# RAGCHEW

## **Summer 2024**





Club members at the Direction Finding competition

#### <u>Editorial</u>

All clubs need new members and GARES is no exception. That is why we are holding an **Open Day** on Saturday June 9<sup>th</sup> 2024. Please help us to publicise it. A copy of our "flyer" is shown on the last page of this issue and printed copies are available from the club.

Personally, I don't agree with the RSGB's focus on promoting Amateur Radio to the young. Peter Waters G3OJV (of Waters and Stanton) said recently that he thought that Amateur Radio was more of a hobby for the "more mature" (especially pensioners) and I agree. We are told that there is an epidemic of loneliness and Amateur Radio seems like a good solution to this as it removes the physical barriers to meeting people although, as Tony Hancock said "I have friends all over the world: none in this country but I have friends all over the world".

So please help us to spread the word around (but it would be helpful if we didn't block the car park with our own members' cars). You can always respond to the club's CQ calls.

Speaking of removing physical barriers, the club's WhatsApp group has helped a number of members to stay in touch although they find it difficult to attend the club itself. If you don't know, WhatsApp is an "app" for mobile phones that allows you to send messages to other WhatsApp users. Although the messages themselves are not moderated, so please bear that in mind, we control who can join our group and can remove anyone who misbehaves. If you want to join the GARES Amateur Radio group, just send your phone number to cliff@g8cqz.co.uk or message me on 07419 115747.

One recent conversation on the WhatsApp group concerned the hack on the Logbook Of The World (LOTW). I'm not sure what the hackers hoped to get as it's totally free and most station information is available on QRZ and in Callbooks but it reminds us to be very wary in all our online dealings. I recently ordered some radio related items on eBay. They were labelled as being located in London although clearly manufactured in the Far East. When the items did not arrive I contacted the seller only to find that they were in Hong Kong. It turns out that they have a deal with a shipping company in London. eBay send the order to Hong Kong. Hong Kong send the item (along with dozens of other items) with UK style labels on them (no Hong Kong post office labels) to the shipper in London who then ships the individual items to customers. Fortunately, the seller was honest and I was given an immediate refund.

Cliff G8CQZ

#### Ragchew is your magazine

Amateur Radio is a very broad hobby and I am sure that there are things that you know about that others don't. There are probably also areas that you would like to know more about. So tell us about it. What interests you? Have you, for example, tried Var-AC, been operating from a new location or get a new rig (or parial). We will look at writing the article if you don't fool up to

a new location or got a new rig (or aerial). We will look at writing the article if you don't feel up to it and it can be anonymous if you wish. Also, what aspect of Amateur Radio do you want to know more about?

I want Ragchew to be about our members' interests and experiences, not about specifications. So please let us know, either at the club, by email to <a href="mailto:ragchew@g8cqz.co.uk">ragchew@g8cqz.co.uk</a> or via the WhatsApp group.

Cliff

#### "2X2V calling CQ New York. Is there anybody on the air? ... Anybody?" Orson Welles "War of the Worlds" original radio broadcast.

#### **My National HRO Receiver**

#### by Brian G4CIB

At a recent club meeting I mentioned to **Jim 2EOGKN** that I had an HRO receiver which had not been powered up for many years and he replied that he had a spare power supply which he was willing to pass on to me. On the plus side, my HRO had slumbered in a dark corner of my bedroom shack, so at least it had been spared the seasonal temperature and humidity variations of the shed or garage. I checked the HT and heater voltages on the PSU and all seemed to be in order. I then did some checks on the HRO, confirming the heater chain was in order, also measuring various points around the receiver to confirm no obvious short circuits. Luckily, I have a large set of plug-in coils for the HRO and it seemed the obvious choice would be the one covering Long wave, working on the theory that if it picked up Radio 4 on 198KHz then that would be a starting point. Then a "shall I, shan't I?" moment. Connecting a length of wire into the antenna socket, with headphones plugged in, I switched on. The valves lit up and after a suitable warming-up time, I switched on the HT. Noise from the headphones and a rapid tune down the lower end of the band range brought in Radio 4 loud and clear.

I realised it must be at least 15 years since I last heard signals from the receiver!

