http://carc.org.uk/
G3WSC
G6RC
M2F

BACS
branch code: 40 06 21
a/c: 71310321

CRAWLEY AMATEUR RADIO CLUB

Local Repeaters
GB3MH: 145.625/88.5(FM)
GB7MH: 439.6375(D-Star/DMR)
GB3NS: 439.675/82.5(FM)
GB7NS: 439.1625(DMR)
GB7ID: 430.975 (438.575)(FM/Fusion)
GB3HO: 430.8875/88.5 (438.4875)(FM)
GB3HY: 430.900/88.5 (438.500)(FM)
Local DX Cluster GB7DXS : Telnet
81.149.0.149 Port 7300

Club newsletter

March 2020

Editor: Richard, G3ZIY

Welcome to this the first edition under the new Committee. I hope to have enough material to produce an issue once every two months — but that largely depends on you, the readers. So please keep that in mind when you are persuing the hobby, and send me some pictures and words. I will soon knock the words into shape if you are not too sure about writing.

I hope you find something interesting in this edition, and I look forward to your comments.

Richard, G3ZIY

Club situation regarding Corvid19 (Coronavirus)

The situation is very fluid. The Committee are keeping a close eye on Government suggestions about holding meetings etc. To that end, please look at your email, particularly on Wednesdays and Sundays before you plan a trip to the club. At this time following Government advice about thorough hand washing, and self-isolating etc., makes sense. This virus is going to run it's course, just as SARS and bird-flu did, but good hygene will doubtless eventually beat it. Don't be offended if I don't shake hands with you!

HARC/CARC Challenge

I am pleased to announce that the runners-up were HARC! You might have guessed as the challenge involved a shortage of beer, that you were up against experts! Anyway thanks for letting CARC retain the trophy! Now to dream up something devious for next year's match. The victorious team pictured at the HARC meeting room are (L to R) Richard G4ANN, Stewart G3YSX/M5SB, John G4PEO and Keith G3VKW. Well done chaps!

Ionospheric reciprocity

Most of our HF signals end up in the ionosphere at some time between their journey between two stations. Many think they traverse a great circle (GC) path on this journey they take — this is after all the shortest route between two places on earth. This is far from the truth however.

The ionosphere consists of many layers, the principle ones of interest to radio amateurs being the D, E and F (which usually splits into the F1 and F2 during daylight hours). In truth they are not layers, but regions, with a depth which varies according to the amount of ionisation the sun produces. The density of each region varies according to the height above the earth's surface, being densest at the bottom of each. This effect is due to gravity. Each region is also affected by the earth's magnetic field as well. There's a lot going on.

Most amateur HF aerials are linear, being either vertically or horizontal polarised. These linearly polarised signals can be affected by any of the above regions, but I am going to concentrate on the F region(s). This consists of very rarefied gases, a mixture of mostly oxygen and nitrogen, but in different proportions to that found at the surface. The sun's ultraviolet radiation excites these molecules of gas so much that their electrons sometimes break free and leave a net positive charge on the molecule. The electrons being negatively charge can get attracted to one of these positively charged molecules, but they are all so thinly spread that the net result is lots of free electrons flying around energetically, particularly in the upper parts of the region.

This plasma (ionised gas with free electrons) is highly susceptible to electromagnetic radiation. The electrons respond to the radiation and push their neighbouring electrons around, as two negatively charged particles repel each other. Thus the HF signal starts traversing through the plasma, as the electrons move. This change of density from the bottom of the region to the top causes the signal to be refracted, just as light is in a prism. As the top of the region is more ionised than the bottom, the bend is more extreme here, and if the signal is below the maximum usable frequency (MUF) it will be bend back towards earth before reaching the top.

This plasma is in a magnetic field, which causes the linearly polarised signal to rotate (Faraday rotation) in both a clockwise and an anticlockwise direction, splitting the signal into two components. These are known as the ordinary and extraordinary waves and traverse the plasma at slightly different speeds. The two waves are now affected by the earth's magnetic field, one drawn towards it, and one away. Thus both diverge from the GC path. The higher frequency signals diverge less as they are more energetic, but this means also that they are more likely to escape the top of the region and be lost to space.

Considering a single ray from the transmitted signal, it will split into two signals and veer away from the GC path, and never be heard at the far end. Luckily HF aerials are generally so broad that one of the rays from off beam will be just the right azimuth before traversing the F region(s) to emerge from the bottom of the region and hit the receiving aerial. The trick is to try to steer the aerial so that the strongest ray is the one that makes it through. An impossible task of course, as the ionosphere is in a constant state of flux.

Now what about the signal you are trying to receive from the distant end? This also has to traverse the F region(s), but it is a different part of the ionosphere! So those signals will be affected differently, and the aerial will ideally have to be aimed a different amount off the GC path to maximise the signal you receive. So ideally (but usually impractically) we each need two independently steerable HF aerials for each band! Luckily our aerials have wide enough beams to work adequately, if not optimally. In any case which direction would you steer your transmitting aerial if you had no feedback from the distant station? Something of a conundrum.

