74 !

THE KNIGHTS QRSS WINTER 2021 COMPENDIUM 4th edition

QRSS - enjoying life in the radio slow lane

Dedicated to the real QRP operators

QRSS

Knightly News

Probably the most important feature of 2021 has been that we have finally started a new solar cycle. We have seen so many false starts, and have experienced one of the longest and deepest solar minimums in living memory. I seriously started to wonder if I'd ever see a new solar cycle start again with some good sunspots !

We start off with a note about the 74! cover photo, provided to use by Pete M0PWX (Isle of Sheppy, in Kent,England) who has become a very keen QRSS'er this year. The cover photo shows one of Pete's fan dipoles that he uses for his QRSS and WSPR activities. I call it the Hog Weed antenna, since you can see that the local Hog Weed is almost as tall as the antenna. Pete's antenna's are that low above the ground. Pete also has another antenna for his WSPR, QRSS and QRSS grabbing activities that is even lower. Another "dipole of delight" attached to the fence panel !

2021 saw the UK, and possibly Europe's first 50Mhz QRSS beacon, brought to you by the Martello Radio Group in south eastern England. The group operates the G0PKT WSPR and QRSS beacons on the 30m, 10m and 6m bands. The 6m transmitter is 1 watt. It's early days yet in the world of QRSS for 6m. Not all countries have access to the band or have receiving equipment to devote to it.

However Bob G4IOG and Chris G0MQW rallied to the cause as ever and put up appropriate grabbers, as did Rad OK1FCX. Good reception from a DX of about 50-75 miles away was seen of the G0PKT beacon (50.294365 MHz), as well as some reception by Sporadic E by OK1FCX. Openings to OK1FCX typically lasted 10 – 20 minutes each and a distance of just over 600 miles. Rad OK1FCX uses a simple RTL receiver dongle and a Raspberry Pi as a 6m band receiver (and for many other QRSS bands too) and simple low height wire antennas. A simple video of a G0PKT <> OK1FCX opening on 6m can be seen here. (Click the link). The G0PKT 6m beacon is permanent, so please give it a go if you can.

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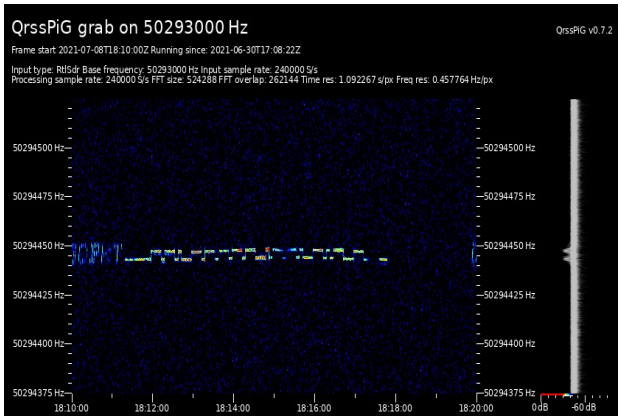
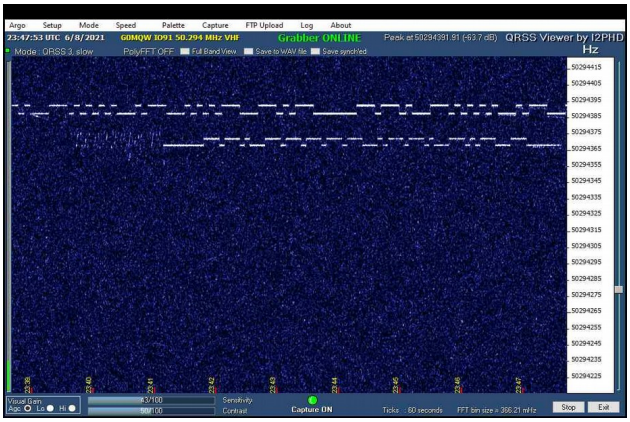
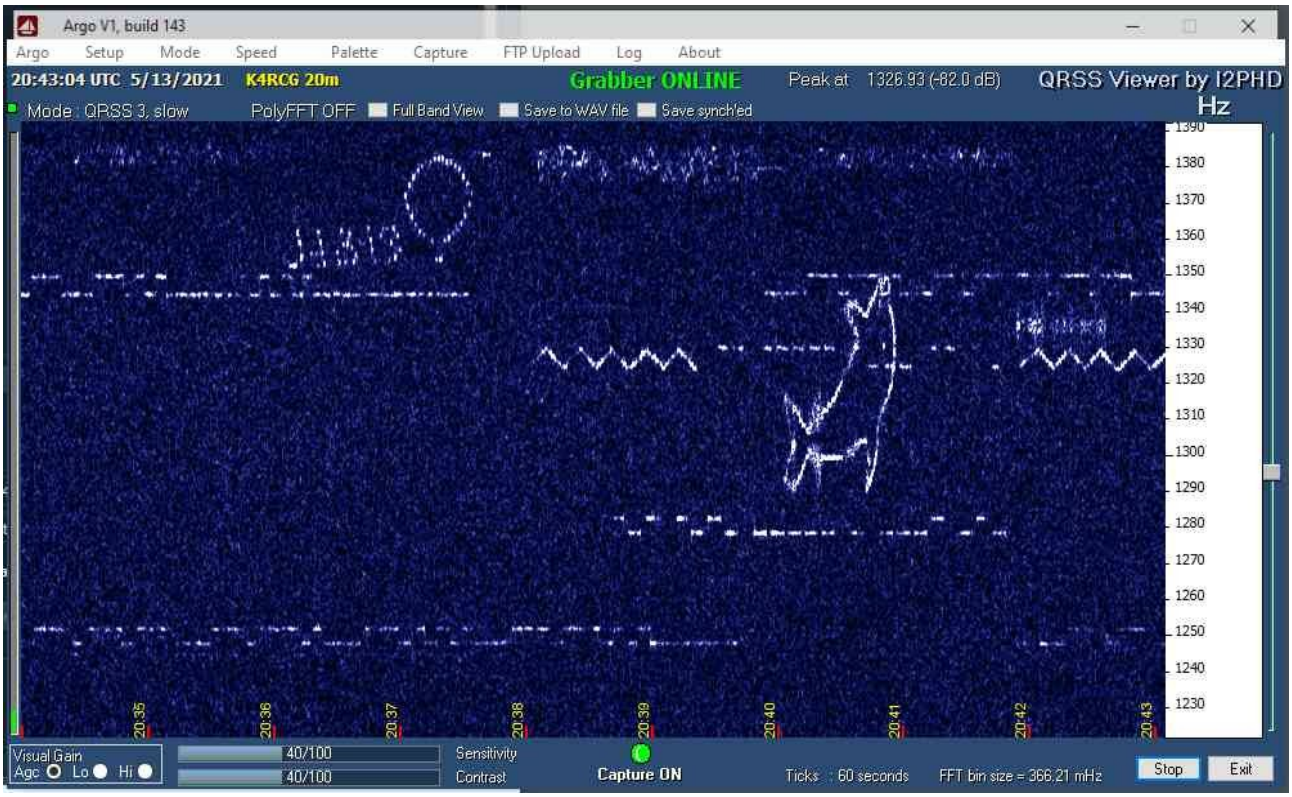
Below are some grabs of the 6m band G0PKT beacon. The first one is from Rad, OK1FCX. I made a small movie of the 6m opening here. The second grab is from G0MQW (75 miles DX). The 75 mile path over land from G0PKT to G0MQW is remarkably consistent, with only moderate fading. I've personally not observed any overwhelming evidence of meteorological effects yet, but that's just my view in my short time. Colin G6AVK can be seen on the G0MQW grabber too (about 75 miles).



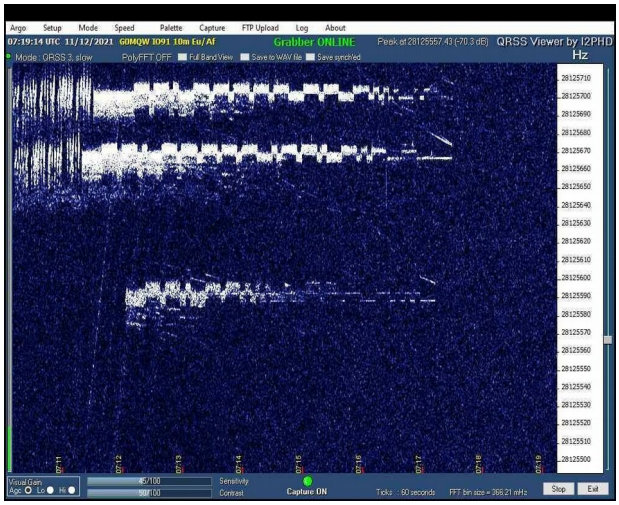


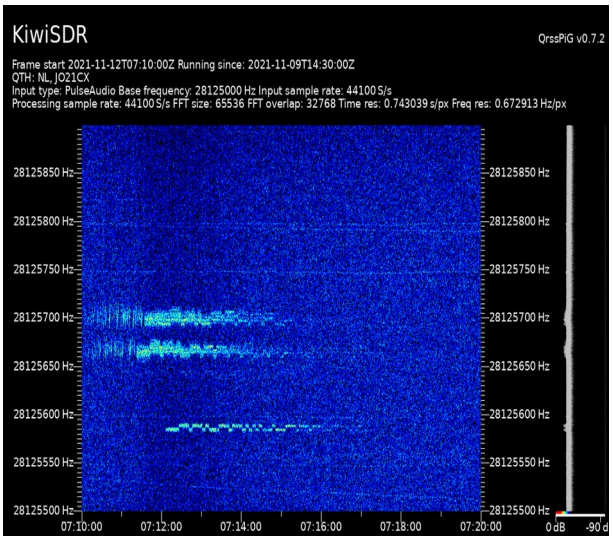
This year we have seen plenty of balloons featuring QRSS in their transmissions, and also had a new balloon gylph entrant from N1PPP in the form of transmitting the Dolphin glyph. Not sure why a dolphin was chosen and we have little information about the N1PPP launches. But at least it provided the grabber watchers with some extra entertainment. Here's a grab provided by K4RCG of the balloon on 20m.

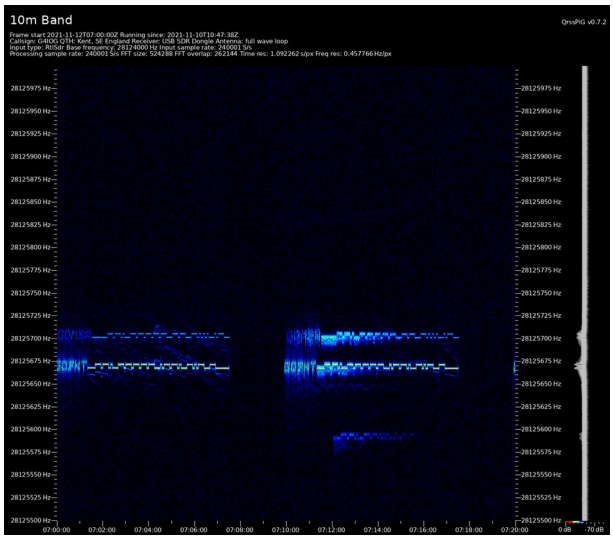


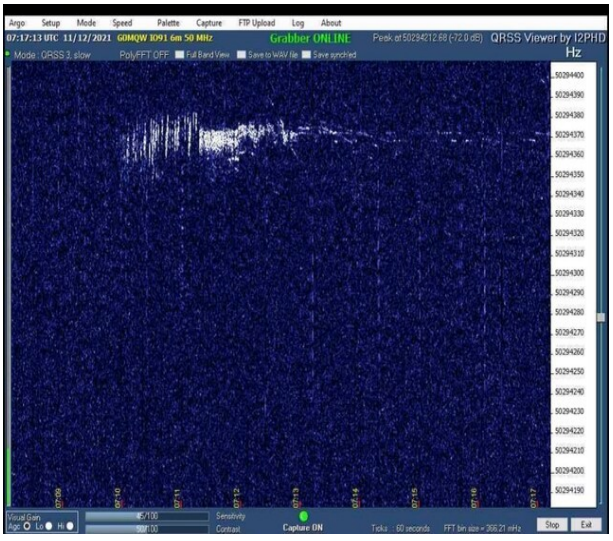
Knightly News

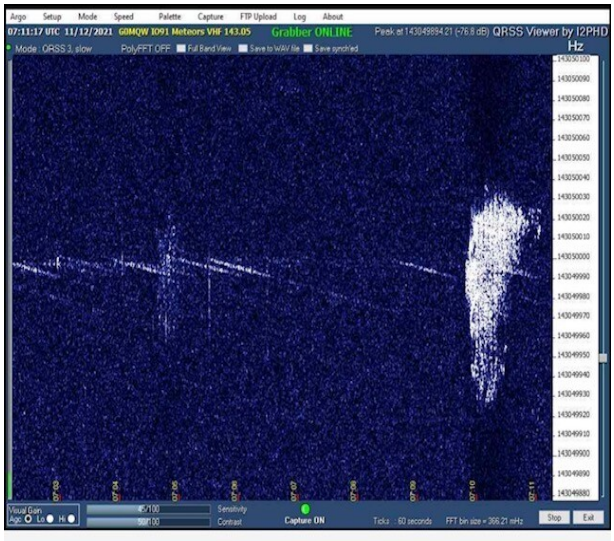
Meteor scatter. Well I must admit that I was going to say that I thought that this year's meteor scatter results from the various showers were pretty awful. But as I write this, the UK's "Sultans of Ping", G0MQW and G4IOG have just sent out some of the best meteor scatter pings of the year and a bonus from PA2ST using the excellent PE2BZ online RX resource. [12-NOV-2021]











Above are time synchronised grabs. First via G0MQW (28Mhz) of G0MBA / G0PKT and G7EOB (top right), followed by PA2BZ grabber of same stations (centre left), and the same three stations via G4IOG. Lower left shows the effect of the same meteor, but of the G0PKT 50MHz transmitter highly Dopplered and lower right shows the 143Mhz radar system in GRAVES (France).

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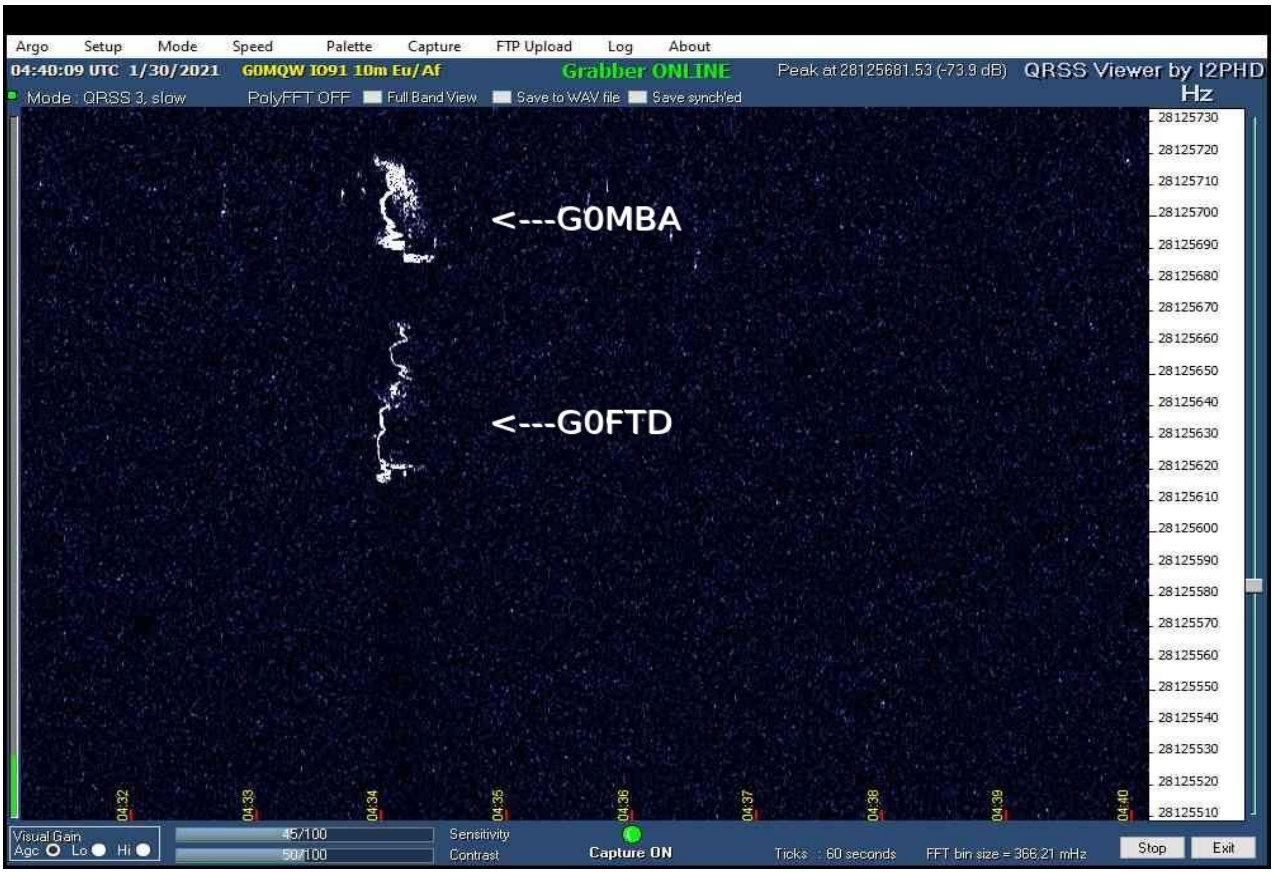
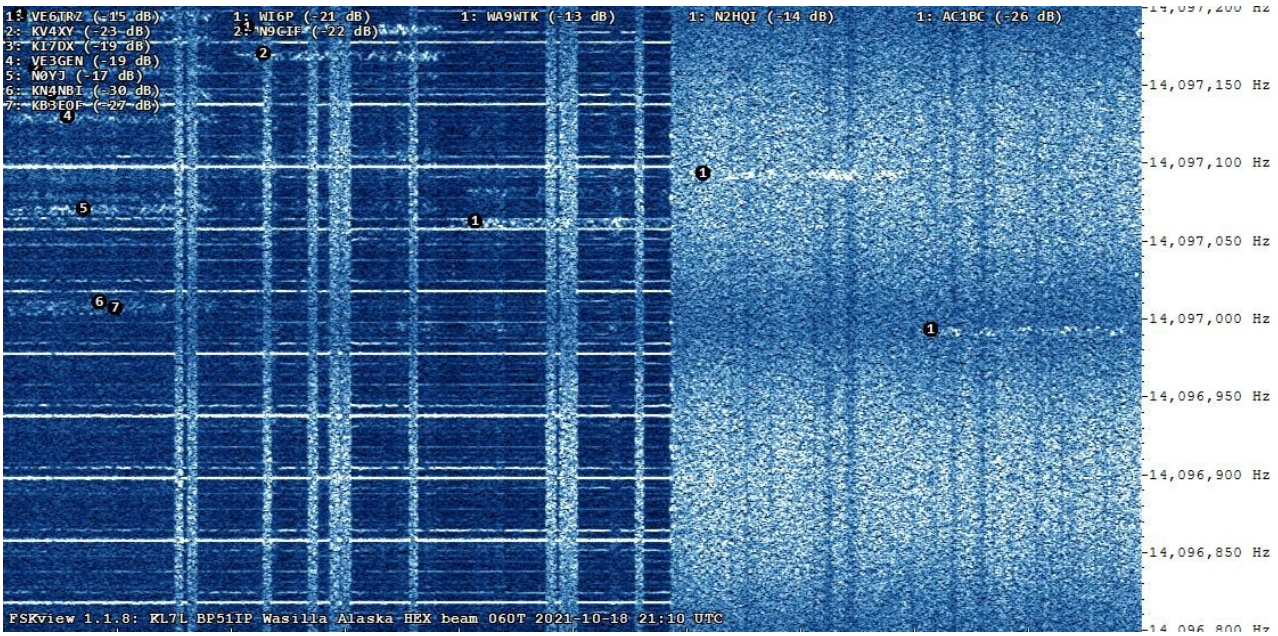
G0MQW managed to capture one unusual meteor scatter event as shown below on the 10m band. The grab shows a very highly Dopplered pair of signals from G0MBA and G0FTD. It is believed that these visual effects are usually associated with a meteor physically breaking up into small pieces, and the result is “long tails” or Epsilon style squiggles on the grabbers.