It must have been around 1971 when my good friend **Arthur G8BRN (SK)**, aware that I was using a very basic Heathkit HW30 2m transceiver (5 watts AM transmitter, super-regenerative receiver), asked me if I would like an HRO receiver. It had been languishing under a bench in a certain establishment at Benhall and about to be disposed of. Having acquired the set, it was apparent that some work was needed to get it working. On the advice of Arthur, I first replaced all the wax-paper capacitors in the set, thanks to **Roy G3VZR's (SK)** emporium Richards Electrics in Barton Street. Next, all the old "body, tip, spot" carbon resistors were replaced. The valves were tested, and some found to be low-emission. It was around this time that I was spending quite a bit of time at London Airport in connection with my work at Smiths Industries, so I was able to nip into London and visit Lisle Street, Tottenham Court Road also Goldhawk Road, in the 1970s still the haunt of electronic surplus stores. It was at such an establishment, Colomor Electronics, that I was able to purchase a complete set of new, "old stock" valves for the HRO. I also purchased from an emporium in Tottenham Court Road a BC221 Heterodyne Frequency Meter, but that's another story.

At around the same time, I was made aware that my employer, Smiths Industries at Bishop's Cleeve were having a massive clear-out of redundant equipment. A couple of amateurs who worked in the factory (who shall remain nameless, but both are now Silent Key) got wind of what was happening and put a bid in to buy the whole lot: power supplies, oscilloscopes, specialist test equipment etc. Remember, this was the early 1970s and most of the kit dated back to the 1950s, so it was nothing like today, everything was very big and very heavy! I managed to have a word with one of the amateurs and he told me that among the mountain of stuff they had purchased was an Ediswan High Voltage Stabilised Power Supply which he offered to me for £5 which I accepted. His photo showed an Ediswan R1095 which was similar to mine but rated at lower output current of 50mA, whereas mine was rated at 250mA. My PSU also had a 500V unstabilised output terminal. I think a lot of the kit was sold off via Norman Harding's in the High Street, Cheltenham.

By now, the restoration of my HRO was well under way. One thing that let it down was the front panel, which was extremely tatty. I decided to dismantle the case, removing the dial mechanism and various controls from the front panel. The plan was to rub down and repaint the panel using an aerosol car spray, but knew that with the best will in the world, the results would not look professional, so a cunning plan was devised. Smiths Industries had a Model Shop, staffed by highly-skilled craftsmen and their role was to produce prototype equipment. The manager in charge of the Model Shop Wiring and Paint shop was Stan Kelly G3COZ (SK), who for many years taught the evening RAE class at North Gloucestershire Technical College in Cheltenham. Now Stan was "old school" and I knew that he would not take kindly to being asked to do a "foreigner"\*, so I put my plan into action. Every lunch-time Stan would take a walk through the engineering lab where I worked, passing my bench and nodding to me. One day I timed it so that when Stan walked through, I would be rubbing-down the HRO front panel prior to painting it. A few days went by, and Stan suddenly stopped, walked over to where I was working and said to me "Is that what I think it is?" I replied "What do you think it is, Stan?" "An HRO front panel" he replied. I told him it was and what I was planning to do. "Let me have it, I'll sort it out!" and away he went with it. A few days later, he presented me with a beautifully resprayed panel with the engraved lettering picked out in white! The only problem was the dial looked distinctly tatty so I decided I would have a go at repainting it myself. Dismantling an HRO dial mechanism is not for the faint hearted, but I did and having resprayed it, spent a few hours working out how to reassemble it, which involved positioning a number of springs held in place with cotton whilst I carefully located the various parts in place. I was very pleased with the end result.

Finally, the whole lot came together, and I spent many hours using the HRO in conjunction with a 2 metre converter, enabling me have a decent receiving set-up compared to the super-regenerative set. At around the same time, I found an article in the "Short Wave Magazine" describing how to produce a band-spread coil for Top Band (1.8 - 2.00MHz) which I duly did and I'm looking forward to trying out again.



My next task is to give the set a good clean, mainly dust inside the chassis, and then start using it.

Many thanks Jim for getting me going again with my HRO in the true spirit of Amateur Radio!