Richard G3ZIY

February's Wednesday presentation - Understanding HF Propagation

This was one of two video presentations created by the RSGB (so far) and took about 45 minutes to run. There was some video, but it was mostly slides with an accompanying commentary by Steve Nicols, G0KYA. In it he covered many of the reasons for the propagation we observe, with the caveat that we don't know it all!

There followed a lively question and answer session afterwards for about 30 minutes, during which the sound links to Steve failed a few times, but Stewart persevered and we eventually got answers to all our questions. All in all, a reasonably effective way to get an expert to present a subject at the club, without them having to travel great distances.

Exercise 'Blue Ham'

This annual exercise was held on the weekend of 7-8th March this year. I noted a good number of different military cadet stations operating on various frequencies in the 60m band, some of them in the segments that UK amateurs are licenced to use. Many of the operators were young people judging by their voices (prompted in the background by more experienced operators) and they really seemed to enjoy working amateur stations. Exchanges were somewhat simplified ('loud and clear' rather than S meter readings, for all the good they are anyway!) and 6 digit Maidenhead locators so as not to exactly give away their 'secret' HQs!

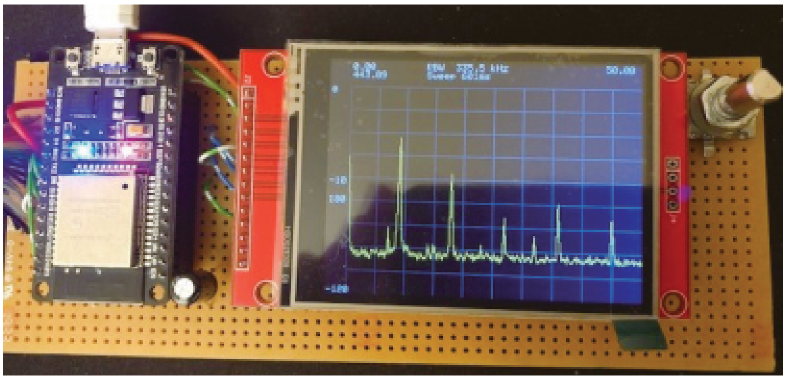
Nana VNA by David, M0WID

A month or so ago a note on the Nana-VNA forum mentioned the development of a low cost spectrum analyser.   Intrigued I took a look.

The information from the developer Erik PD0EK can be found in the HBTE (HomeBrew Test Equipment) group under groups.io (https://groups.io/g/HBTE/files).

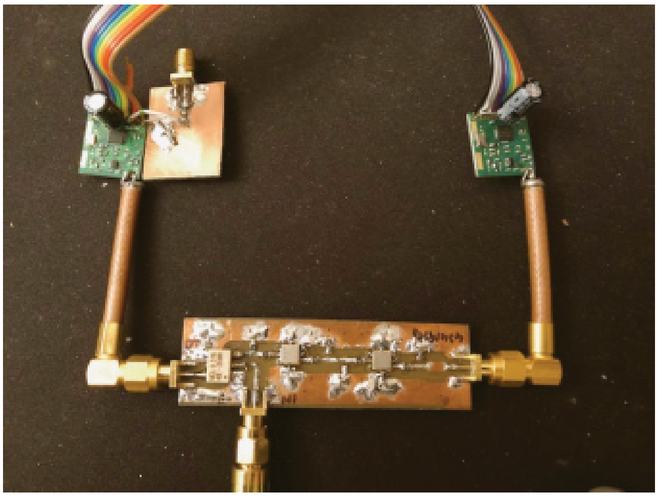
The basic idea is to utilise two low cost SI4432 modules (around £3 the pair, delivered), an ADE-25 mixer (around £3.66 for 5, delivered) and a couple of 434MHz 1Mhz or less bandwidth SAW filters (free plus postage from a G-QRP club member, also available from RS). The SI4432 needs an Arduino or similar for control (I used an ESP32 – around £4) and an optional display (I used a 2.8" ILI9341 touch display, around £6).

With changes to the filters on the SI4432 modules which I have not yet made the analyser should be usable to around 250MHz, without these changes it runs to around 150Mhz.



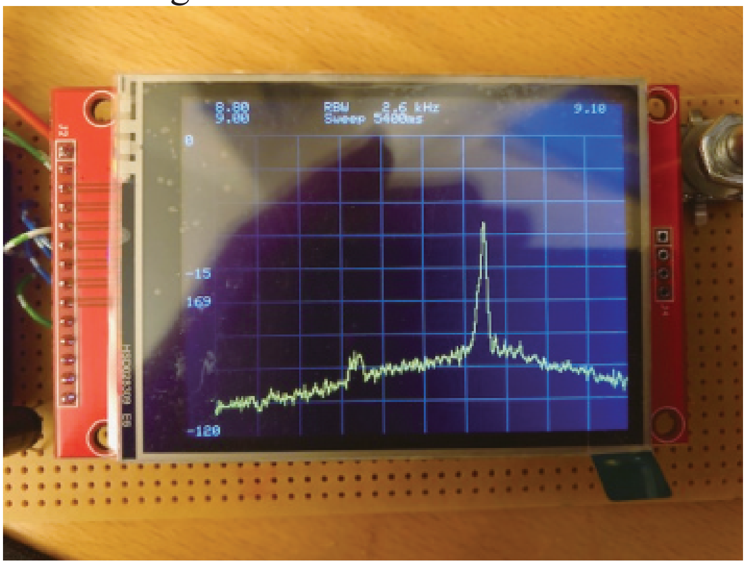
This is my hacked together prototype showing the output from my club project Antenna Analyser in signal generator mode at max output (via a 15dB attenuator):