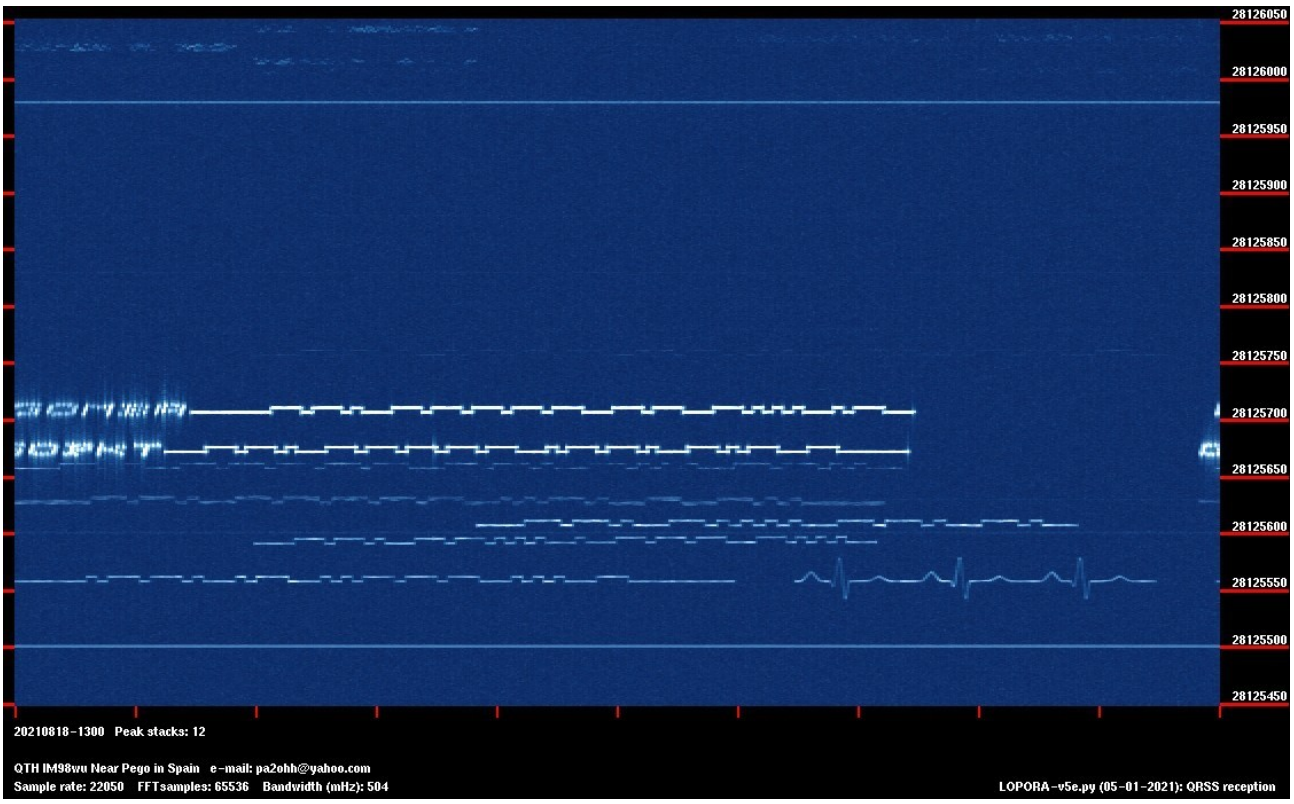
Intruders: In previous years we have seen quite a few oddities arrive on the amatuer radio bands, and they always seem to pick our WSPR / QRSS segments. In the past we have seen the Two / Three Line Oddity on 10Mhz with carriers spaced from memory exactly 2Hz apart, and plenty of Over the Horizon Radar Systems. There has also been The Pulse, which sends 1 second pules and if heard using the AM mode sound like a WWV transmission. They have also been heard in many other places in the HF spectrum. Things have been quiet recently but on the 20m band there has been what is believed to be a data modem, believed to be near Vladivostok.

It was seen pounding the KL7L grabber earlier in the year. When idle it looks like a bunch of carriers spaced out at about 45Hz. But when sending traffic (using sets of PSK carriers) it creates a blurry image on the grabber.

Below: an example grab is shown here with both idle and traffic modes evident. Note how the signal turns into what looks like two ribbon style noise bands.

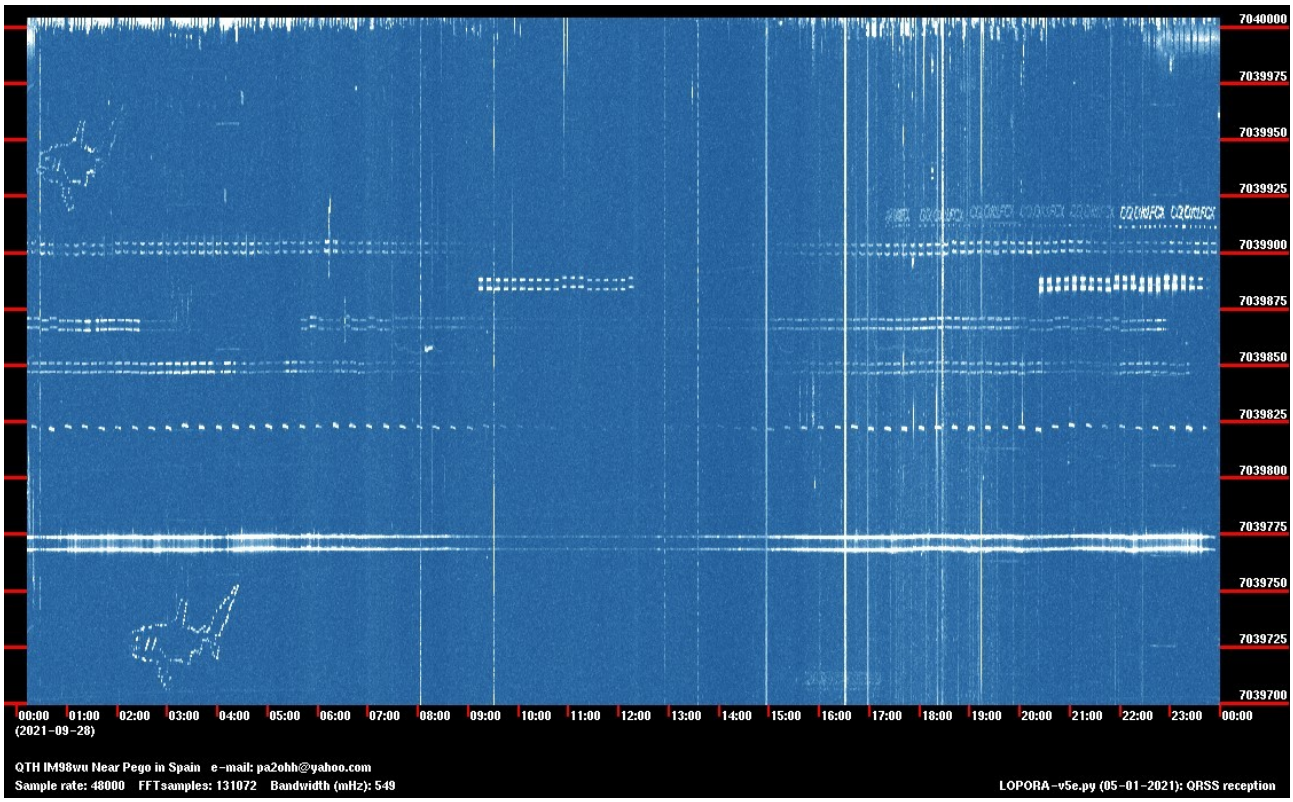


Funnies: Submitted by Onno PA2OHH (actually in southern Spain) are a couple of fun grabs. First one shows PA2ST's "Heartbeat" graphic as received on 10m. PA2ST was having fun programming up a two channel signal generator to produce this. The second is from Rad OK1FCX sending his sharks swimming about on the 40m.

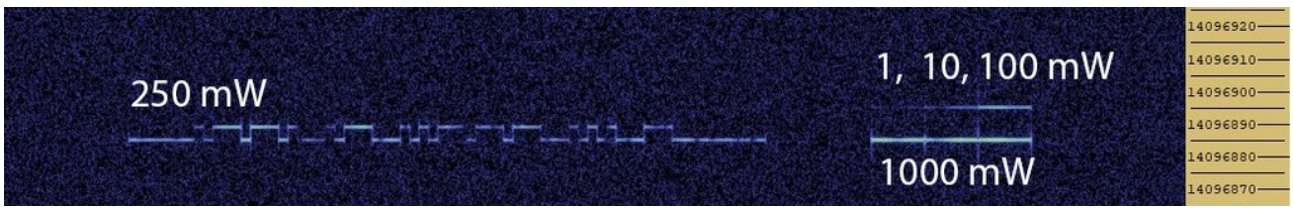


Expanded view of PA2ST's heartbeat.

And here is Rad OK1FCX turning 40m into an aquarium. (24 hour long grab).

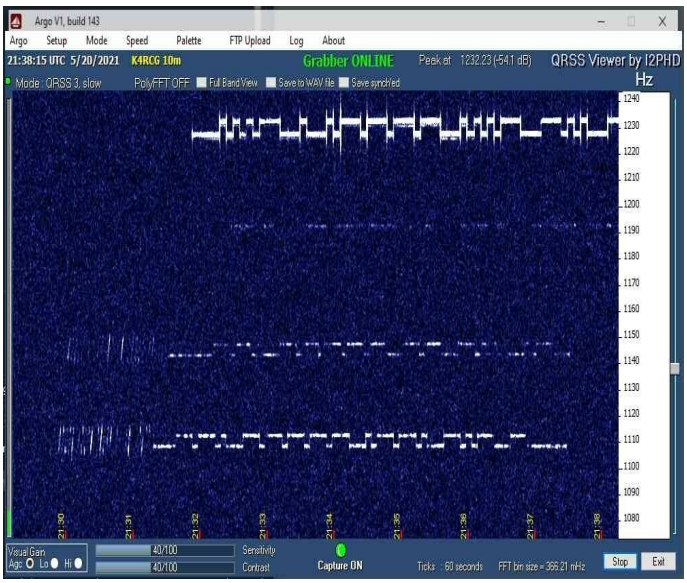


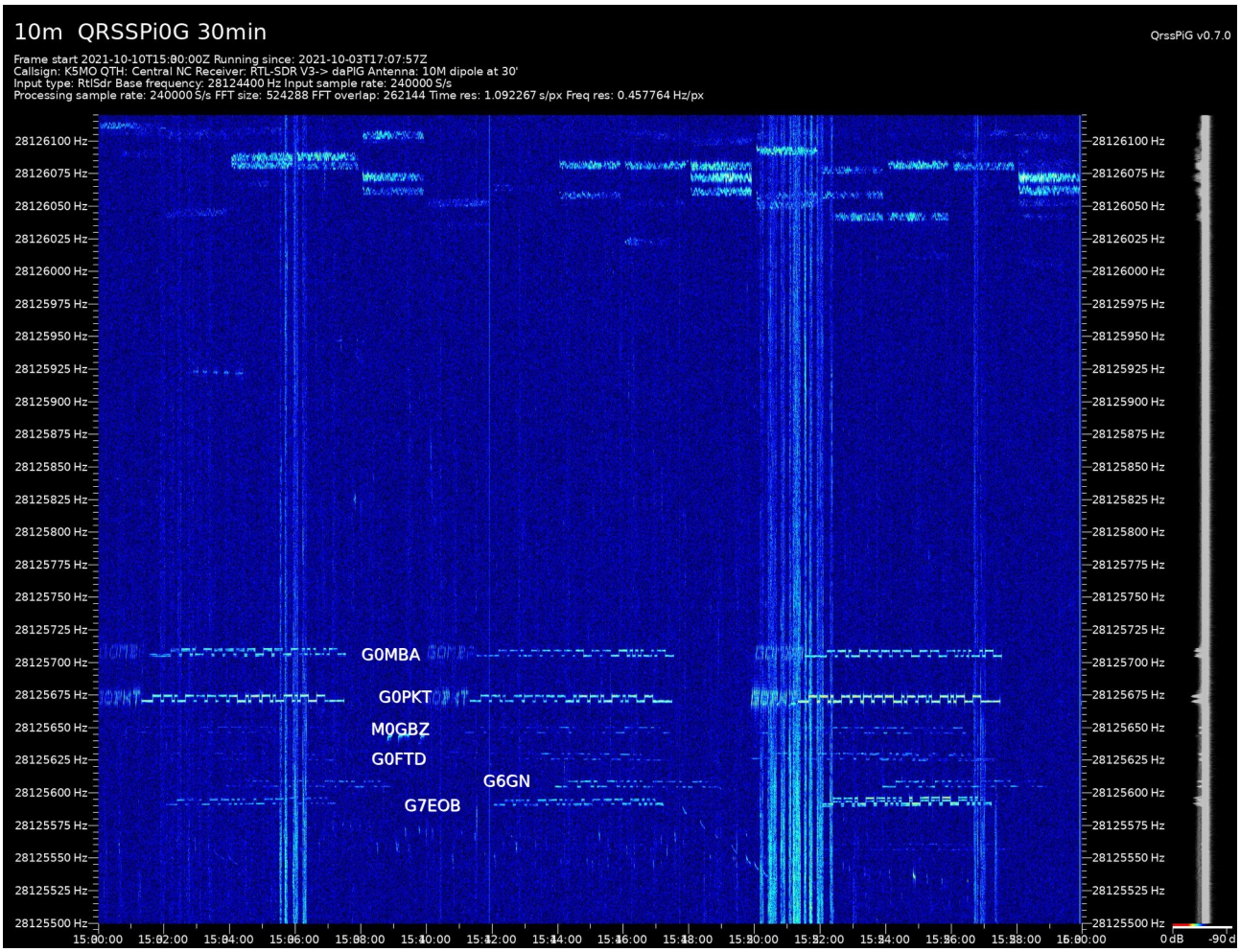
PA2ST's QRSS power test pattern: Ben also had some fun with his programmable signal generator so that he could see just what the difference in power levels would do in reality on a typical grabber. The results were enlightening and should provide an excellent reference for us all in the future as to how much power matters, or not ! Personally I feel that you need a minimum of 6db to 10db increase in power each time you want to make some sort of sensible signal upgrade on the trace. With QRSS, if you have 500mw then you already have enough ! But that's only my opinion.



A video showing the power levels in the real world, as received by SA6BSS can be seen here – (click the link). PA2OHH'S website also shows some simulated power levels, but using QRSS3 mode as opposed to Ben's QRSS6.

2021 gave us the first Solar Cycle 25 Transatlantic signals on 10m. To the left we see a grab from K4RCG showing VE1VDM, N8NJ, G0MBA and G0PKT. Below we have the results from K5MO's 10m grabber in North Carolina showing many UK signals too. If I remember correctly, VE1VDM was seen by EI7GL via multihop Sporadic E too, earlier in the year.

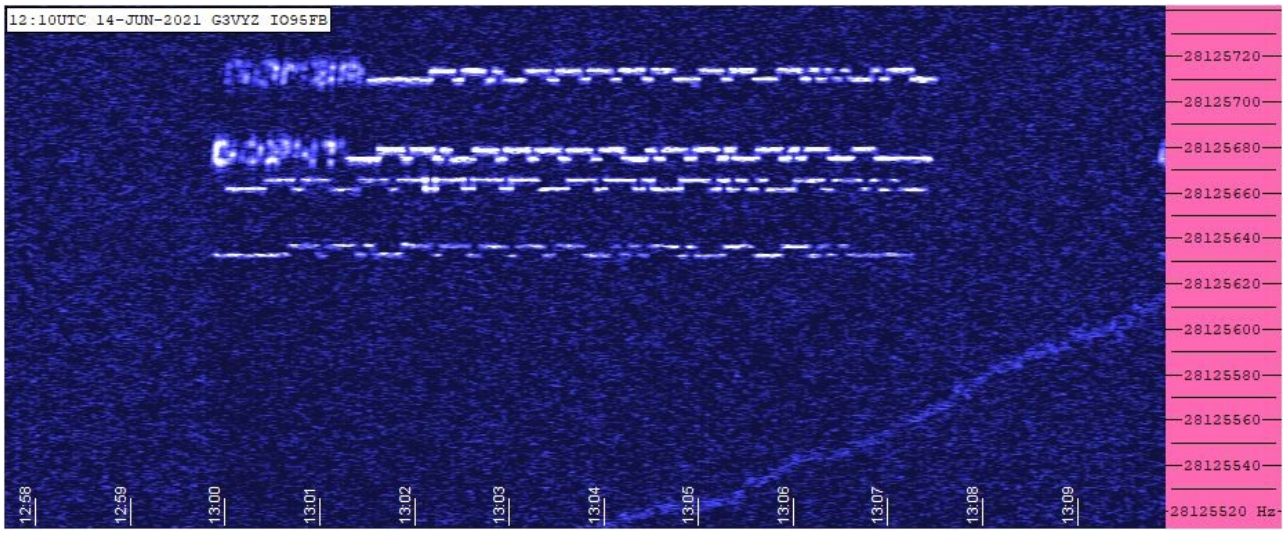


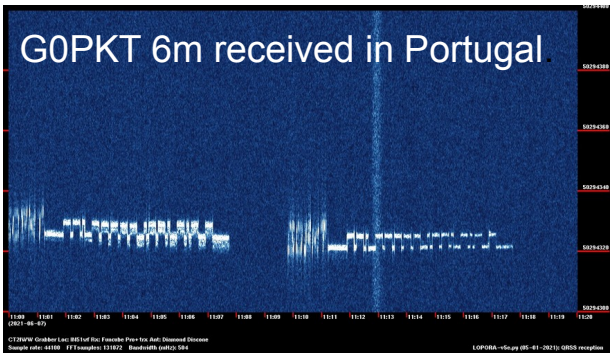


Enormous thanks to both John K5MO and "Captain" Bob K4RCG for being available on 10m. I know 10m is a hard band, and it's often difficult to devote 24/7 facilities to the band, but it's worth it in the end !