\* A "foreigner" – common British slang for unofficial work (from the Urban Dictionary)

#### Contests

For various reasons (and mainly because of the difficulty in finding CW operators) the club has not entered the main **National Field Day** (NFD) this year but we will be entering the **Low Power Field Day** on Sunday, July 21<sup>st</sup> 2024. This is a much more sedate contest that even has time off for lunch. At the same time, and in the same location as our station, we are holding a horticultural **Plant Swap**. In addition to swapping plants, you can also help us to erect the aerial at "The Ferns, Broad Street, Hartpury, GL19 3BN".

#### Arduino Controlled 0-125MHz VFO Project

#### by James G8YYH

This is the first of two oscillator projects in this issue. James has done a wonderful job using a professionally produced printed circuit board, surface mount components and SMA connectors.

In my free time over the past year or so, I've been investigating Direct Conversion Receivers. I've bought a few "plug and play" RF modules off eBay to set up a basic RF receive chain to experiment with, this included an LNA for the frontend amplification, and a mixer module. I also experimented with a few LM386 circuits for the final audio gain stage, which eventually evolved into a mini side project to make an amplifier for my electric guitar, but that's an article for another day! To generate the Local Oscillator, I was inspired by a few articles online that have used the Si5351A clock generator module as a variable frequency LO (such as :<u>https://aa7ee.wordpress.com/2018/05/11/yup-its-another-si5351-vfo/</u>). There are also quite a few articles online if you look up "Si5351A Direct Conversion Receiver" (or words along those lines). This module is essentially a 0-125MHz variable clock generator, not really intended for RF purposes. But it serves as a fairly appropriate LO for a mixer, as we want a square wave with sufficiently high power to switch the diodes in the mixer.



The Si5351A is controlled via a SPI bus interface. To control the module, I decided to use one of my Arduino development boards I had lying around to drive the SPI bus controls. You can order this as a handy breadboard friendly module from Adafruit. Thankfully, there is also an open source library that deals with the low level programming of the device (https://github.com/etherkit/Si5351Arduino). All you have to do is use the built-in functions within the library to set the frequency, power etc. and then the library handles all the low level writing to the registers of the SI5351A. I decided the output frequency would be controlled by a rotary encoder module, and I also opted for an OLED module to display the frequency selected at the

time by the user, both of which are available as breadboard modules. Initially, I breadboarded all the modules out. I also wrote some fairly simple code to set the output frequency of the Si5351A by controlling the rotary encoder, and to read back the set frequency and output this on the OLED screen. After having success with this, I then decided to see if I could take this a step further and do a PCB design.

There are quite a few PCB design tools out there, but you have to pay for most of them. KiCad is an open source alternative, and is nearly as feature complete as some of the main PCB design tools on the market (There are some features that KiCad is lacking in, but for hobbyist use, KiCad is extremely good considering its price point of £0) . A major time saver with KiCad is that a lot of commonly used components are already in the libraries you get when you initially install the software. I usually use SnapEDA if the default component libraries don't have a schematic diagram or PCB footprint for a component I want to use in a design. This website allows you to



search for any part you're looking for, and import the diagram and footprint for that specific part relatively easily into KiCad (Assuming a footprint of the part actually exists on the web)

The PCB uses the same microcontroller that the Arduino development board uses (ATMEGA328p), but in a surface mount package. The rotary encoder and OLED screen were also carried over from the breadboarded version. I added in a Micro USB connector, so that I could power the board off a connection from my PC, rather than having to rely on a DC supply to power the board. USB is able to output 5V at 500mA max, which is more than enough for what I need. USB-C allows you to deliver a lot more power than this, but wasn't needed, and would overcomplicate the project, as you need to perform power negotiation between the two devices you've connected.



For the ATMEGA328P, I used the same pin-out on my PCB design as I had done with the breadboard, so I didn't have to make any code changes. There were a couple of other considerations to be made, such as the fact the SI5351A requires 3.3V CMOS logic, rather than the 5V I/O the ATMEGA provides, so I had to design a level translator circuit for bidirectional level translation.

The SI5351A has a 50 Ohm output impedance from its 3 clock generator outputs. Track width for RF at 125MHz doesn't matter too much here, as the length from the output of the IC is not an appreciable fraction of a wavelength (125MHz = 2.4m, the track length is a few

cm). There are calculators online that allow you to find the impedance of a microstrip line based on the dimensions you give (i.e. the height of the track to the bottom ground plane etc.), so I tried to keep the track width equivalent to 50 Ohm from the output of the IC to the SMA connector I have on the PCB.