The SI4432 is quite a piece of work. Designed for low power long range communications (LORA), it can output a 1-20dBm signal from around 240MHz to 930MHz with 312Hz steps, sensitivity of -121dBm. The DSP based filtering and modem allows the receiver bandwidth to be adjusted between 2.6kHz and 620.7kHz. The SI4432 provides a measure of the received signal strength with 0.5dB resolution. GPIO pins are used on the modules to control a TX/RX antenna switch, and another can be configured to provide a clock signal. When used for communications the modem can be configured for OOK (on-Off Keying) FSK and GFSK with bit rates configurable from 0.123 to 256kbps and a claimed range of up to 1000m. Perhaps suitable for controlling that antenna tuner at the end of the garden?



Software is currently very basic, the commands are sent via a terminal application to the analyser. Readings can also be sent to the PC for further analysis or use in some other piece of software.

Zooming in on the fundamental and narrowing the receiver bandwidth it becomes essential to leave enough time for the DSP filter output to stabilise at each LO frequency step, so the sweeps become quite slow – 5.4 seconds here. Setting the correct gains for the receiver programmable amplifier is also important – too high and spurii appear, too low and you lose dynamic range.



Updated software is promised to provide touch screen facilities to control the Tiny-SA directly rather than via a PC. Shielded construction might also help!

By setting both SI4432 into transmit, the Tiny-SA can be also used as a 0(ish)-250Mhz signal generator, output around -6dBm max, adjustable. A 250Mhz low pass filter would be required.

By attaching a programmable attenuator module such as PE4302, which can also be controlled by the software, stronger input signals can be handled and the output strength of the signal generator can be controlled.

With a small additional circuit the GPIO clock output can be used as a -30dBm power reference signal.

Frequency of the SI4432 drifts noticeably; even the draft from walking past has a very audible effect when monitored on the FT817. Enclosing with shields to separate the LO and RX modules and perhaps controlling the temperature inside may improve matters. The SI4432 provides the facility to tune the oscillator by adjusting the capacitance. With minimum LO step sizes of 312Hz (156Hz if less then 480MHz) absolute accuracy is pointless, but if the frequency can be made stable the frequency could be calibrated to be close enough.

Other Low Cost Spectrum Analyser Options

An SDR receiver, eg the SDRPlay at around £95, can be used and is likely to give better results as well as being more versatile. It would be interesting to compare performance.

Conclusion

The Tiny-SA is an interesting and educational project. It is great to be able to change the various gain and time and attenuation parameters and see the effect on the trace.

As well as being educational the Tiny-SA is a useful test tool, allowing harmonics and other spurii to be seen. The local display without using a PC is convenient for quick measurements. The minimum RBW (Receiver BandWidth) of 2.6kHz may make two tone tests of linearity tricky if not impossible – yet to be tried.

This is nowhere near a finished project, but still an interesting and useful piece of test gear that is easy and fun to build.

73, M0WID

1 Icom IC-756 Pro III £950
2 MFJ-969 300watt HF+6m manual ATU NEW - not unwrapped £225
3 SignaLink USB data interface NEW - not unwrapped. £80
4 MyDel MP-304 Mk.II 30amp heavy-duty non-switching traditional style PSU. £70
5 QJE PS 3011 30 amp switch mode PSU. £40
6 RM KL405V 200 watt 3.6/30MHz linear amplifier As new - used once only £150
7 Nissei Tx-502 1.6/525 MHz cross needle power meter, as new used once only. £90
8 Daiwa PS-120M II 10 amp PSU £30
9 MFJ-260C 300 watts 0-600MHz dummy load NEW £40
10 Heil ProSet HC5 ICOM and Yaesu adaptors £50
11 Vertex PA-26 (RC45-24) AC Adapter 24v/1.8A DC output For Yaesu NEW £20

Please **contact Howard** G4PFW at howardpalmer@sky.com or 01293-535002 (Answerphone)

COMMITTEE

Chairman .... Mike Davies............... G0KAD
Vice Chairman & QSL Manager... John Pitty.................... G4PEO
Hon. Secretary .... Phil Moore................. M0TZZ
Hon. Treasurer .... Alex Sheppard............ M1YAP
Hon. Newsletter Editor .... Richard Drinkwater.... G3ZIY
Committee Member .... Richard Hadfield........ G4ANN
Committee Member/Events Secretary ....Stewart Bryant G3YSX