported". Outside contests, John had a nice QSO with **MØHGY/P** on The Wrekin using horizon-

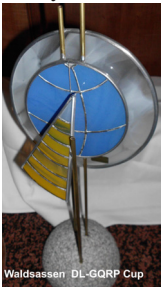
A 6m beacon on 50068lHz PIC16F628 controller, about 1W out to a vertical at 35ft.

tally polarised FM, all with the indoor 5-ele beam. HF highlights included **TC57A**, **4L4WW**, **Z32ØT**, **K3RA**, **7X2GK**, **OY/MDØIGD**, **TR8CA**, **9K2RA**, **PP5JAK** and **YY4KWB** on 15m and **RU27WN**, **HB3ØOK** and **EM1ØØU** on 17m, all with 5W SSB from an Alinco DX-70TH and indoor inverted-vee.

GM4UBJ's holiday operating this year (first week in July) was again from northern France as **F/GM4UBJ/P**, this time from a Gite on the Canal du Haute Colme near St Omer (photo right), and was almost exclusively on 6m. Bill says, "I had a ball! The band was open until around 11pm every night and I worked YU, HA, S5, I, OE and ON with an FT-817 at 2.5 watts and my buddipole at 13ft". **G3OOU** was QRV in July with his GV3 callsign with contacts mostly around Europe. **G4YVM** also used the GV prefix in July and worked some nice stations, many of whom were callsign collectors, so will be sending out special QSL cards shortly. On 31 July David 'bumped into' **G4LQF** on 80m CW. They were friends 30 years ago when he was at university near Norman's Birmingham QTH. David's email brought back memories of great times for your scribe in the early 1980s when I stayed at Norman's QTH with lots of other members over the weekends of the NEC Radio Exhibition.

I didn't have room to publish all of **DL2BQD**'s photos of the DL QRP Convention at Waldsassen on 27/28 April in *SPRAT* 115. My apologies to Dieter and to you all for the delay.

Old Collins OM, Tom, DM4EA.



Bernd, DK3WX and Karen.

Please let me know how your autumn goes for the winter edition of *SPRAT*, in particular what you have been building, who you have been working, and any other information, news, ideas, suggestions or opinions about QRP, by 20 November 2013. Also interesting photographs please, so 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 photograph to let other members know what you look like! Let me know if you intend operating from somewhere other than home during the winter and spring, so I can members know to listen out for you.

QSL Cards from Nasko - LZ1 YE

LZ1YE has sent me details of some attractive QSL cards including the Club Log.
Members can make their orders by sending samples, explaining what they want to print, and sending the materials: photos, files...etc via e-mail: qsl@qslprint.com or qsl@kz.orbitel.bg or if no internet access via the postal address: Atanas Kolev, P.O.Box 49, 6100 Kazanlak, Bulgaria. Examples of cards and prices can be seen at **www.qslprint.com**
For people need QSL cards urgently LZ1YE dispatches three days after the payment is made. UK Members can pay via a UK address: Please send your cheque / cash via recorded delivery to: LZ1YE QSP Print service, c/o Melanie Rowe, St. Leonards House, 35 St. Leonards Road, Exeter, EX2 – 4LR, Devon. e-mail: m0mja@aol.com (make cheques payable to : Melanie Rowe)

Look at 'www.celticpilgrim.com' for Amateur Radio in a Lovely Place

G3RJV has a Wooden Lodge situated in the Dyfi Valley in central Wales close to the Irish Sea and in the Snowdonia National Park. It has been completely refurbished with a large living area, conservatory, double bedroom, twin bedroom and a double bed sofa in the living area. Naturally there is a small amateur radio station with a QRP HF transceiver and a 2m multimode. An easy to use station in a quiet location.

Look on the webpage above or for leaflet write to G3RJV or email g3rjv@gqrp.co.uk

GQRP Club Sales

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

Antenna Handbook – 2nd edition – members £6.00, non-members £10.00 plus post } £1.80 (UK); or £5.50 EU
Radio Projects volumes 2, 3 & 4 – by Drew Diamond – members £5, non-members £10 } or £7.50 DX per book

6 pole 9MHz CW (500Hz) or SSB crystal filter (2.2kHz) £12 plus post (max of one of each) } £2.80 (UK); or
Polyvaricon capacitors – 2 gang (A = 8 to 140pF, O = 6 to 60pF) c/w shaft extension & mtg screws - **£1.40 each** } £2.50p (EU); or
– 2 gang – (both 8 to 295pF) c/w shaft extension & mounting screws - **£1.40 each** } £3.80p (DX)