For resistors and capacitors, I intentionally went with 1206 size SMT components, as these were a good compromise between solderability and how much space they take up on the board. Soldering the ATMEGA and the Si5351A was definitely the trickiest part of assembling the board, but was made easier with applying solder paste to the pins of the IC and then dragging the tip across the pins. The paste mostly adheres to each individual pin, and then you can use solder wick to remove any solder that's bridged across.



For manufacturing, I went with JLCPCB, which is a manufacturer out in China. To manufacture the boards, all you have to do is send off the manufacturing files that KiCad produces, and enclose them in a .zip file. You can then upload this .zip file to the manufacturer, and you are supplied with an instant quote.

Since this was my first time using JLCPCB, I had a voucher that meant the cost of producing the boards was £5. Delivery was £20. From sending the board off for manufacture, it took about a week for the boards to arrive.

You can view the code I wrote for the PCB at: https://github.com/jamesfletcher22/Si5351aArduino

The schematic and pcb files are also available at: <a href="https://github.com/jamesfletcher22/FreqSynthPCB">https://github.com/jamesfletcher22/FreqSynthPCB</a>

Images:   Fig 1: Breadboarding to test whether the circuit will work.   Fig 2: The PCB   Fig 3: Partial construction, running the Si5351A from an Arduino Module before moving to the ATMEGA328P chip   Fig 4: Testing the complete circuit using a small spectrum analyser to show the purity of the signal.	
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#### The Story Behind the QSL Card – GW3ZV

#### by Brian G4CIB

You may recall in my HRO article in a previous "Ragchew", I mentioned **Stan Kelly G3COZ**. When Stan died, a relative of his who worked with Leta had the task of clearing his stuff, and knowing she was a licenced amateur, asked her if she was interested in a load of cards he'd found. It turned out to be Stan's QSL card collection. I've never really studied them in detail, but recently I started looking through them, some of which are 2-letter call signs from the early days, which gave me the idea to research them. This was the inspiration for "The Story Behind the QSL Card". I quickly realised that some cards would be relatively easy to research, whilst some really interesting ones much harder, so at the moment I am working on at least half-a-dozen cards in the hope that at least one will come up trumps. For the first in the series, here is a QSL card confirming an 80m QSO between Stan and **John Banner GW3ZV** on 26<sup>th</sup> April 1951. This card caught my attention for two reasons, firstly that Aberdare, the QTH of John Banner was described as "The Home of Sobell radio" and that he was an MBE (Member of the British Empire). A search on the internet for John Banner MBE took me straight to the Hirwaun Historical Society web site and with their permission I have reproduced the following information.



"For many years, Mr. John Banner MBE, lived and worked in the village of Rhigos. He was an out-going, yet modest man described in the book 'Angel Visits from Biplane to Jet' by its author, Group Captain Frank Griffiths (Rtd) as 'A large man – a splendid press-on type'. Mr. Banner became the general manager of Sobells (later GEC) when Sir Michael Sobell chose to move his factory to Hirwaun in the 1950's. Labour costs here, were low compared to London and where of course, Sir Michael could get discounts and grants from the government as Hirwaun was a re-development area. John Banner was awarded his MBE for the work he did for the TFU (Telecommunications Flying Unit) which was based at RAF Defford, during the Second World War. Whilst working at the TFU (later known as Radar Research Flying Unit), along with others, he designed a 'homing device' that went on to save the lives of numerous aircrews at sea and on land and on the 1<sup>st</sup> October 1942, he bravely tested this device by jumping into the Irish sea from an aeroplane, fully equipped with a parachute and a dingy. The device was named 'Walter' and consisted of a small telescopic mast and a small amount of 'boffinery' which was powered by a tiny battery. 'Walter' was packed into the pilot's parachute pack. Mr. Banner was born in 1905 in West Bromwich. He died in 1986 shortly after suffering a car accident. He was married to Ivy, and they had three children, two girls and a boy. A memorial can be seen in the village of Defford, Worcestershire, dedicated to the memory of RAF aircrews, scientists, engineers and civilian personnel".

Members may not be aware that there is an interesting museum located at Croome Court, adjacent to the old Defford airfield, dedicated to the service personnel and scientists who developed radar in the Second World War. It is well worth a visit.