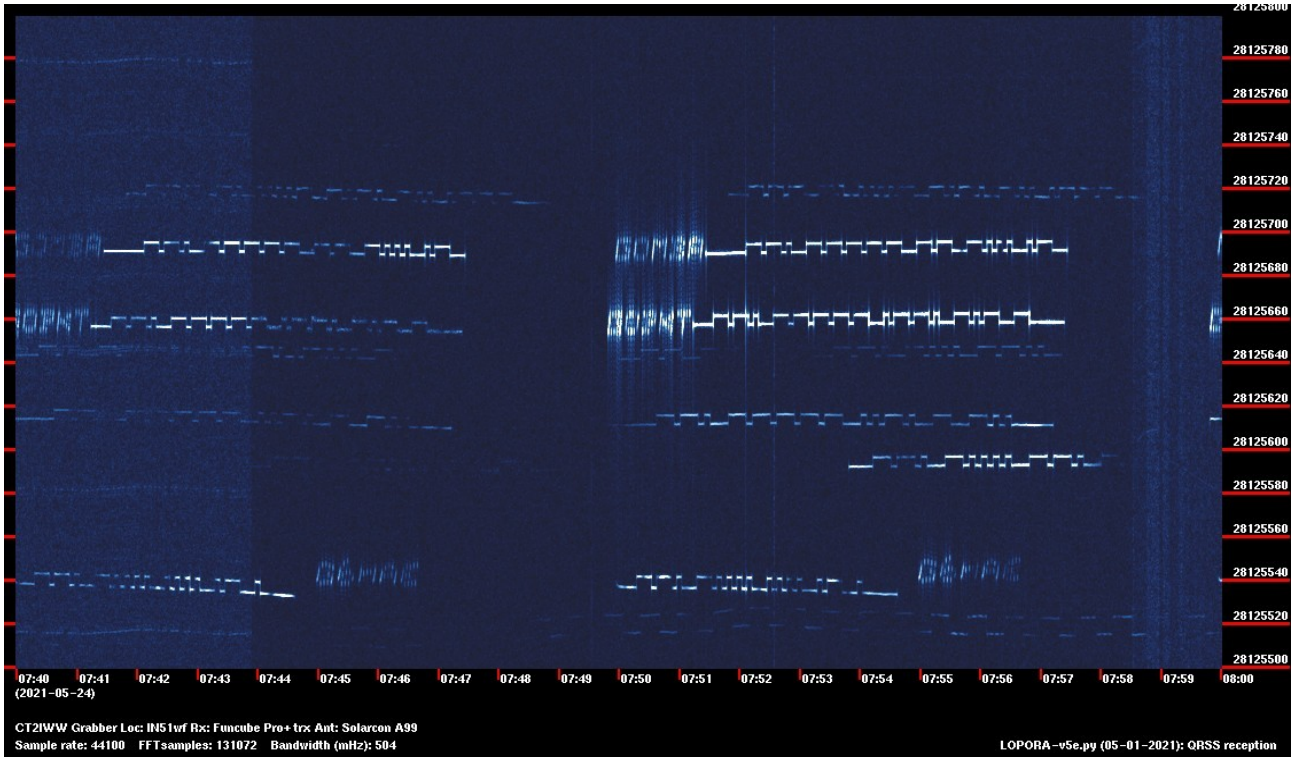
Knightly News

G3VYZ: On the 14th of June some good short skip Sporadic E was observed by Les G3VYZ. Here we see the “usual suspects” down in Kent and Essex in the S.E. corner of England making it up to Les about 300 miles away. G0MBA / G0PKT / M0GBZ and G0FTD can be seen.



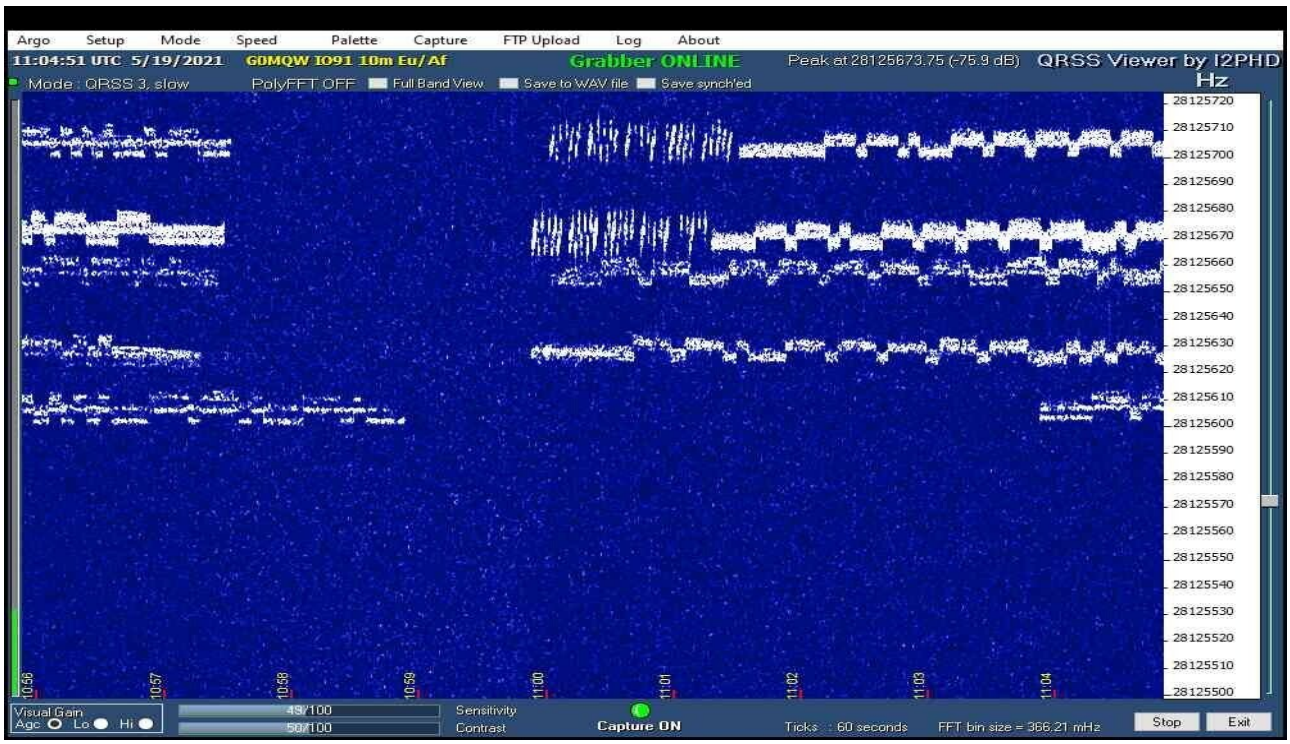


CT2IWW was active this season and managed to provide a capture of the G0PKT 6m beacon (left, with dongle drift), as well as a very nice group of stations on 10m, when using his RTL SDR dongle and a CB vertical. An unidentified square wave can be seen at the bottom.

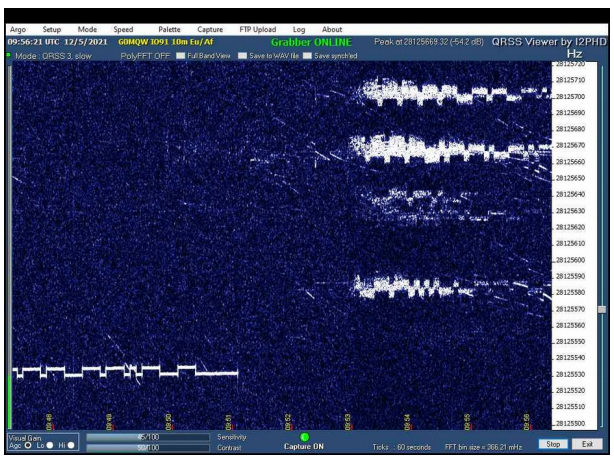


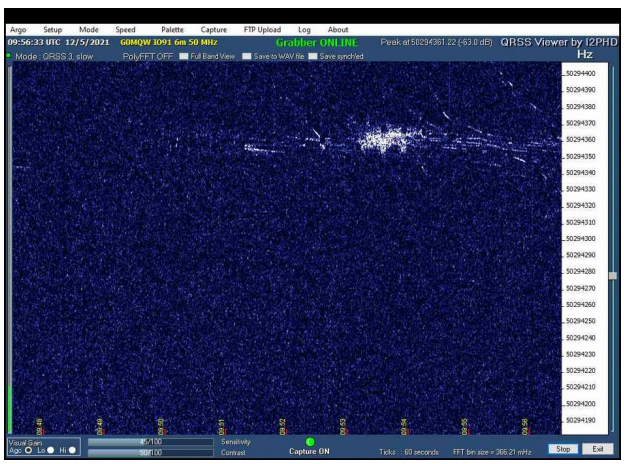
Knightly News

More short skip phenomena: 19th May 2021 all hell broke loose on 10m. It was the first day of the year that the 10m Sporadic E season had cracked open. In fact, I had been watching the date very closely since the 18th May 2020 was the day that exactly the same thing happened last year. **Will this magical date come again in 2022 ?** The snapshot below is highly unusual, since it shows the a group of stations in south eastern England appearing on the G0MQW grabber who are only 75 miles away, via extremely short skip E layer mode. Note the way that the signals have quite a bit of Doppler effect on them and appear quite wide and fuzzy.



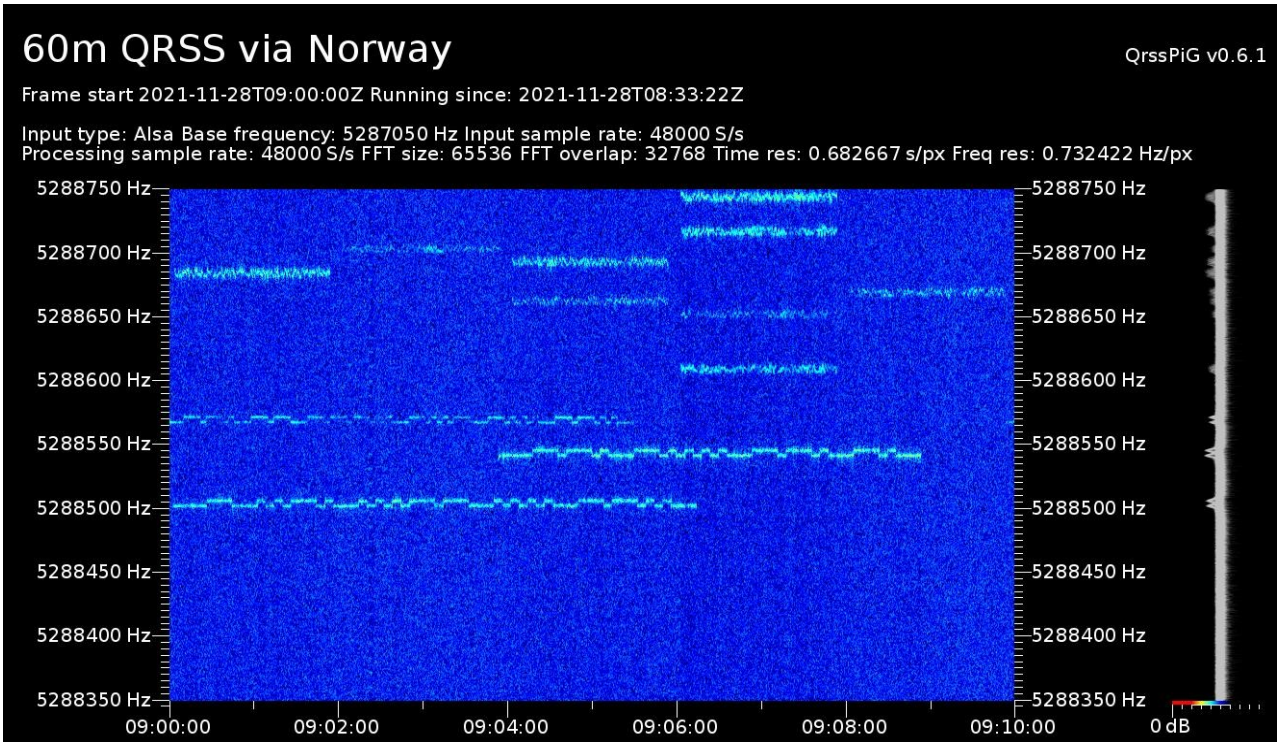
10m vs 6m meteor scatter comparison: Using the simultaneous grabbing facilities of G0MQW again, I was able to do some comparisons between both bands, when the same meteor entered the ionosphere. The results were that about 50% of the time, 6m would show a reflection that was shorter than the 10m band one. The grabs below are time synched. 10m (Left).



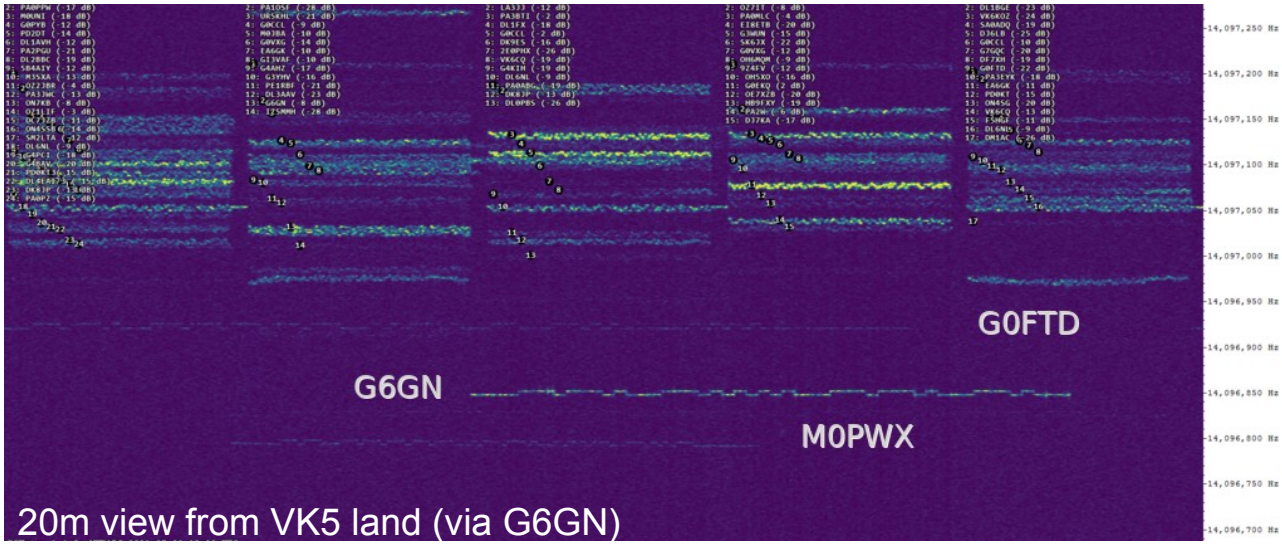


John Lutz N9JL has been busy with QRSS grabbing again this year. John uses indoor antennas for his grabber and is currently getting excellent results on several bands of interest, 1750m, 22m and 10m. I think John is the first person to go public with a 1750m band (186Khz) grabber ! In the US and Canada, the 1750m band is legal, and as old as the hills. Rules are 1w input and a 50ft antenna. That generally means an ERP of less than 1mw, that's QRPppp. Permitted frequency range is 160-190Khz. See https://en.wikipedia.org/wiki/LowFER Many licenced radio amateurs are active on both the Lowfer and Hifer bands too.

The 60m band: 60m has seen a fair amount of activity considering both the status of the band and the number of overall QRSS fans on the scene. The most consistent users have been GM8XBZ, G6GN, TF3HZ and M0BMN, although 'BMN has been missing for a few months at the time of writing (come back Paul !). Here we see a nice grabs of the first three users seen via Norway on a cold November morning.

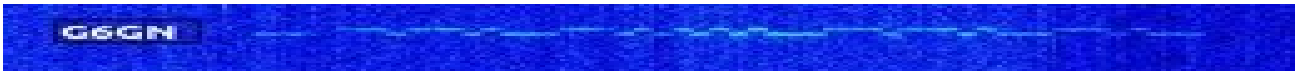


20m: 20m seems to be plodding along quite well these days. Activity is consistent from Europe and North America, and there's always plenty of balloon to see with the typically 10mw of output power. G6GN throughout the year has taken the time to try some remote monitoring on the band and has seen some surprising results. Mike sent me a nice grab via South Australia that shows his (always) excellent signal making it down under, and even G0FTD can be seen using nothing more than a simple wire loop wound around the bedroom walls ! M0PWX is in there too with his Fence antenna (as seen elsewhere in this issue). With results like this, it would be nice of we could regain the interest of the VK/ZL operators on QRSS again.



20m view from VK5 land (via G6GN)

Other bands: We have also seen tests on the 160m band this year, and once again Mike G6GN and DL6PB have been out there pushing the boundaries. Good results were seen of his signals via the G0FTD remote SDR grabber via Norway.



All in all, we have now seen QRSS activity around the world on all bands from the 1750m band, the 22m band, 6m and all HF bands. The only bands we have not seen any traditional QRSS activity is on the 136/475Khz bands. I have said in the past that the users of these bands seems to be a species of their own, and almost anti beacon-ists. Dave WA5DJJ gave up running grabbers on these bands too. Dave also sends us in his news and views of 2021 below. Dave writes -

Most of us have had our lives turned upside down many times this year with personal collisions with the COVID virus. I have personally lost close friends and the QRSS signals of KJ5R and KE5OFK. Many of my other signals on the grabber have been off and on due to effects of the COVID virus. On 40M NM7J (Las Vegas,) and NM5ER (Sparta, North Carolina) running 1 watt and 500mW respectively and both using a form of the END FED HALF WAVE appeared together on SA6BSS's 40M grabber in Sweden. I have a young Amateur Radio Operator KI5JXQ (14 years old) who really loves QRSS and WSPR. He usually runs his WSPR and QRSS on 40M and 20M. One day this last year he made it into SA6BSS's grabber. His station uses a home brewed End Fed Half Wave antenna mounted so the end is pointed directly into a 10,000 foot mountain to the east of his station makes it an almost sure assumption that his signal went out to the west. That was another instance when he was the only one there. Mikael sent him the screenshot by email and he has been very happy ever since.