Pair 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, 7.0475, 7.122, 10.106, 10.116*, 14,060*, 18.086, 18.096, 21.060, 24,906, & 28,060 all are **£2.00 each** (* = also available in low profile HC49/S) } plus **postage** } **(ANY quantity)** } £1.20 (UK), or
HC49U crystals- 1.8432, 3.500, 5.262, 7.00, 7.159, 10.006, 10.111, 14.00MHz – **50p each** } £2.60p EU, or
HC49U crystals – 2.00, 3.00, 3.20, 3.579, 3.5756, 3.5820, 3.6864, 4.0, 4.096MHz 4.1943, 4.433, 5.0, 6.00, 7.20, 7.6. 8.0, 10.0, 11.0, 12.0, 13.50, 15.0, 16.0, 20.0, 24.0, 25.0, 27.0, 28.0, 32.0, 33.00MHz – **all 35p each** (Some of these are low profile types) } £3.80p (DX)
Ceramic resonators – 455, 480kHz, 2.0, 3.58, 3.68, 4.00, 14.32 & 20.00MHz **– 50p each** } Post free
Diodes - Schottky signal diode – 1N5711- 20p each; 1N4148 GP Si – 10 for 10p } if ordered with
Varicap diode – **MVAM109** – 40pF @ 9v, 500pF @ 1v. **50p each** } max of 2 } with heavier things
– **MV209 – sorry – all gone – I am looking for more!** } like binders,
SA602AN - £1.50 (note – I may supply NE or SA, 602 or 612 as available. All are fully interchangeable. } toroids,
MC1350 - £2.00 These are getting in short supply now so max of 2 per member } polyvaricons
PICAXE-08M – 8pin - £2 each; CA741 op-amps 8pin DIL **– 5 for £1** } or filters
LM386N-1 - 4 to 15v, 300mW, 8pin **DIL - £0.40 each** } Use just
LM386M-1 - 4 to 15v, 300mW, 8pin **SMD** [0.2" (4mm) x 0.25" (5mm)]- **£0.35 ea** } that
TDA7052A - 4.5 to 18v, 1W 8pin **DIL** low noise & DC vol control – **£0.60 each** } postage
TA-7642 Radio IC – direct equivalent of **MK484** (& ZN414) – **75p each** }
2SC536 transistors (npn) fT - 100MHz, hFE-320, VCBO +40V **- 5 for 50p** } If ordered
MPSH10 transistors (npn) fT - 650MHz, hFE 60, VCEO 25V **- 8p each** } with books
2N3904 transistors (npn) fT - 300MHz, hFE-150, VCBO +40V **- 10 for 50p** } or CDs
2N3906 transistors (pnp) fT - 250MHz, hFE-150, VCBO -40V **- 10 for 50p** } add this
FETs - IRF510 – 50p; 2N3819 - 17p; 2N7000 - 10p; BS170 – 8p - all each } postage
Dual gate MOSFET – BF981 - SOT103 - 1GHz (diode protected gates) **- 85p each** } as books
Pad cutters – 2mm shaft – 7mm o/s, 5mm i/s diam – 5mm pad with 1mm gap **£5.75 each** } or CDs
10K 10mm coils – 0.6uH, 1u2H, 1u7L, 2u6L, 5u3L, 11u0L, 45u0L, 90u0L, 125uL – all 80p each } do not
Magnet Wire – 18SWG – 2 metres – 60p; 20 & 22 SWG – 3 metres - 60p; } travel well
24, 25 & 27SWG – 4 metres - 40p; 30, 33 & 35SWG – 5 metres - 30p. } with parts.
This 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) } Postage
Axial lead inductors (they look like fat ¼W resistors) these are low current – a few hundred mA } for
4.7, 6.8, 10, 15, 18, 22, 33, 39, 47, 56, 100, 150 and 220 - all uH and all 18p each. } components

Toroid Cores – **priced per pack of 5 – max of 2 packs of each per member**
T25-2 – 50p, T25-6 – 60p, T30-2 – 60p; T30-6 – 70p ; T37-2 – 75p; 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 - £2.20; T130-2**- £1.50ea ; T130-6** - £2.00ea. FT37-43 – 80p ; FT50-43 - £1.20 ; FT37-61 - £1.20 ; FT50-61 - £1.20; FT140-43** - £2.50 ea ; FT140-61** - £2.50; BN43-2402 - £1.20; BN43-202 - £2.00; BN43-302 - £2.00; BN61-202 - £2.00. Ferrite beads – FB73-101 (3.5mm dia x 3.2mm long, 1.2mm dia hole) – 40p for 5
All toroids are plus postage – up to 5 packs = £1.20 (UK), £2.40 (EU), £3.50 (DX). Each additional 5 packs, please add 50%
**** Except ** items** – they are heavy and each counts as 2 packs (ask for quote if you want more than 2 of the large toroids)

SBSS PCB clamps – single - £12, two - £20 all plus post (£2.80 UK & EU : DX – order direct from Rex please)

MeSquares & MePads - £6.50 each plus post (£2.80 UK & EU : DX – order direct from Rex please)

Limerick Sudden kits RX (160 through 20m); **TX** (160 through 20m); **ATU** (80 through 10m) **£36.00 each plus post**
UK - £2.80, EU - £5.20, DX - £7.80

Sprat-on-DVD – 1 to 148. Only £4 each to members plus postage, UK - £1.20, EU - £2.60, DX - £3.70

Sprat Binders – nylon string type – Black with club logo on spine -16 issues per binder – **new stock** - £4.75 each plus postage (one: UK - £1.60, EU – 3.00, DX - £4.00. More - add £1.10, £1.50, £2.50 each)

Cheques (UK) and payable to G-QRP Club. Sorry, but cheques in other currencies are uneconomical to us due to bank exchange charges!

MINIMUM ORDER for cheque or PayPal payments is £5 For orders less than £5 – please use postage stamps (any denomination) - any quantity of stamps is OK, or cash. 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 g3mfj@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 - thanks