Just to conclude this interesting story, I have donated the QSL card to the Hirwaun Historical Society for their archive.

If you enjoyed this article, come along and hear Brian talk about the **Story behind QSL Cards** on **Monday 3rd February 2025** at Down Hatherley Village Hall.

#### Local Oscillator for a 2m FM Receiver

#### by Cliff G8CQZ

This is the other article about oscillators: the "bodgers" solution. It's big, bulky, based on Veroboard (stripboard) with larger components and modules purchased from eBay.

Many, many year ago I purchased a 2m FM receiver that had a VFO plus 12 crystal controlled channels. The trouble was that I could never afford more than a couple of crystals and the VFO is only marked (on a 4cm diameter disc) at 500KHz intervals so finding an exact channel is difficult. Many times, I have thought about throwing the receiver away or "donating" it to a club raffle. Then a few weeks ago I was looking through my components box and asked myself "could I build an external channel oriented local oscillator"?

The resulting design uses just three main components:

- an AD9851 Direct Digital Synthesiser module
- an LCD display
- a PIC controller chip

Plus a few switches, a voltage regulator and an emitter follower to link to the receiver.

#### Xtals

Crystals for this receiver are in the range 44.4333 to 45.100MHz. To get the crystal frequency for a particular channel, take the channel frequency and subtract the receiver's intermediate frequency (10.7MHz) and divide the result by 3 so a crystal for 145.475MHz would be 145.475-10.7 = 134.775 and 134.775/3 = 44.925MHz.

#### The AD9851

This chip uses a cheap 30MHz xtal and can generate up to 180MHz although it's best to stay below about a third of this if you want to avoid a low of filtering. As the receiver's maximum xtal frequency is just under 45.5MHz and the AD9851 is good up to 60MHz, it looked like a good match. The AD9851 is available as a module, complete with xtal and mounted on a board with 1/10" pin spacing, from a number of suppliers on e-Bay for around £25.

#### The LCD Display

I used a two line, 16 characters per line display that I already had. They are also available on eBay for about £4.

#### The PIC Chip

Although an Arduino or Pi Pico would have been a lot faster and easier to program, they do not have 8 bit parallel outputs. Both the AD9851 module and the LCD display have 8 bit interfaces. Therefore I used a 16F876 chip, which has two 8 bit interfaces and a 5 bit interface.

#### The Software

Whenever a channel is selected, the PIC sends a sequence of four separate 8 bit transfers to the AD9851. This allows it to select a frequency that is accurate to  $1/20^{th}$  of a hertz. Having done that, it updates the display by sending a sequence of characters.

The channels are held in the PIC as a simple table. Each entry contains the characters to display and the code for the AD9851. Changing channels is simply a case of looking up the next (or previous) entry in the table and sending the data to the appropriate device.

#### **Design and Construction**

I tested the design by building it on a series of multi-pin breadboards and (I must admit that it was to my surprise) when it worked, I decided to build the circuit on Veroboard. I also used a rotary switch rather than a series of up/down switches that I had started with. Finally, I added an output for a possible transmitter.





#### **Problems Encountered**

Having completed the project, I discovered that the LO was about half a channel off frequency and this was caused by the cheap 30MHz crystal on the AD9851 module, which turned out to be 1.3KHz low. This was cured by listening to the LO on a receiver and recalculating the channels.



Images	
Fig 1:	Completed unit
Fig 2:	Internal view
Fig 3:	Close up showing main components.

#### What do you mean "I can't afford a Spectrum Analyser"

In line with my usual policy of "bodging" solutions, I used a cheap "dongle" type receiver to check the frequency of my oscillator and to check for harmonics. It needed some work to avoid overloading and to stop interference from 'on the air' signals but I found that a standard oscilloscope probe set to "x10" input and connected to a low value resistor did the trick.



Do you want a hobby that is Technical, Social, International, Competitive, Adventurous and open to all ages?



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- Communicating by Voice, Data and Morse code
- Speaking other languages
- Experimenting , building & restoring radios
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- Helping emergency services
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(What3Words: ///canal.logbook.universal) Saturday 29<sup>th</sup> June 2024 from 10am to 4pm For more info: g4aym.org.uk also RSGB.org