So far, I have not had any CME reactions on the ionosphere on my SUPER GRABBER that I saw on the last solar cycle. One reason for that is most of the signals on my SUPER GRABBER are locally generated (within 100 Miles) and are not greatly affected by the changes in the upper ionosphere. But I keep watching for them to happen.

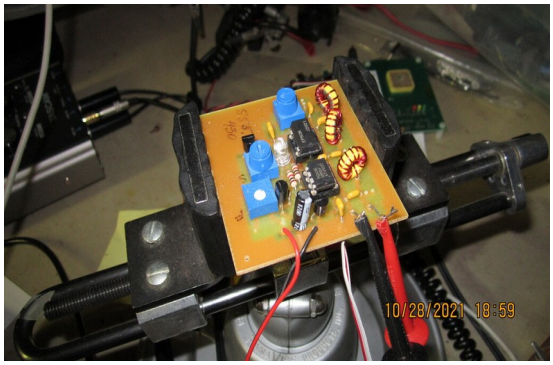
Hans Summers went to great lengths to add a FSKCW mode transmission software to the QCX firmware package. If you will update your software to version 1.07 You will see in as a beacon mode in the menu. My experiments have been by running the QCX, QCX+ and QCX-Mini on 8 volts DC that in the QRSS beacon mode your QCX will do a really good job of putting out about 1.25 Watts on any band between 80M and 17M on a stock unit. It works really well makes it really easy to operate QRSS on one band. By running them on 8VDC, I have NEVER blown a final amplifier on a original QCX transceiver. You also do not need a GPS module or any other accessory to make QRSS transmissions happen. Thank you Hans for trying to help the QRSS community out by adding thousands of transmitters that are capable of operating on this mode.

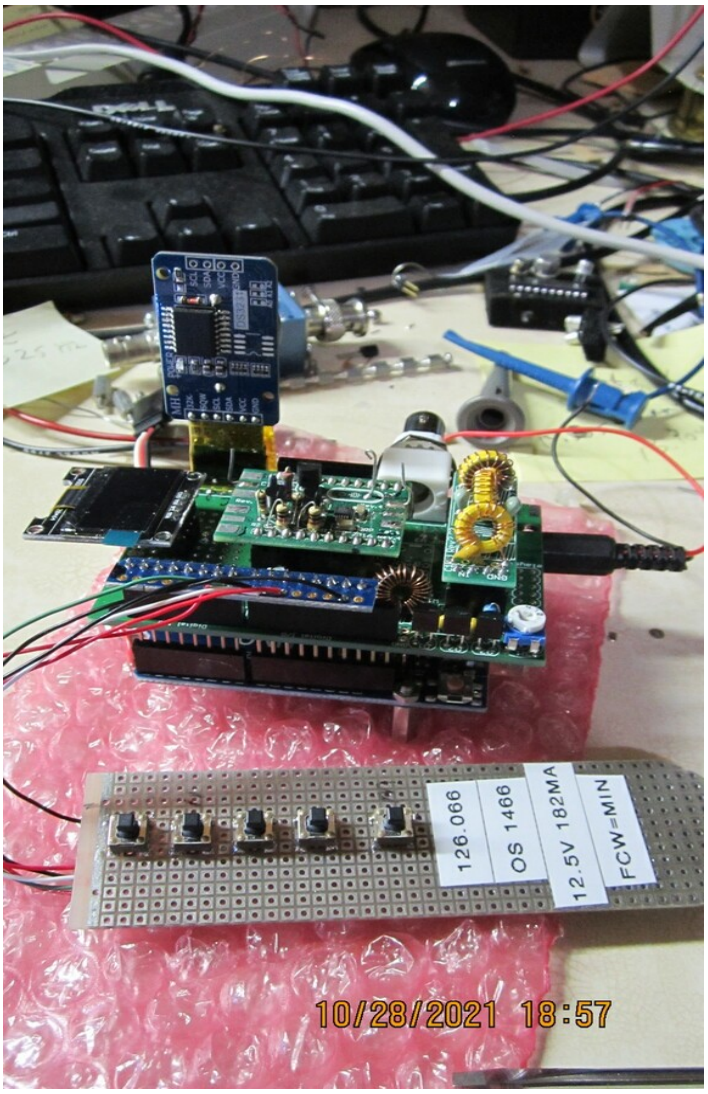
I would like to wish all of the KNIGHTS OF THE QRSS a very Merry Christmas and hopefully a much better New Year. Keep expanding your QRSS capabilities and operations. Encourage your friends to do the same. Speak about your QRSS experiences at your club meetings. Encourage others to investigate the mysteries of Radio Wave Propagation. QRSS is a really fun and educational way to do that.

Dave is also hoping to construct a transmitter in a box and place it down the end of a garden, with the antenna coming directly out of the box, and then feeding the system with a remote PSU at his sons home.

WA1EDJ - 22m Hifer band sent the following: Here's a few pictures of my 22m equipment. One of them is a QRPLabs /Arduino based with Si5351a synth. It's QRSS and runs Hans's G0UPL stock code to control the Si5351a. Currently QRV 22m, 13.555.385 Mhz signing EDJ at about 5mW. The one with the RTC module sitting vertical is a W3PM design WSPR TX. Uses a DS3231S RTC for stand alone timing. Arduino based. No GPS . Good for weeks. I run it on 22m WSPR or 10m.

Also have an N4LTA designed QRSS TX. Uses Epson based Osc. Not currently on air. All of these rigs feed a vert. GP type home brew antenna about 10 feet off ground via 100 foot of coax. **Below:** a selection of WA1EDJ's Hifer band rigs.





Late in 2021 comes news of a handy utility from PA2OHH. Ever wanted a quick grabber to view signals? Now you can feed audio to any web browser and see them regardless of OS. Windows, Android, Linux, Mac OS, just use the browser. Ensure that the security settings allow the browser access to the mic input or soundcard and away you go. It can be found at https://www.qsl.net/pa2ohh/litopo1.htm

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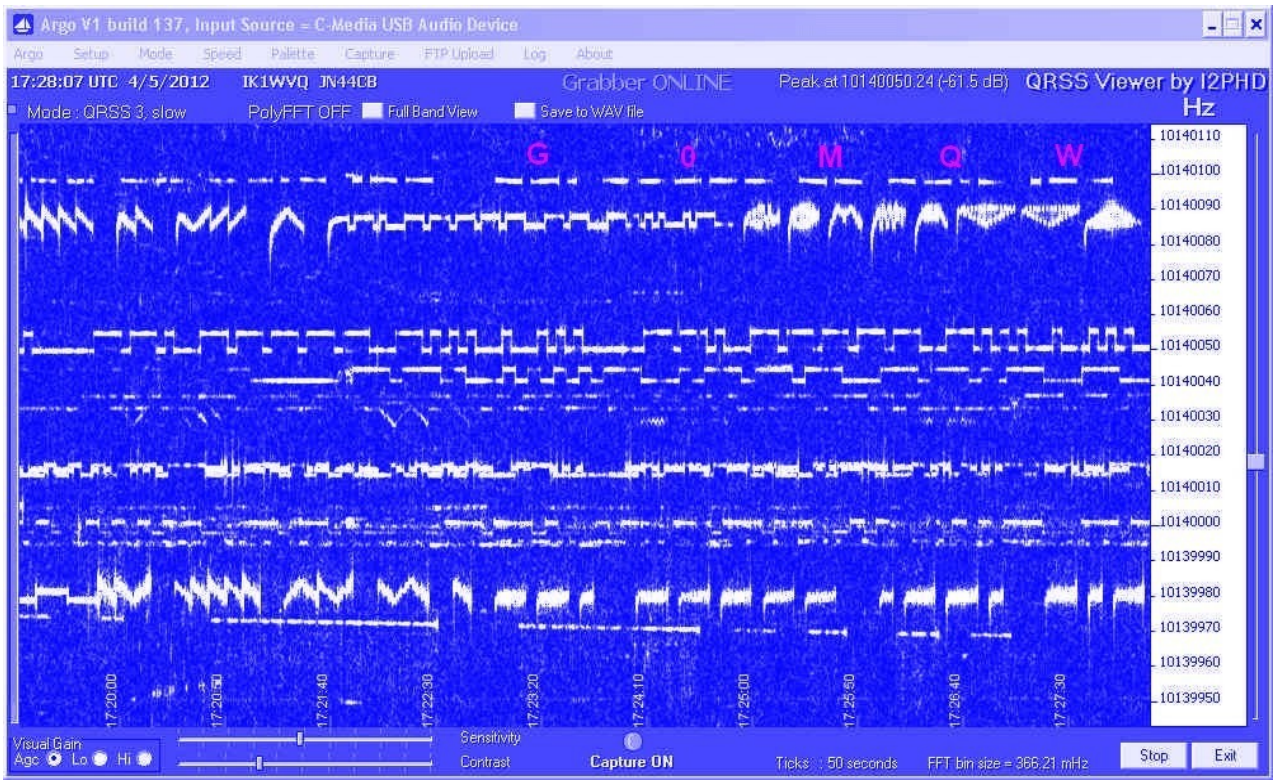
74 de Andy G0FTD

The Men Behind The Grabbers.

A chance to see news and notes from KL7L, G0MQW and M0BMN.

G0MQW – Left, shown on a recent visit to the Ross Revenge, Radio Caroline ex-pirate radio ship. My first entry to the QRSS world was with a crystal-controlled 30m kit from Kanga. I found out later that it was a clone of a G0UPL design, but it gave me the bug. I spotted myself on the sadly defunct Italian grabber of, as I drifted around 30m. I opted for plain dashes and dots as the FSK just exposed the frequency excursions. [The grab below shows the G0MQW first copy via Italy. The 30m band was very busy too!]

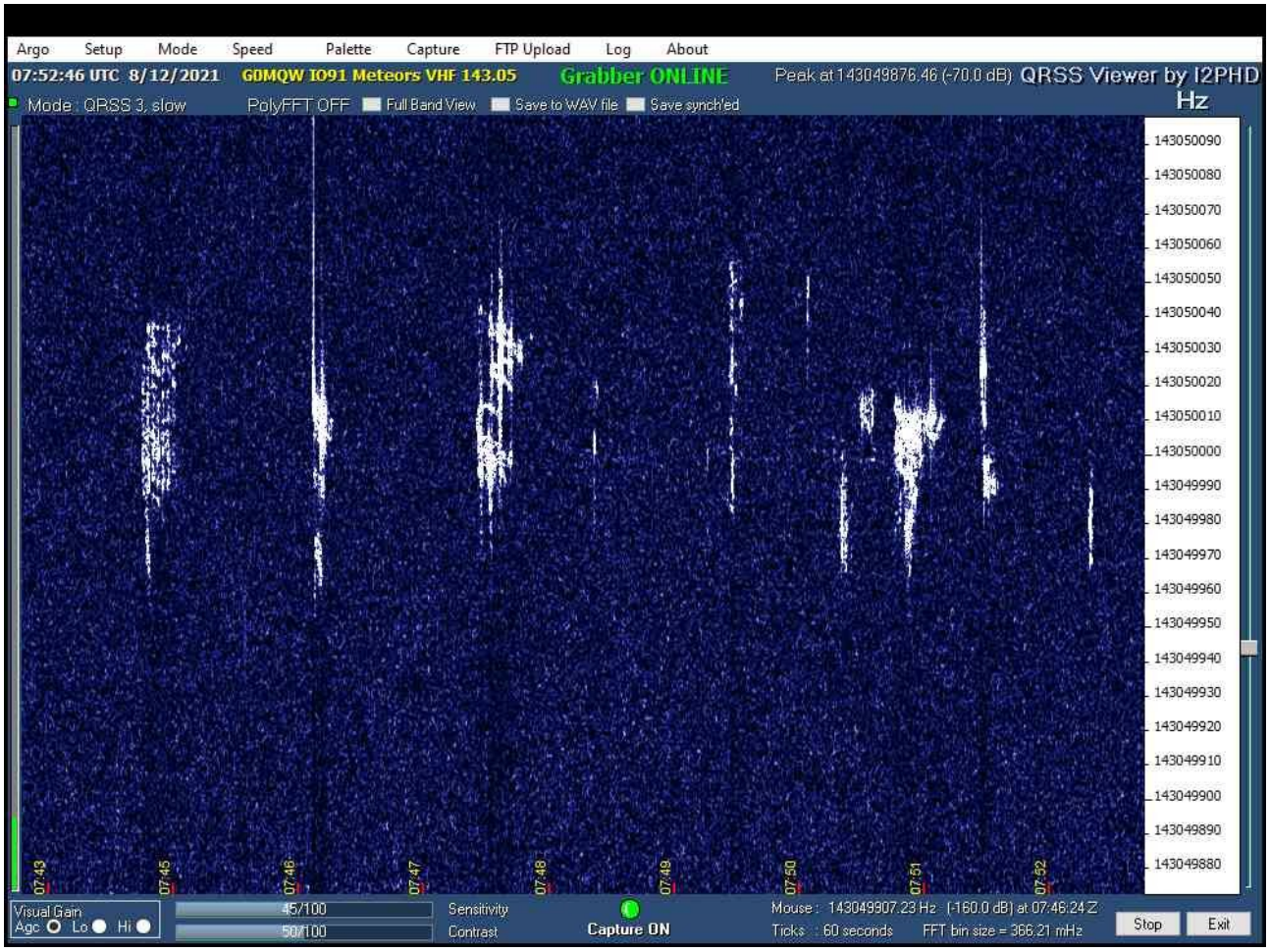


I started grabbing on 30m, once I realised how easy it was to do and that it would use receivers which were otherwise standing gathering dust. I've never been much of a transmitting radio amateur, which probably stems from 30 years working for BBC Monitoring at Caversham. As the number of 30m grabbers increased I decided to cover a band that had fewer grabbers, where I could make a more significant contribution. And so my 10m grabber was born down at 28000.800 kHz.

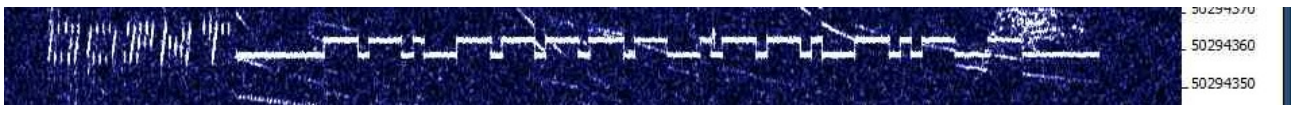
As time has passed I've added more grabbers, adding the new international 10m QRSS segment above the European one, a grab of the GRAVES Space radar on 143.05 MHz for sometimes part-corroboration and comparison of meteor reflections.

GRAVES beams up and south and doesn't show meteors entering to my east or north, but there are some which match on 10m and 2m. I have experimented with other 10m beacons and the Belgian Meteor Network just below 6m. There is also a new UK-based meteor beacon planned. Based in the South of England, and based on the tests I've observed, it's probably going to be too strong at my QTH to be of much assistance in meteor spotting, but I will assess it once it is operational.

Shown below are some typical GRAVES 143Mhz radar pings via meteor scatter.



The latest grabber that I have established, now that G0PKT has commenced parallel QRSS operations, is on 6m and that's been very interesting. I see it every day in some form, but meteor reflections are much better observed via 10m. Below – typical G0PKT reception from 75 miles away on the 6m band.



Antennas

I decided that a separate antenna was required for the 10m grabber to use exclusively and I built a J-Pole along the lines of a Slim Jim, using a 10m tall extendable SOTA pole with guying. I was rather pleased with the apparent gain and I could “see” G0PKT for quite a part of many days and I was intrigued by what were clearly aircraft reflections and meteor “pings” - except the pings sometimes lasted minutes as ionised patches of the ionosphere gradually decay but reflected the signals from the East coast of England.

That involved some juggling of antennas and so I found that the ¾ wave 10m J-pole vertical is a very effective 6m antenna, 1 ¼ waves I think, so I’m leaving it alone. The Butternut HF9V 160m-10m is on the two 10m grabbers and 10m WSPR and with its improved ground radial system and a lower noise location as far away from all buildings as possible, does really a good job. It is screened to the West to the Americas unfortunately, but I like the trees that do tend to compromise signals from that direction. A 6m dipole serves for the GRAVES signals and is better than a 2m dipole, I think all the lobes are a bonus.

There is definitely less RF noise in my garden on 10m than there used to be. Plasma TV sets have all been replaced and the ADSL signals seem less prevalent. So, for an urban environment about ½ miles from the countryside, I’m grateful for that. But please don’t ask me to grab 80m or 160m, as it’s too noisy to operate without using antenna noise phasing.

I do have other antennas in the back garden; a full-wave 40m Delta Loop, which can be disconnected at one end for a 160m ½ wave or strapped together for an 80m ¼ wave. There is also a Wellbroook 1530 active loop.

Computers: I’ve stuck with Windows XP and then 7 and 10, as I shall never be a Linux or Raspberry Pi person. This does mean the occasional new laptop, unwanted Microsoft update, random audio sound card swapping and crashes, but generally it’s been easy enough to operate. The Box archive is of course in the cloud and sometimes it bridges any FTP upload gaps, if the saving of files survived the hiatus.

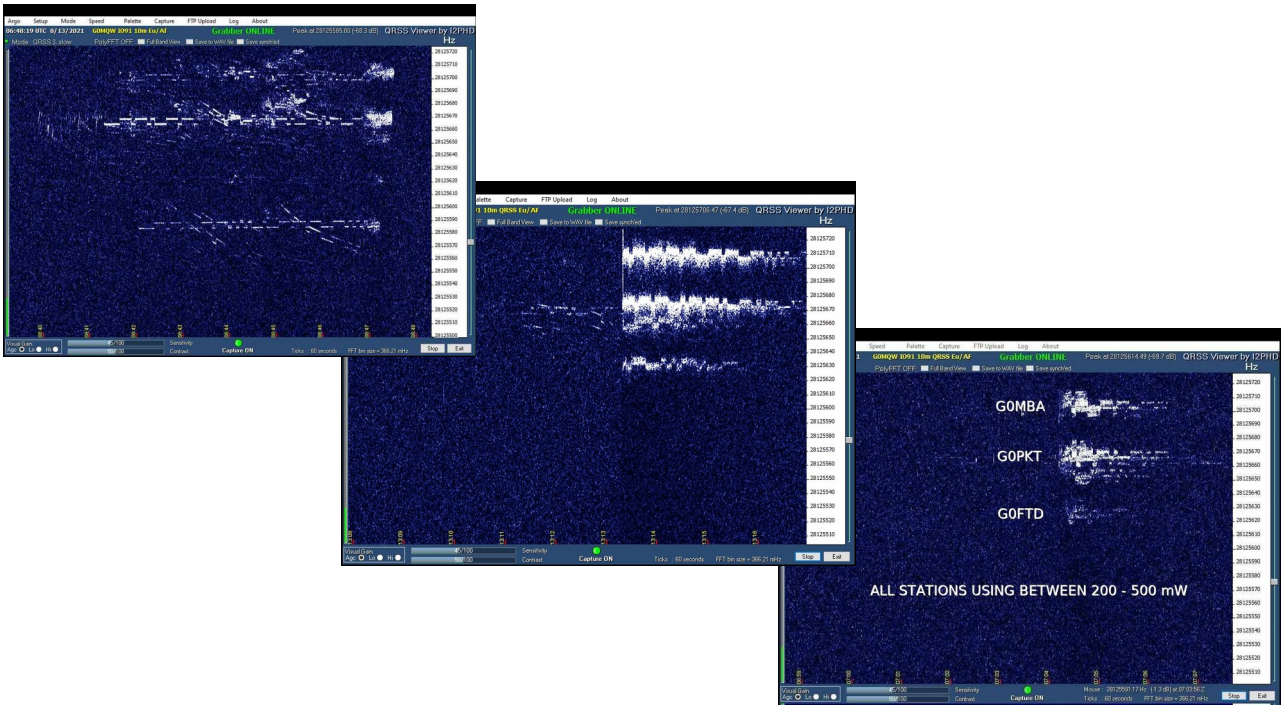
The computer I use is a £70 second-hand ASUS with a 32Gb SSD. It squeezes in Windows and enough room for my grabs, it operates without a fan and is pretty reliable. The Argo software is very reliable. I keep them closely in sync and the computer timing updates regularly. It’s easy to save a profile for the four grabbers, but the different soundcards aren’t stored. Occasionally I’ll put the wrong receiver and soundcard to a grabber.

The Men Behind The Grabbers.

The trick with 10m QRSS and VHF reflections is to be consistently monitoring and saving grabs. Despite being semi-retired, I have a busy life and I often don't have time to review all the grabs, but during the main meteor showers I keep a closer eye on events. I did experiment with recording the sound files to hear some of the bigger reflective events, but frankly one noisy ringing/wail is much like another. It's the visuals which tell us more. As 10m improves with the sunspot cycle, I'm hoping for more QRSS operators on 10m from the rest of the world (RoW).

Experiments: I run three soundcards which feed four grabbers and 10m WSPR. The three receivers are a TS-2000, IC-703 and FT-817. The later receiver has been a surprise, it's fairly stable and sensitive. That said, I did experiment with a £3 eBay 40m Pixie transceiver re-crystalled for 30m and it was surprisingly good for QRSS reception, once I'd worked out the offset and used an ATU to reduce 41m broadcast signals. I have tried an SDR; a FunCube Sat Pro+ dongle, but it wasn't reliable enough using Windows for continuous grabbing. Some quirk of it or its integral soundcard or Windows produced multiple offset images of single transmissions after a few days. I do have an RSPL1A, but haven't added it to the grabber collection yet. That will need a separate installation and another band to monitor, it's also quite reliant on a fast machine for the heavy processing load.

I've attached some previous meteor scatter grabs which just prove the value of monitoring 24/7/365. I'm proud of them and with the help of Andy G0FTD who spots breaks in service, or events of note I can keep the show on the road. It's my contribution to the hobby and has definitely proven just how many different sorts of propagation can be seen on 10m.



News from Laurence KL7L ..

So overall this past year has been pretty good on 20m globally - I tend to leave the Hex beam pointing around 045-060 deg which given its wide beam width covers both Eu over the Pole and the East coast. I do turn it to the Western Pacific, typically later in the Alaskan afternoon to catch incoming beacon Glyphs from the likes of VE3KCL/OCL balloons coming in from Asia.

Typically, these small beacons aloft cover around 50% of the globe or more as seen from here - rougher coverage is from East Europe, European and Asiatic Russia till around Mongolia when visual signals return till they typically exit the Americas - Many have loitered at very high latitudes for weeks at a time.

WSPR and visual QRSS have been very interesting to watch with G6GN signal typically the strongest from Eu, having taken up the baton from G0PKT who now isn't seen so much on 20 or 30m.

Spectrum spread due to Auroral conditions can spoil ID at times but can produce up to 20Hz deviation making it nigh impossible to decode unless you can average out the spread and know where the tx station should be, TF3HZ in Iceland is often loud but Aurorally "wide".

In my mornings you'll often see many signals on WSPR via QRSS Plus from me but no decodes - this is just the Aurora doing its thing - and it doesn't take much to cause this at all, even quiet conditions can produce too much spread.

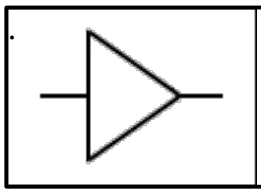
The Men Behind The Grabbers.

30 and 40m have been affected by increasing local noise from a "growing" neighborhood even here in Alaska - and some changes to the doublet lengths to put a strong null in those directions have worked to some degree. As I swing the Hex beam (shown right) into the line of houses along my road the noise level goes up by 6dB at 14MHz. Afternoon QRM from Russia and China has also been a newer issue from Springtime with very strong wideband data on 20m - they come and go but it makes an awful mess as given my location on hop count they are S9+ ! 40m is pretty bad at this time with strong radar or even worse an RTTY contest. All the best from Alaska - new snow dump of nearly 12 inches overnight going to make an interesting commute.

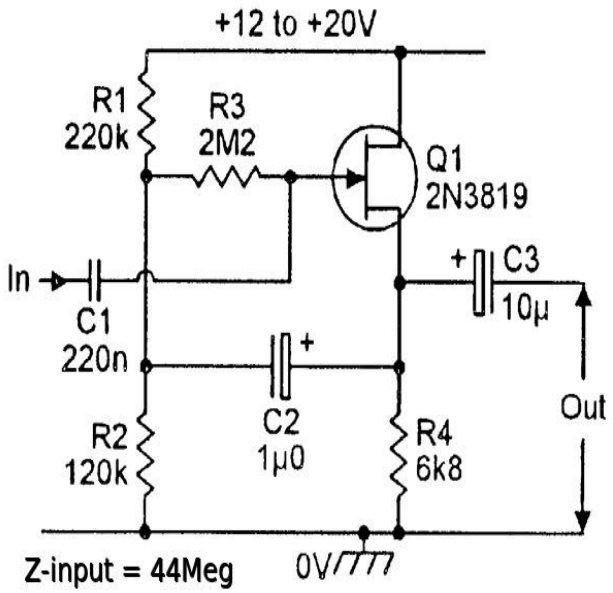
And Photographic evidence of Paul M0BMN !

And now, we have photographic evidence of Paul M0BMN. Paul is often seen on the 30m and 20m bands with his characteristic “worm” as he calls it at the beginning and end of his QRSS transmission. (I always think of it as the old style resistor symbol).

Paul does both transmitting and occasionally some grabbing of QRSS signals, and is now also running kit business called Phoenix Kits - https://www.phoenixkitsonline.co.uk/ that caters for the traditional radio kit builders.



A potentially useful LF pre-amp.



Some 20 years ago (or more) I required a pre-amp for developing mobile antennas and receiving systems in the automotive field. One of the constraints was that the antenna had to be no more than a 1 metre long rod or equivalent. I believe that this is the version that I used. The input impedance was much higher than well known designs and gave better results. For anyone trying to receive from about 100Khz to about 6Mhz then this could be the pre-amp for you.

The 22m HIFER band.
An Introduction by John K5MO.

License free QRSS: There's a slice of the spectrum available to everyone in the US where regardless of having a ham license or not, one can experiment with the various flavors of ultra-low power communication.

The FCC has benevolently allowed experimenters to make use of the Industrial, Scientific and Medical (ISM) band that's conveniently located in a very sweet spot of the shortwave spectrum just below the 20m band.

13.553-13.567Mhz is not only used by smart cards, industrial heaters, sealers, and NFC readers, but can also be used by anyone in the US subject to specific very low power limits. The band is 14Khz wide, Hifers only operate in a small portion.

Thankfully, very low power limits are perfect for low bandwidth, high efficiency communication modes such as WSPR, QRSS and to a lesser degree CW. As a result, there's a growing community of folks taking advantage of these challenges to both transmit and receive signals in this band using all of those modes!

Thankfully, very low power limits are perfect for low bandwidth, high efficiency communication modes such as WSPR, QRSS and to a lesser degree CW. As a result, there's a growing community of folks taking advantage of these challenges to both transmit and receive signals in this band using all of those modes!

The pertinent limit in the FCC power limitation is thoughtfully and practically given as 15,848 uV/m measured at a specific distance. Note that, while this seems like a useful objective limit, it's virtually impossible under real conditions to actually make an accurate, reproduce able measurement such as this. W1TAG* and others have estimated that here on Planet Earth, that translates into about 2 mW into a 1/4 wave vertical, or 5 mW into a halfwave dipole. Link - http://www.w1tag.com/Hifer2.pdf

Now, we have a measurement that's actually practical to use. Calculate your estimated feedline loss at 13.5Mhz adjust your transmit power upward to compensate for feedline loss. Alternately measure voltage across a resistor at the end of your feedline and calculate the power delivered to the antenna, and you've done your due diligence. Should the FCC show up in their van wanting to quibble about a few 10's of uV/m from the pipsqueak signal coming from your back yard, you've likely got bigger issues at hand! Needless to say, with good faith efforts to comply with the unmeasurable limit there's zero risk of running afoul of the bureaucrats.

One of the things that makes operating a transmitter here so attractive, is the simplicity of the equipment needed. For CW, simple beacons using a few logic gates configured as an oscillator will do the job. Epson makes a programmable oscillator that is quite easily implemented as a transmitter for this band.

Silicon Labs makes a remarkable programmable oscillator chip that is instantly frequency agile and very inexpensive both as a discrete device and a small development board. If one is interested in cobbling up software (or copying available software off the web) to control this device (Si5351) more complex modulation schemes such as frequency shifted QRSS or WSPR are straightforward to implement.

You get on-the fly adjustment of both frequency and power out with this device, with nothing more than a $2 Arduino Nano and 5 wires to interconnect the two. Add a low pass filter and you're on the air with a transmitter capable of anything from CW to WSPR thru use of "sketches" available on line. Total cost should be less than 20$.

My abililty to program in C resembles a monkey operating a piano. Even sit it was possible to fairly quickly modify a program used to generate a CW beacon to produce multi-frequency QRSS signals. Once done power, frequency shift and nominal transmit frequency and "message" are all changeable with a few keystrokes. (I do have some code to share if you contact me). So...that leaves the question of listening. Who hears these things anyway?

There's a few answers to that, most of which are likely familiar to QRSS operators. There's grabbers out there that upload 22m frames to QRSSPlus. WA5DJJ has 24/7 22m band grabbers active, and occasionally so does N9JL. Overseas, Andy (G0FTD) frequently parks his Grab-O-Matic to the output of various Kiwis around the world and shares them via the Knights mailing list.

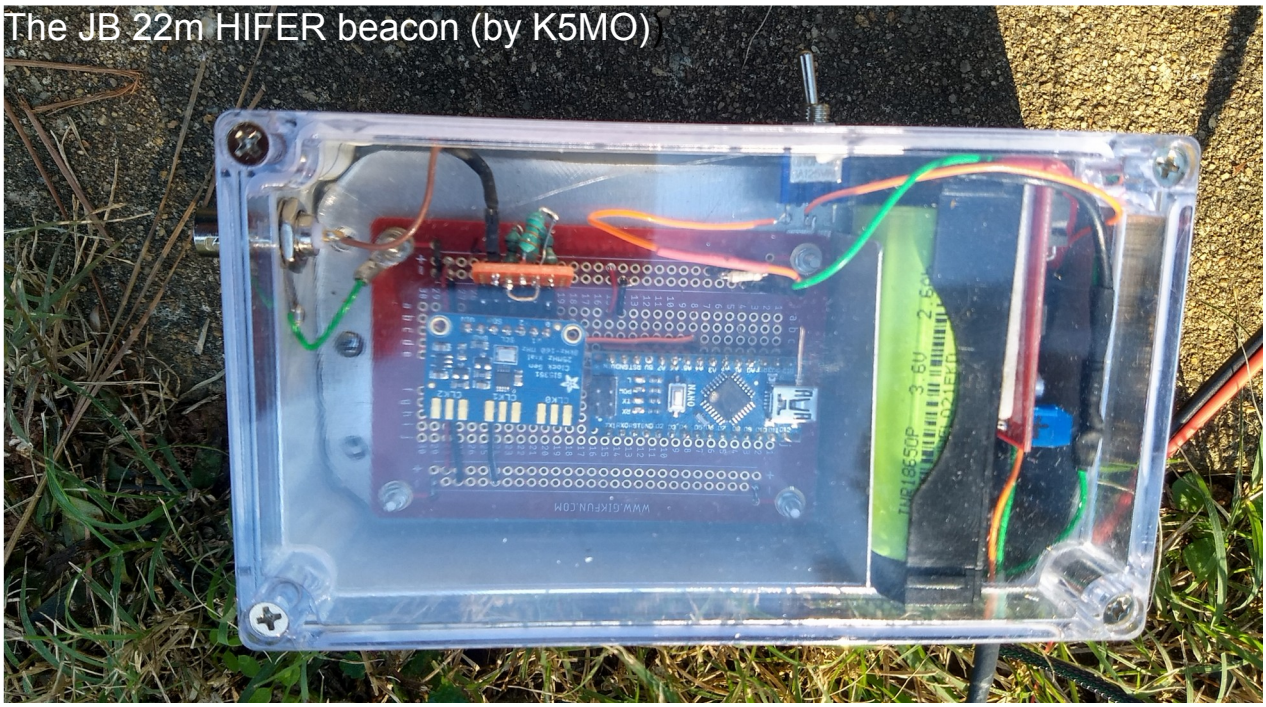
The Longwave Club of America (LWCA) https://www.lwca.net/ has several resources available, including a list of operators, callsigns and modes of transmission heard on 22m as well as a discussion and announcement board centered around these "HIFER" signals. Anything from signal reports to theological arguments regarding output power regulations are found here. There's also a handy technical section that does a deep dive into the FCC Part 15 regulations regarding operation in the ISM bands as well as providing some design information for transmitters .

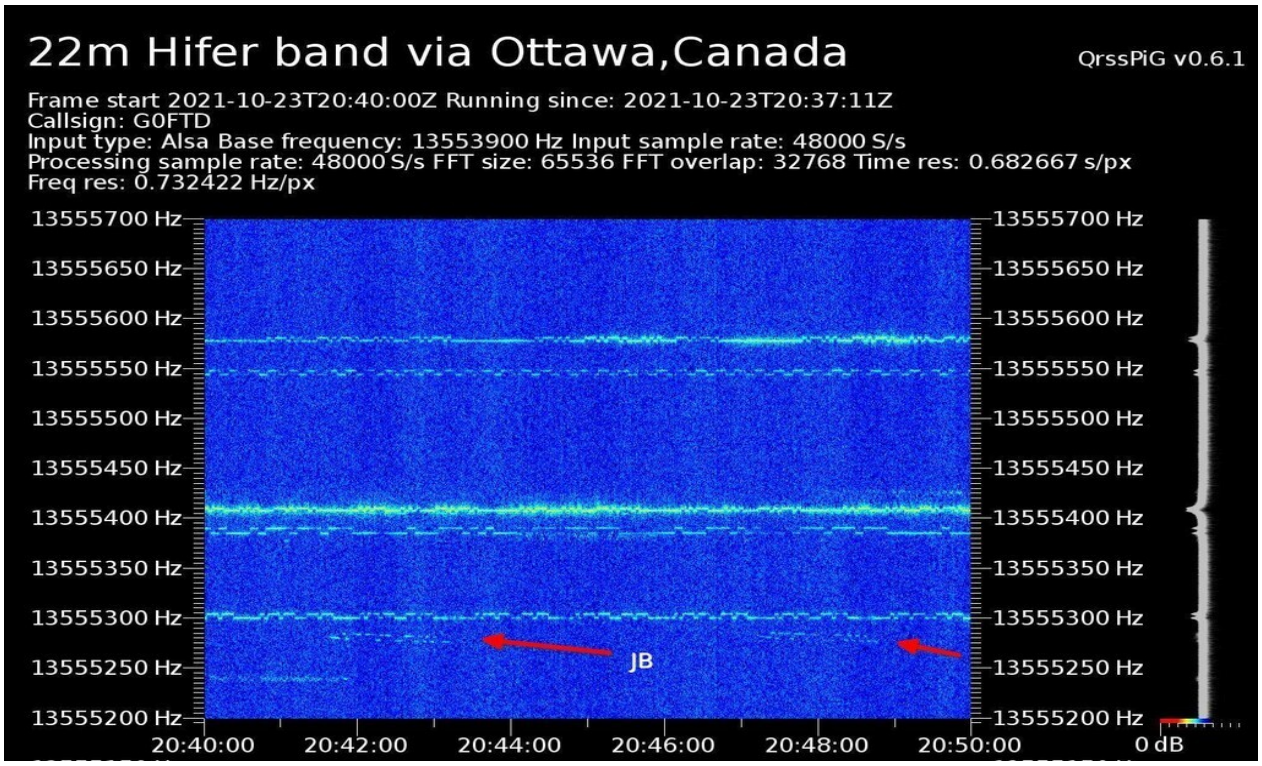
Likewise, the HF Underground forum* hosted by long time SWL/Ham Chris Smolinski has a section with some reporting activity on beacons (WSPR and CW) on 22m. Link - https://www.hfunderground.com/board/

So, how's the activity on 22m? I mean, 2mW makes the typical QRPp signals often used on QRSS and WSPR ham band transmissions look like "full gallon" QRO! What's there to hear other than diathermy machines?

Fortunately, due to the prime spectrum allocation, the answer is "plenty!". I have been operating an ARGO grabber and see signals at almost all day, every day. I'm using nothing fancy, just a sloper antenna and a shortwave receiver, yet there's WSPR, CW, QRSS,Freq Shifted CW (dits one frequency, dashes another), and ultra low speed slant QRSS . My best DX is about 1200 miles, but I've also heard (and seen) signals from just a couple hundred miles. Often the signals are clearly audible, to the level that a conventional CW QSO would be possible. Like any RF, grey line effects bring the magical events

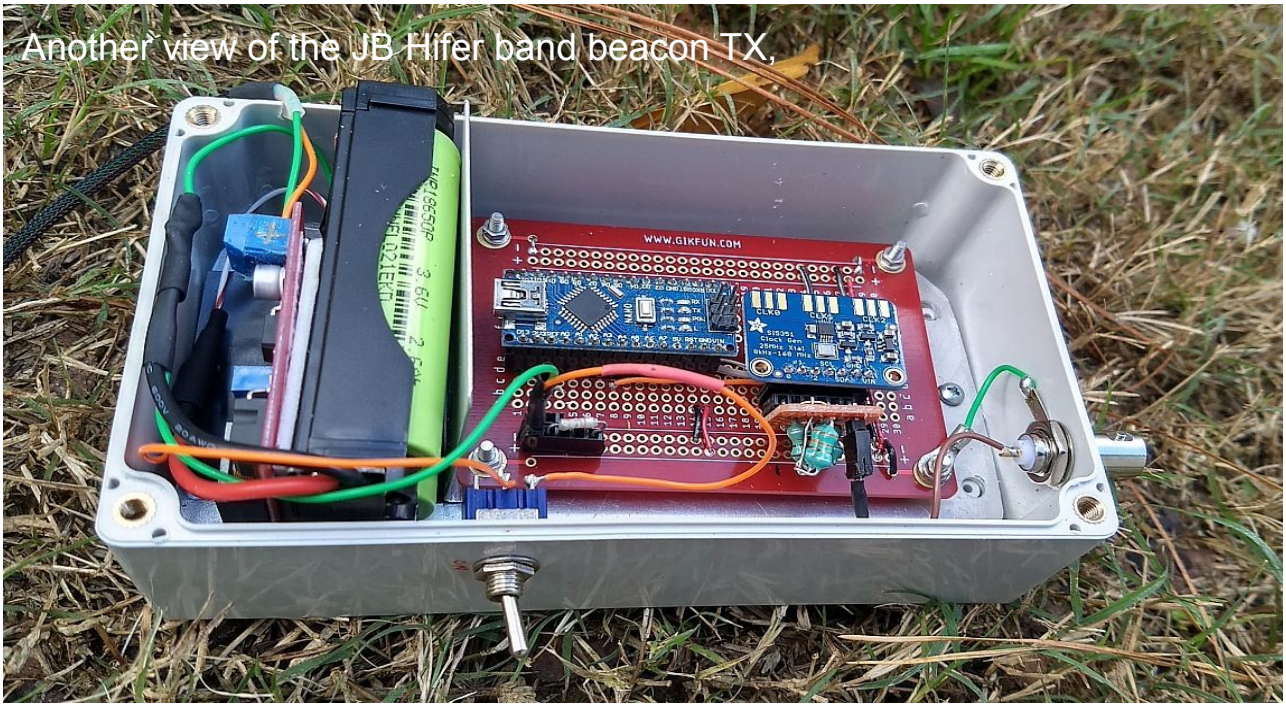
So do "mystery" transmissions that appear and disappear without background information. Feel free to take a look at any of the 22m band grabbers on Scott Harden's site [https://swharden.com/qrss/plus/] to see what's happening out there. Better yet, grab a few transistors and join the fun. Just watch out for those white vans cruising the neighborhood. (At least in the US).





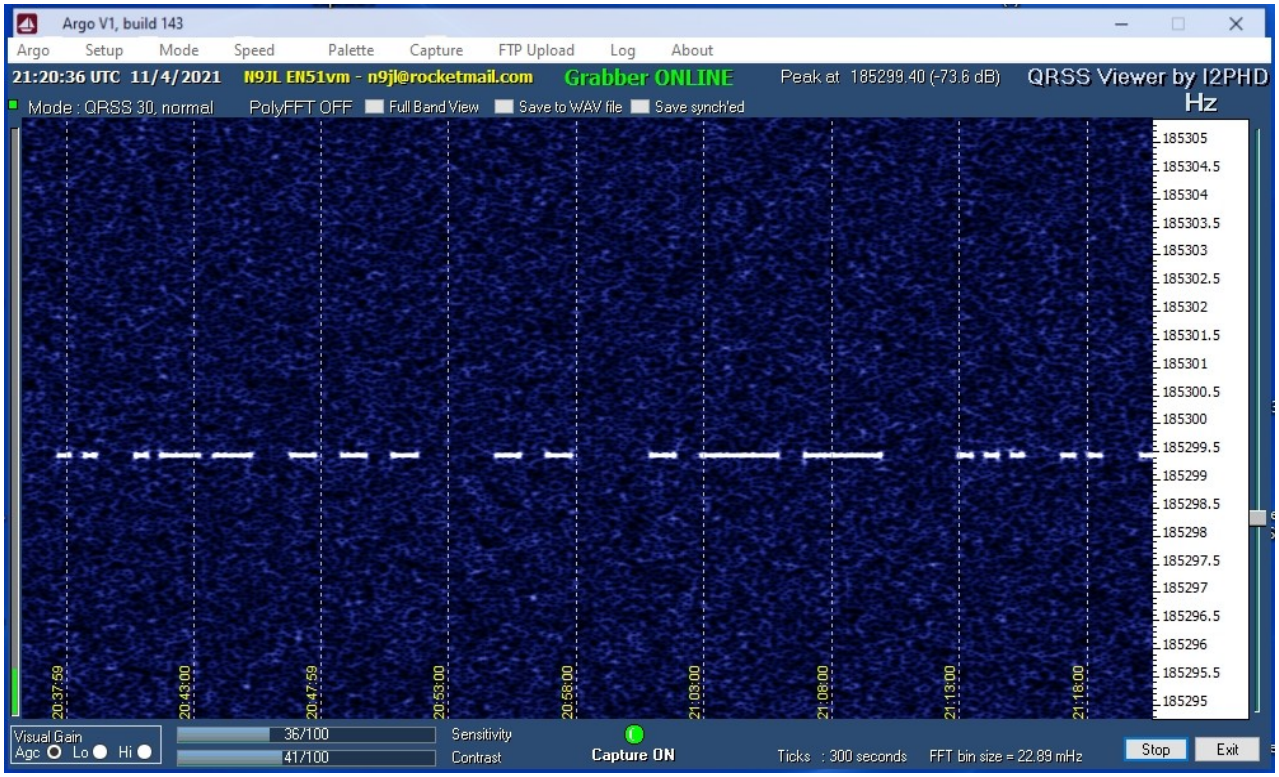
My several milliwatts from the JB beacon made it to Ottawa in Canada.

The 22m HIFER band. An Introduction by John K5MO.



In Brief..

From N9JL comes news, not from the HIFER bands, but the 186Khz LOWFER band. Same type of operation but FCC allows 1w to a 50ft antenna. ERP ends up being a milliwatt or less. Here we see DX from K3SIW about 35 miles away. https://www.lwca.net/sitepage/part15/index.htm

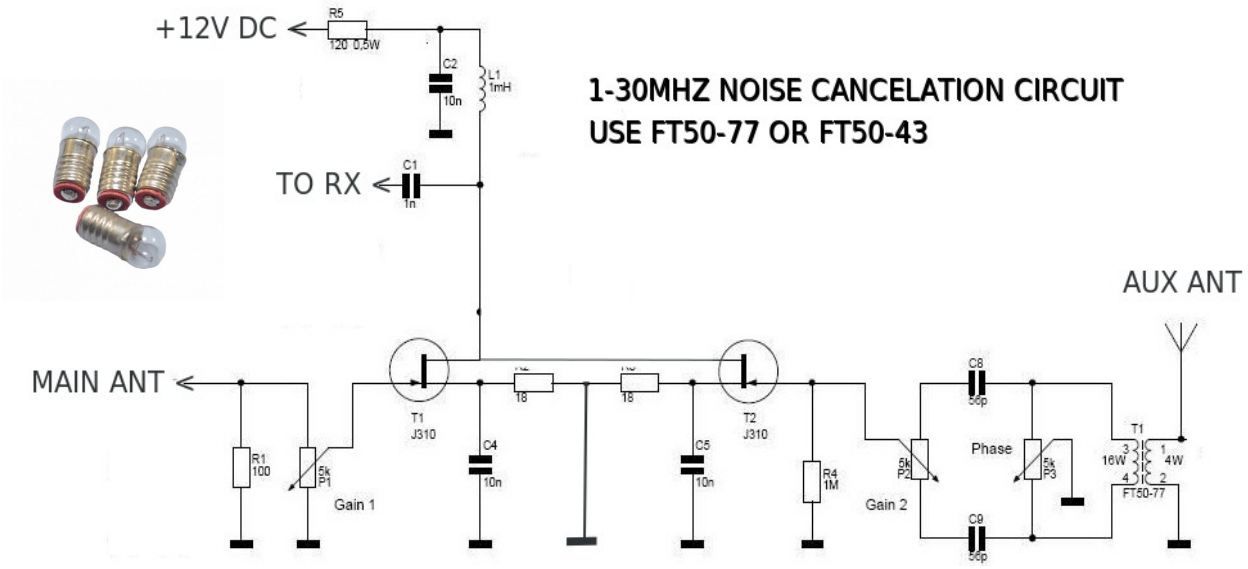


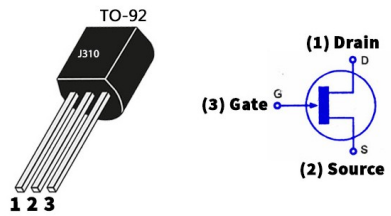
A simple noise canceller for HF.

Here's a very simple noise canceller for the HF bands. It should only cost about $10 to build and the design has proven to be highly effective. There are two J310 FET's and some minor passive components. Two antennas need to be connected. The main antenna and an auxilary antenna that is best placed as close to the noise source as possible if you can. The stronger the noise is on the auxilary antenna, the better the cancellation works.

Note that J310's are unijunction, and that means that the Drain and the Source connections may be reversed with no ill effects at all. Electrically they can be reversed but take note of the physical position of the pin out !

The use of an FT50-43 is probably the easiest way to build a general purpose unit since they are more common. The FT50-77 can be used if the builder wishes to enhance the usability down on the LF bands, such as 2200m, 630m band. More turns down at these bands is better, some experimentation may be required.





The circuit is shown receive only with no relay's for TX/RX switching. Of course there is no real need for switching of used on a QRSS receive only grabber system. However it is feasible to insert small 6v torch bulbs or pea lamps in series with the antenna inputs as protection. They make excellent RF fuses if the are low voltage and draw about 50/60ma !

PA2OHH's "Luxury" TXCO.

How does it work: We first will have a look at the temperature curve of a crystal (FIG 2). When we heat up a crystal, we see the frequency increase to the first turnover point T1. Then the frequency falls back to the turnover point T2. And then the frequency rises again until the crystal breaks. At room temperature, the crystal acts on the slope in the graph, the red-colored part. And you can see that with temperature variations we have a considerable frequency variation (dF normal).

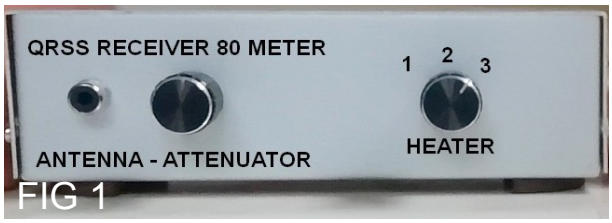


FIG 1

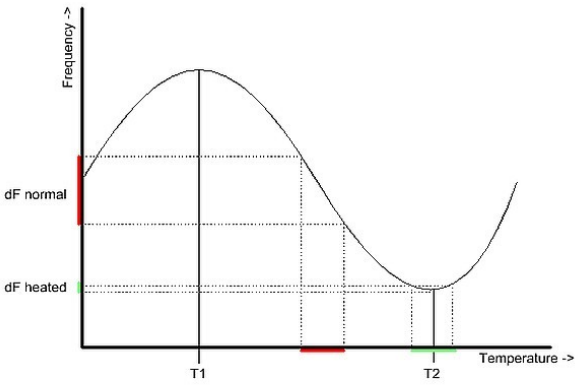


FIG 2

But we are going to heat the crystal to the turnover point T2 in the graph, the green colored part. And then you see that we have a much smaller drift (dF heated) with temperature variations!

All we have to do is heat the crystal to the turnover point T2! And we do that with a resistor of 1/4 watt!

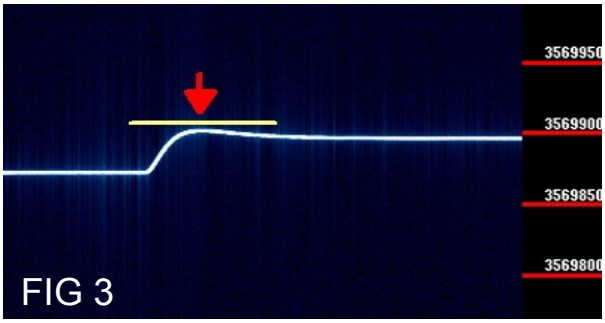


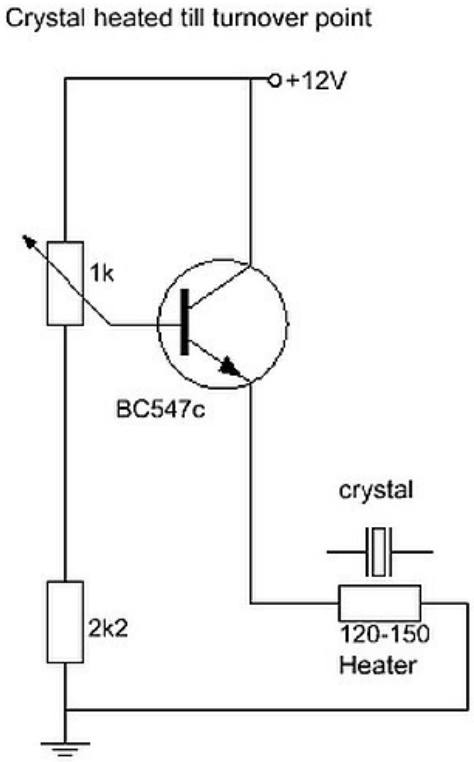
FIG 3

The problem: I used this principle already for my RTL.SDR grabber, an old version without TCXO, see Compendium 2019. But it was difficult to find the right value for the resistor. And there is another problem. It works if the temperature variations are not too far from the usual 21 degrees. But in my shack, the temperature varies from 8 degrees in the winter to 32 degrees in the summer. The temperature of the crystal is way too far below the turnover point during the winter and way too far above the turnover point during the summer!

But there is a solution! The "luxury" version with an adjustable heater! We can control the heater with the help of a transistor and potentiometer with a setting for every season. The low position 1 is for the summer, Position 2 for the colder autumn & spring and the high position 3 for the ice cold winter (FIG1).

The emitter of the transistor follows the base voltage (minus 0.7 volts). The voltage is adjustable between approximately 65% to 100% of the supply voltage. Select the value of the heater resistor so that the turnover point can be set at all temperatures within the range of the potentiometer. I used a BC547, but any "standard" NPN transistor can be used.

It is now also very easy to set the temperature of the crystal at the turnover point. Turn the potentiometer up very slowly, the oscillator frequency will decrease. Then the frequency goes up again. The lowest point is the turnover point. Set the potentiometer to this position. So the problem that it was so difficult to find the right value of the resistor has been solved too!



Above you can see the circuit built into the 80 meter QRSS receiver. Long wires to the heater resistor to prevent heat loss due to conduction through the wires. And the heater resistor is glued under the crystal, heat moves upwards. The resistor of the transistor's emitter to ground has no function. It has a high impedance and is used to hold the transistor on its place.

Isolating the crystal and the heater resistor did not work. Even more power was needed with insulation material. So the insulation material cools the heater resistor!

The turnover point can be adjusted with a frequency counter or by listening to the signal with an SSB receiver. This can also be done differently for the QRSS receiver. Connect a calibration signal to the receiver. You will see a line on the QRSS screen (FIG 3). Turn the potentiometer and you will see the line rising, peaking and then falling again. Set the potentiometer to the peak, which is the turnover point.

With apologies to Monty Python, I came across this in my archives. KB5UEW's Steampunk style QRSS rig, mechanical clock keyer and other 1940's parts !

I built this one using a mechanical clock, vacuum tube and other parts that were from the 1940s. I was able to use silicon diodes since silicon diodes were used in the 1940s though not popular. The output measured 249mW. Transmissions were sent from Los Lunas and successfully received in Florida.

de Earl Cox

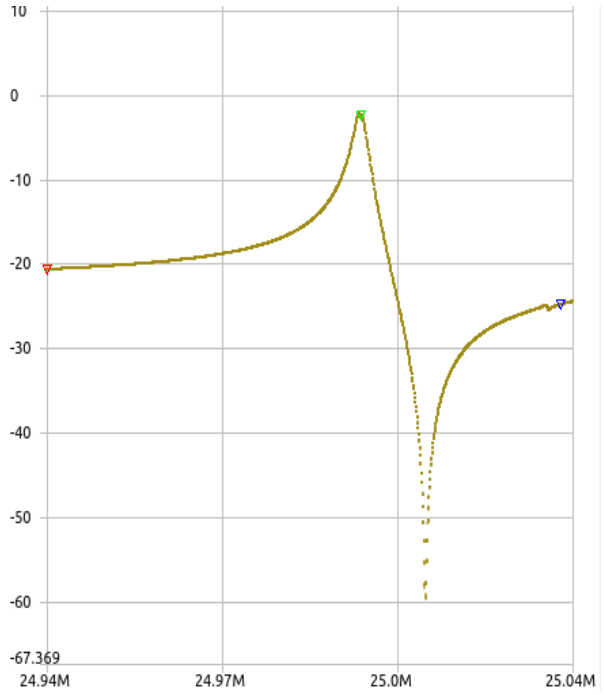
KB5UEW

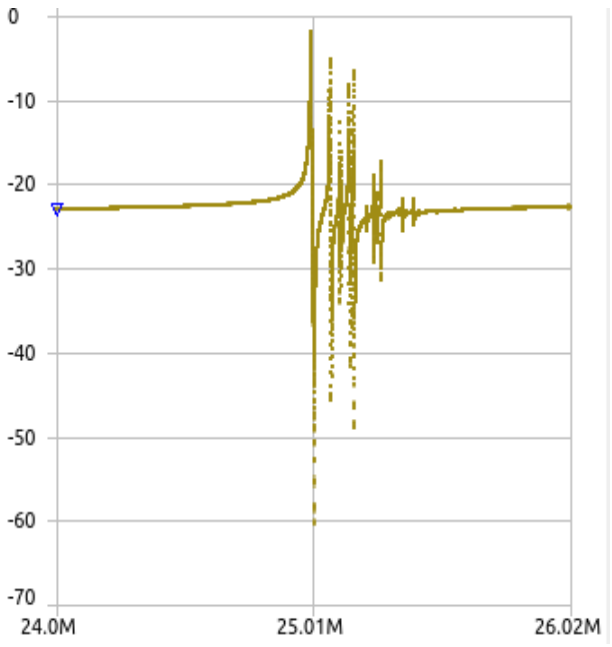
A pictorial look at PA2OHH's latest homebrew QRSS grabber.

Nearly everyone has seen and viewed PA2OHH's QRSS grabbers, and Onno has usually home brewed from scratch each one of them. Here we take a pictorial view of the dual band 10m/20m receiver that we see submitting grabs to QRSS Plus each day, built in to a simple wooden box. Full details here - https://www.qsl.net/pa2ohh/20qrxdc.htm

Using a crystal as a BPF for an SDR.

Using SDR dongles for inexpensive QRSS grabbers is now quite commonplace. But the biggest problem is that they come with no front end signal pre-selection at all. That's a major problem for dealing with very weak HF signal in the face of extremely strong broadcast and utility stations right next door to our amateur radio bands. In the previous 74! compendium, a set of specially designed LC filters were published, and should be quite adequate for dealing with the problem, and are much narrower band designs that the usual basic LPF's and BPF's. There is also an enhanced alternative, a simple crystal filter employed as a band pass filter. Builders like PA2OHH have used the technique in his grabbers, and simple QRP transceivers have also done the same.





So how do you do it ? Insert a crystal between the antenna input and the antenna feed line and that's it !(Fig 3). It acts like a frequency selective attenuator, providing typically 25db of attenuation at some 25Khz away. This is what we want on something like the 40m or 30m bands where huge strength broadcasts and totally ruin QRSS reception.

The response plots above were taken using a Nano VNA and a crystal that I happened to have to hand which was a 25Mhz crystal in order to illustrate the point. The upper trace shows the resonant and anti resonanace of the crystal. We want to use the resonant part for our filter. The lower traces show the other resonances and anti resonances that extend a few Khz away. These are unimportant to us, since we are only really interested in using the attenuation effect that extends over 25Khz away.

For example, we QRSS'ers hang out at just below 7.040Mhz, and broadcasters will be found typically from 7.200Mhz upwards, well into the 25Khz area of maximum attenuation. Actually the attenuation is a big more on the high side of the crystal, more like 30db, even better ! Also remember that the test that I did was pretty crude, no attempt at any impedance matching was tried (not really required, but could improve performance figures by a few dB). And there maybe have been some signal leakage from one measurement port to the other, due to signal radiation offered by the long or unshielded crystal leads that were several centimetres long. (Fig 4).

FIG 3

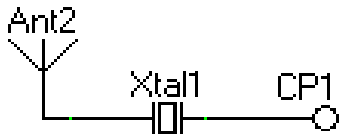


FIG 4

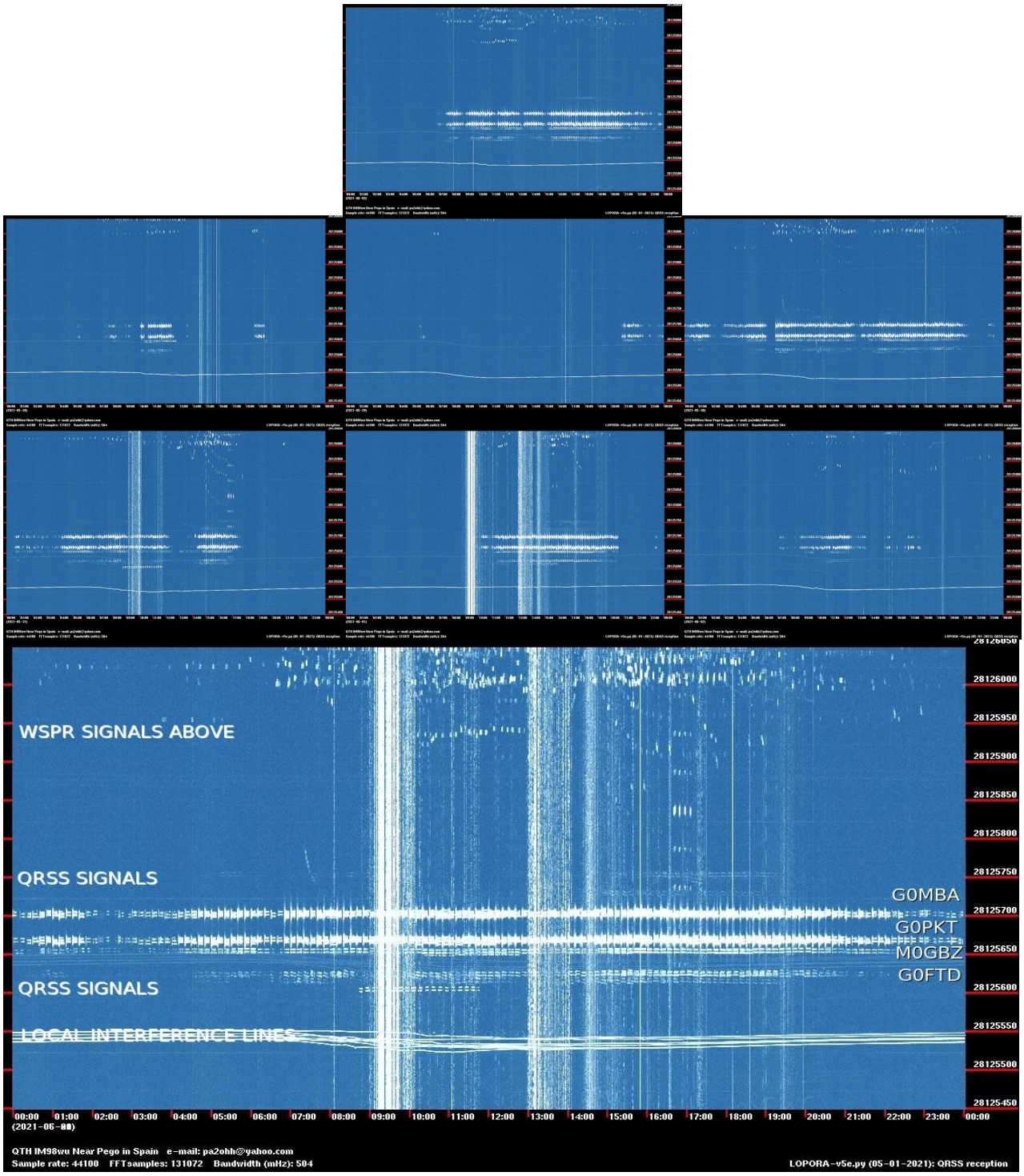
So what do we get in practice ? A typically 25Khz wide frequency selective RF attenuator offering about 25-30dB of attenuation. Loss through the crystal was measured at 1.8dB (not worth worrying about all since we already have far too much gain in the receiver anyway at HF). Signal peak bandwidth typically 500-800Hz wide. **How do we implement it in the real world ?** Take a crystal at the wanted frequency that you want to receive, use either a series or parallel trimmer capacitor across the crystal to bring it exactly to the wanted frequency and insert it in series with the antenna input. In fact you could do a simple crude test using nothing more than a receiver, a piece of wire and the crystal inserted next to the antenna socket. Tune SLOWLY across the crystal frequency and observe the noise floor and see the difference. A real nice and easy experiment. (Fig 3).

Obtaining crystals ? Usually it's the 40m and 30m bands that we have the most trouble with. There's a ready supply of crystals on the market for 7.040 and 10.140Mhz already. For other bands you may need to approach a custom crystal manufacturer. They are still about, but maybe cost 20 dollars,British Pounds or Euros. Still a low cost compared to what it's giving you in the hobby for the long term. And remember that you can use this technique on ANY receiver, not just an SDR. Further useful reading can also be found here https://www.arrl.org/files/file/QEX_Next_Issue/Nov-Dec_2009/QEX_Nov-Dec_09_Feature.pdf

A study of Sporadic E reception from UK to Southern Spain during 2021

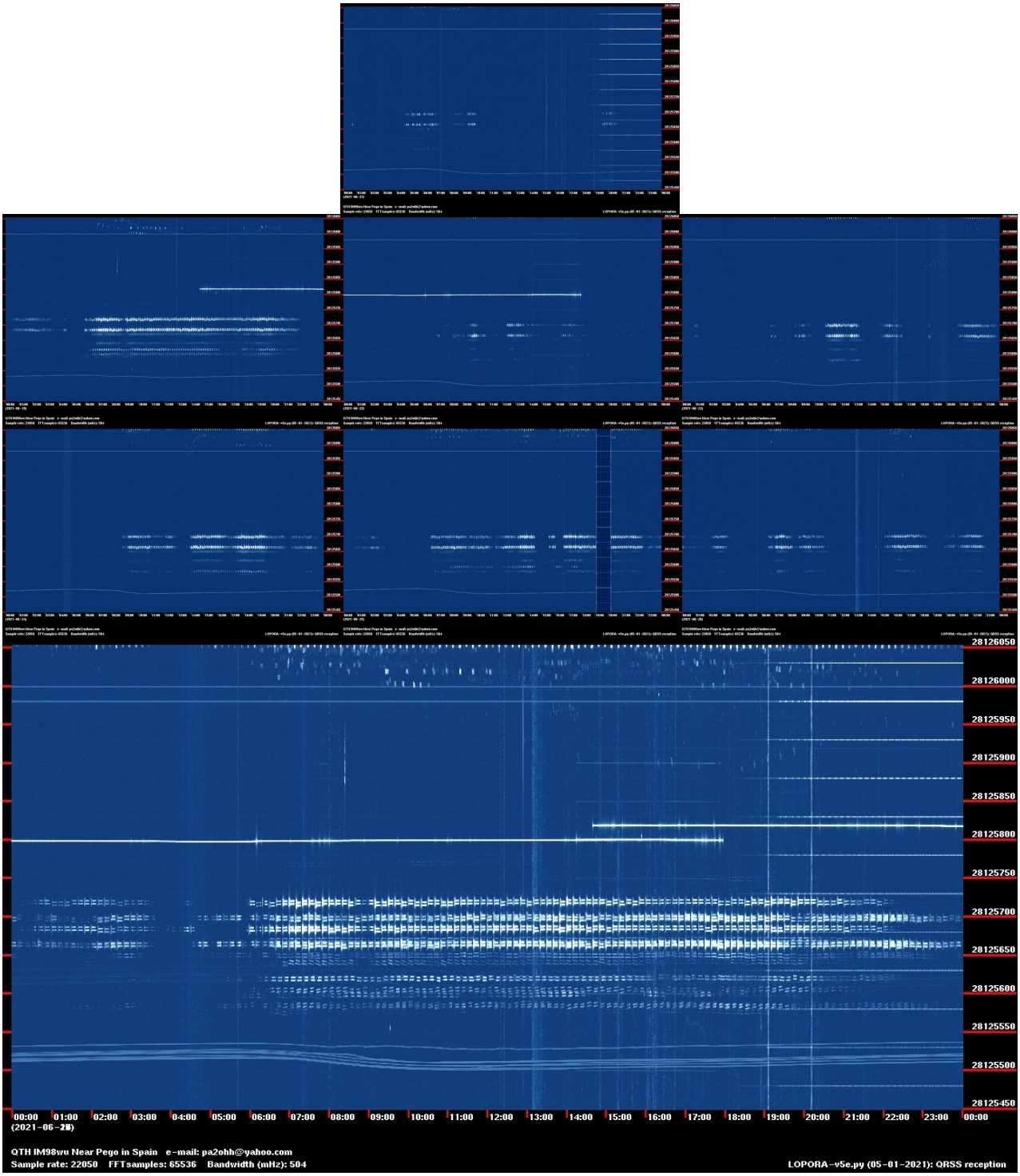
I took a 24hr set of 28MHz grabs from each day at the end of the month, for 7 days in order to get an idea of either the randomness or consistency of daily openings. The larger grab is a 7 day stack. Grabs start at 00 UTC and end at 24 UTC. Midday or noon is at the centre.

May 2021



A study of Sporadic E reception from UK to Southern Spain...

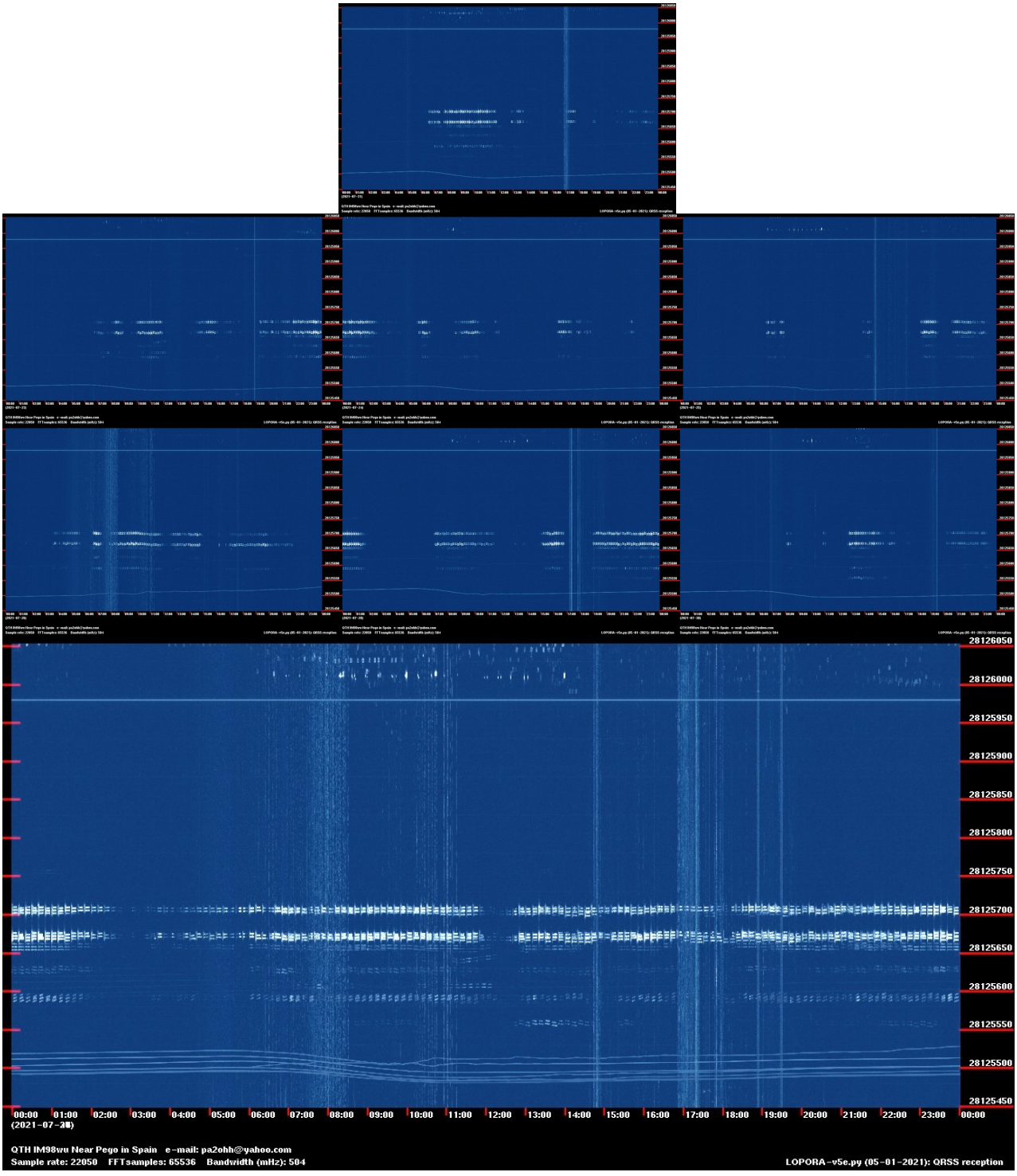
June 2021



May and June were excellent months, with the the band open at just about any time within the 24 hours available. It is clear that opening can open at just about ANY time, including late at night and after midnight local time. Having 24/7 remote transmitting and receiving stations on the QRSS mode (and WSPR) have allowed us to see this in much greater detail than ever before.

A study of Sporadic E reception from UK to Southern Spain...

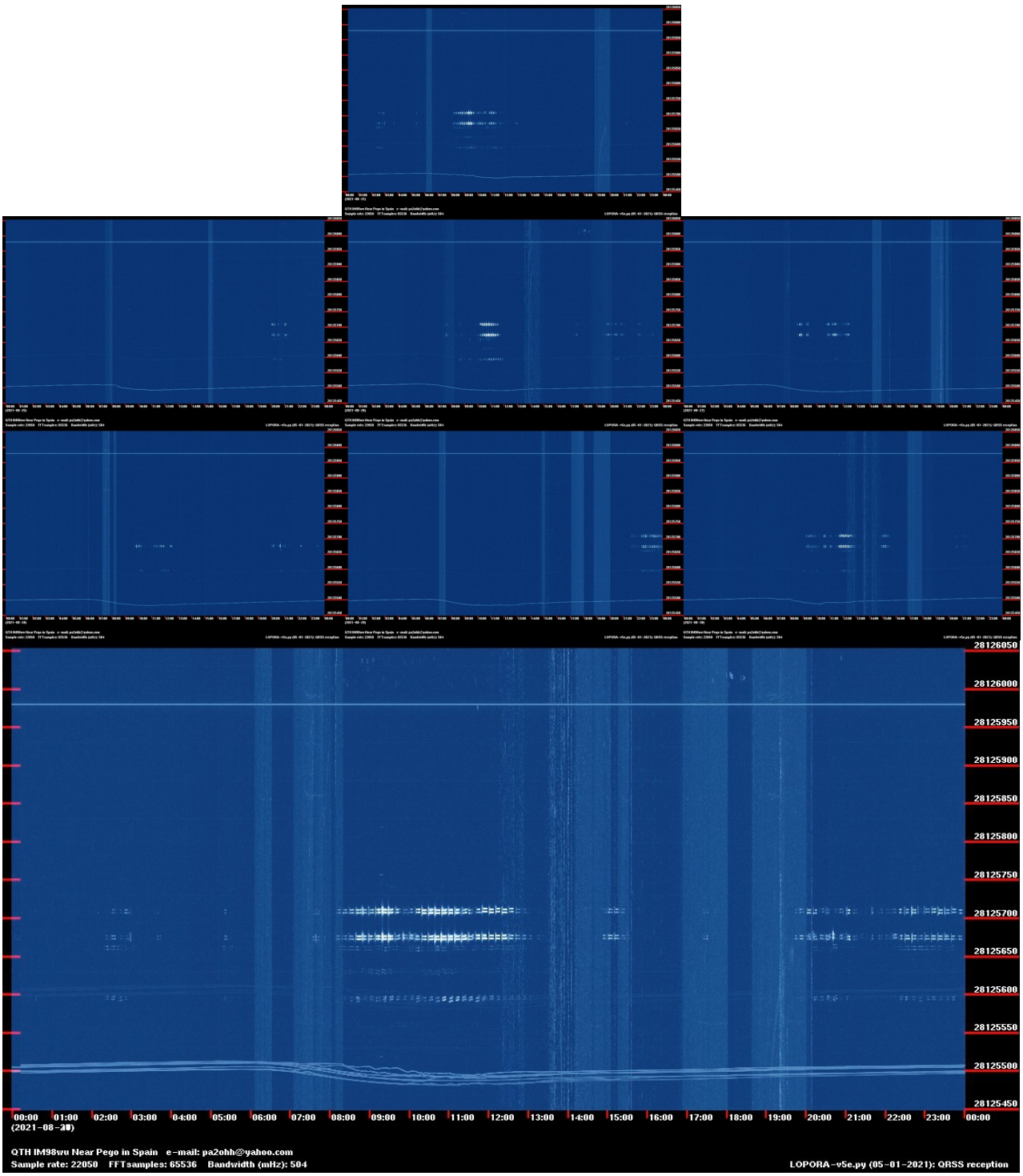
July 2021



Once again the conclusion is much the same as May and June. Sporadic E could occur at any time within the 24 hour period, and openings lasing at least several hours. The predominant signals on the traces come from G0PKT and G0MBA located in south eastern England, in the county of Essex.

A study of Sporadic E reception from UK to Southern Spain...

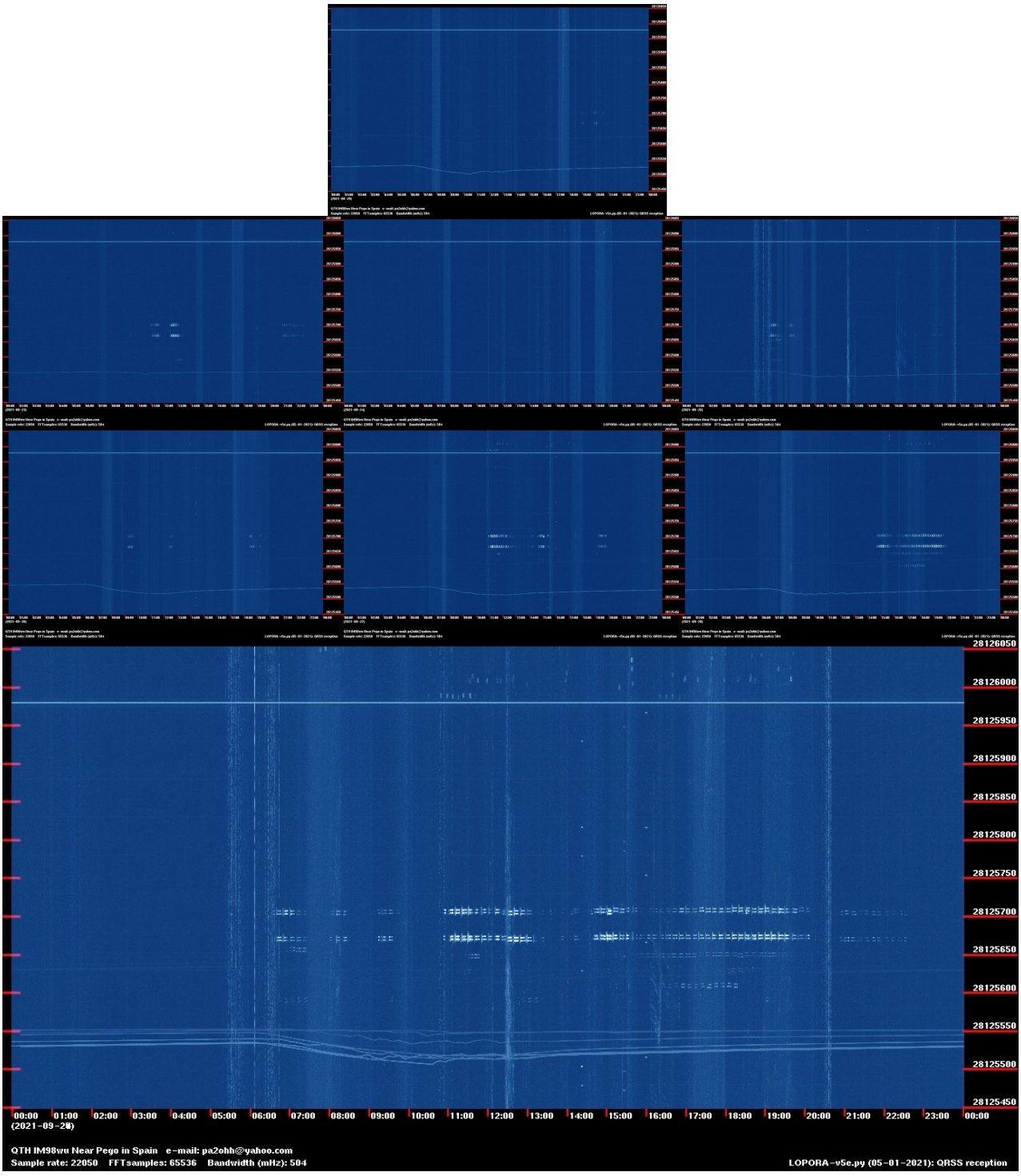
August 2021



The month of August appears to have a reduced amount of Sporadic E available. Openings were shorter and mostly restricted to to around the midday period with some exceptions. It appears that the sporadic E season is now waning.

A study of Sporadic E reception from UK to Southern Spain...

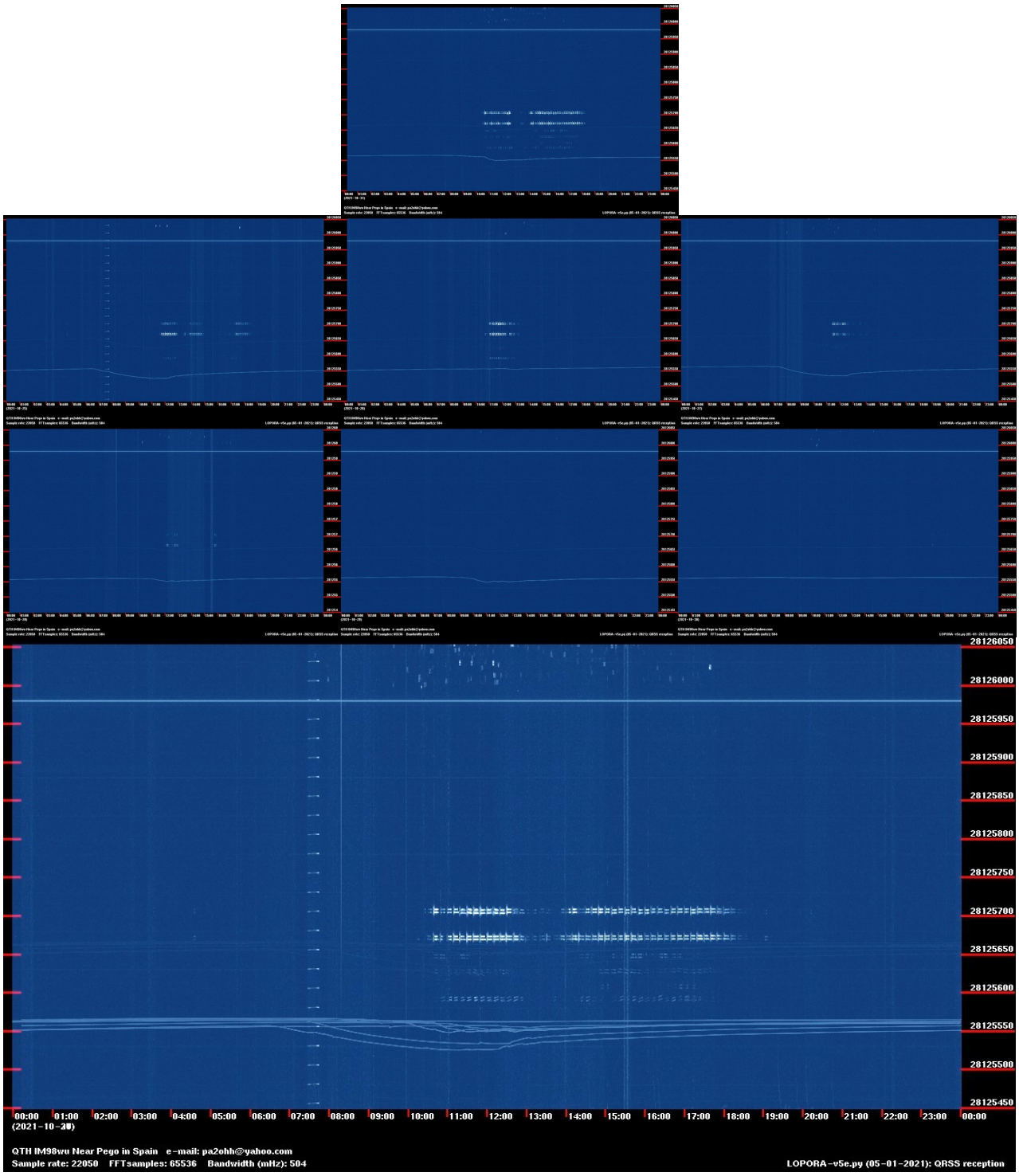
September 2021



Not much different to August really.

A study of Sporadic E reception from UK to Southern Spain...

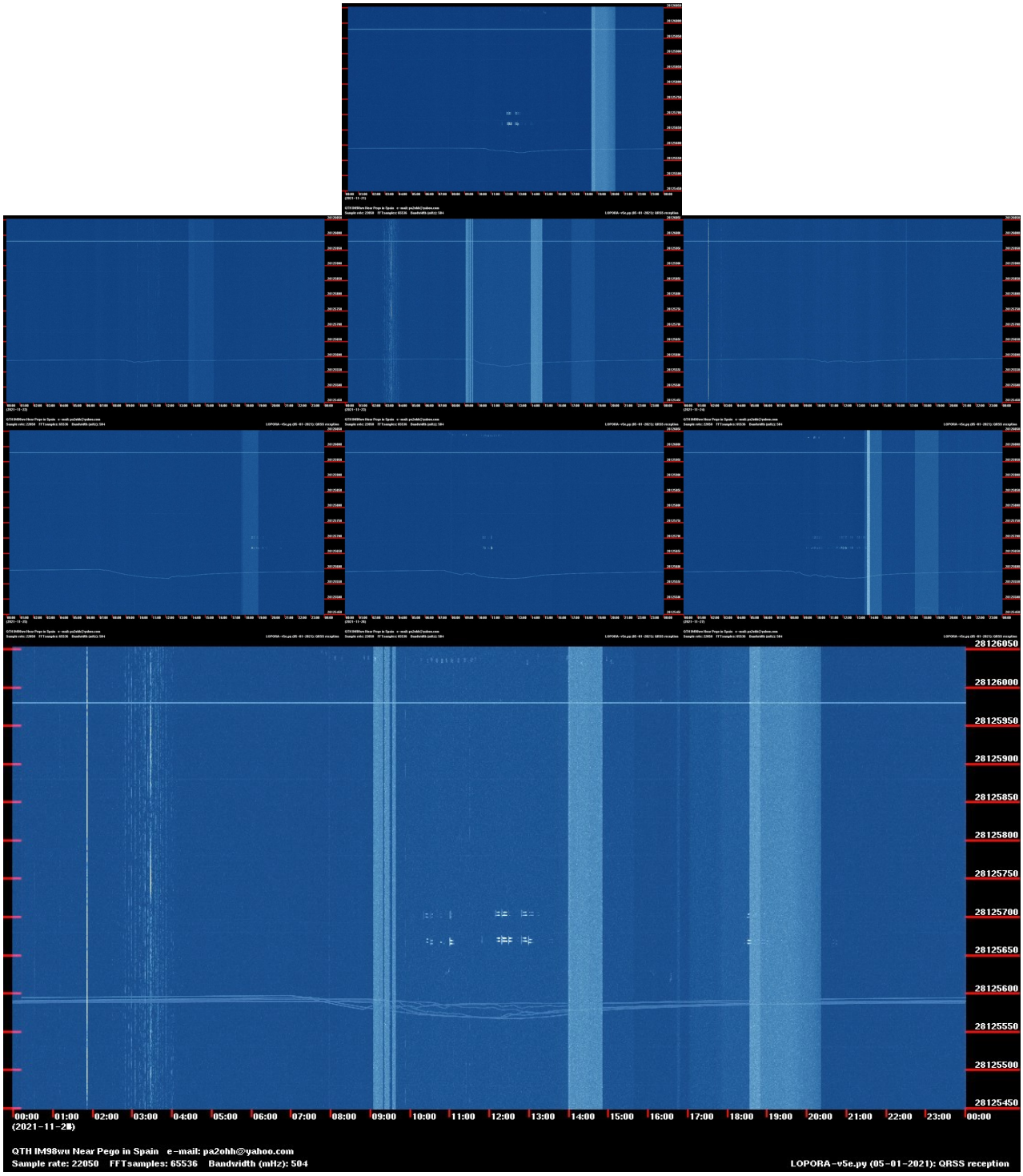
October 2021



Openings are still shorter than previous months and appear to take place from midday to late afternoon.

A study of Sporadic E reception from UK to Southern Spain...

November 2021



At this point it is fair to say that whilst the band has been open, the Sporadic E season is as good as dead. At this time of the year there is a small question of what the propagation mode is. Sporadic E or maybe some light F2 layer coming into effect ?

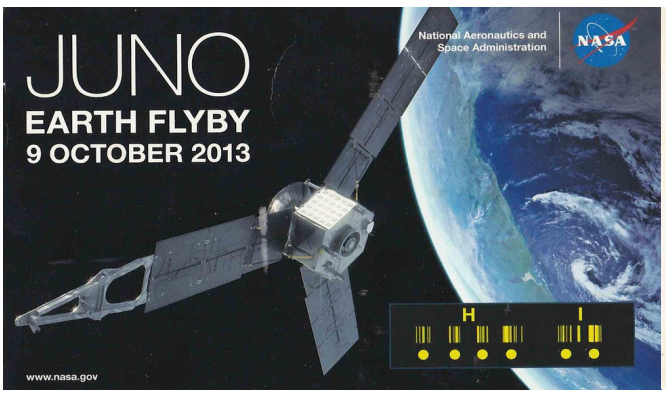
A study of Sporadic E reception from UK to Southern Spain...

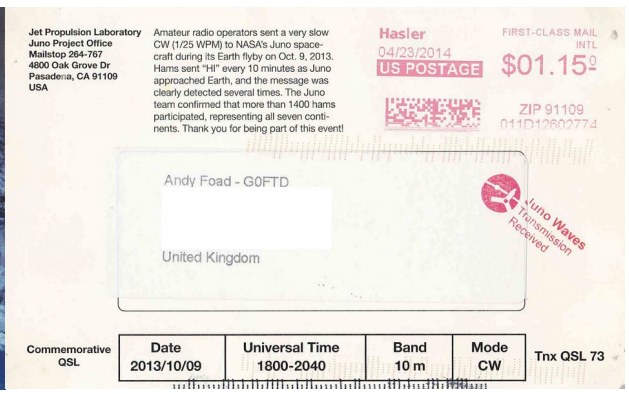
To the left is the map showing the approximate locations of the transmitters and the receiver in this experiment. The PA2OHH QRSS grabber that I took the data from is actually located in southern Spain, where Onno currently resides. The bulk of the transmitters shown in the grabs are from south east England, shown by the TX symbol on the map. TX powers were typically 200-500 milliwatts to simple verticals and dipoles, and a simple antenna at the receiving location. No Yagi or beams!

The RF path length is about 850 miles. For the last two years, the 10m band Sporadic E season has remained dead until about the 18/19th of May when all hell has broken loose and suddenly the band explodes. It will be interesting to see if a similar date occurs next May too. It seems that May, June and July are the peak months of the season if the current evidence is consistent for future years. The beginning and end of the season appears to be quite sharp.

A QSL card from a NASA space probe.

Here's a quick blast from the past. Back in 2013, NASA was asking radio amateurs to send QRSS signals to it's Juno space probe on it's way Jupiter, and using the 28Mhz amateur radio band. NASA wanted to use the signals to act as some form of calibration for the onboard magnetic sensors, and the message on QRSS was to send a simple HI. The exact TX frequency if I remember correctly depended upon the last letter of your callsign. More info available here (click the link). I used my QRP Labs rig for this.





Well here we are almost at the end of the year again. As always I never really know if another 74! Compendium is possible, but I say this every time. Amazingly I have had more feedback and contributions for this issue than ever before, thanks guys !

In fact it was harder this year to go through them all, filter the contributions into some kind of order and then mould them together.

A severe lack of time meant that I had to do something quick, and make what I had gel together to provide a QRSS-centric format in a very short time. As always, the aim of 74! is to gather all those useful data grabs that would otherwise be forgotten about, and the useful knowledge that they contain that would otherwise be lost within a few days of posting. I don't want that knowledge to be wasted, especially when it can educate and inform future operators about interesting propagation effects. Regretfully, all this useful stuff never gets published in the traditional amateur radio publications, and so 74! exists.

This year has seen an upturn in propagation. Not amazing but at least the grabbers are more alive with signals than this time last year, when it was awful. We have also seen increased interest in the 22m Hifer band,and for the first time, the 185Khz LOWFER band as well as 50Mhz. QRSS and Knights members are certainly spreading their wings ! What next I wonder ? Maybe some QRSS DX-Peditions ? That would be cool.

We have recently had quite an influx of new members joining too. Please remember that Knights is more focussed on providing content such as databases, useful Wiki pages and files areas, rather than being just a traditional email reflector. (It is the 21st century you know).

My advice is to log in to the Knights group using your web browser first, have a good read of what is available and then use the email reflector side of things to provide fast alerts of activity.

During the year, I occasionally ask some generic questions on the group, purely out of natural interest. I noted once again that Knights members have about a 50/50 split with their operating system usage, mostly between Windows and Linux. And that simple antennas remain king, with a small mix of the unusual, such as hidden drain pipe wires and indoor antennas too for those who transmit. Some receiving stations do appear to enjoy some larger antennas and wires. That's it for now. Please remember the WA5DJJ New Years QRSS-fest. Fire up those transmitters and grabbers and make some activity. ***Clara ecce egrediebatur inde vitae !*** 74 de Andy

Back cover photo sent in by
PE2BZ (Perseids meteors)