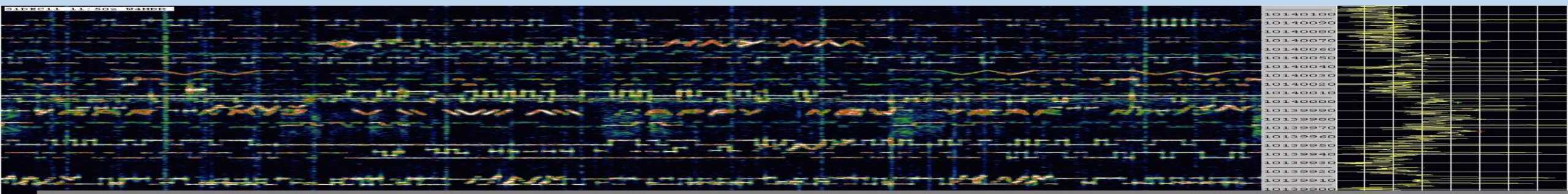


QRSS THEN AND NOW

Qrss is an evolving niche` technology involving a world wide group of active experimenters stretching our knowledge about radio wave propagation.



When I started: FALL 2008

Every once in a while an Amateur Radio Operator gets hooked on a mode or type of operation that really grabs him and won't let loose.

For me, it was QRSS. I read about QRSS on Bill Meara N2CQR's Soldersmoke blog in the fall of 2008 when he was bragging about seeing his 10mWs signal in Belgium while transmitting from Rome, Italy using a dipole antenna on 30M.

The question that came up in my mind was "How can that Happen? We are in a solar minima, the solar flux index was only 68 and sunspots were often ZERO." He is only running 10mWs (.01 watts) to a 30M dipole antenna.

Sort of sound like conditions today doesn't it.

IF HE CAN DO IT – SO CAN I

The Battle cry of the uninformed person who has a lot to learn. I am still learning and will continue learning. I really didn't know what I was getting into, But I am here to try to show you the ADVENTURE that followed.

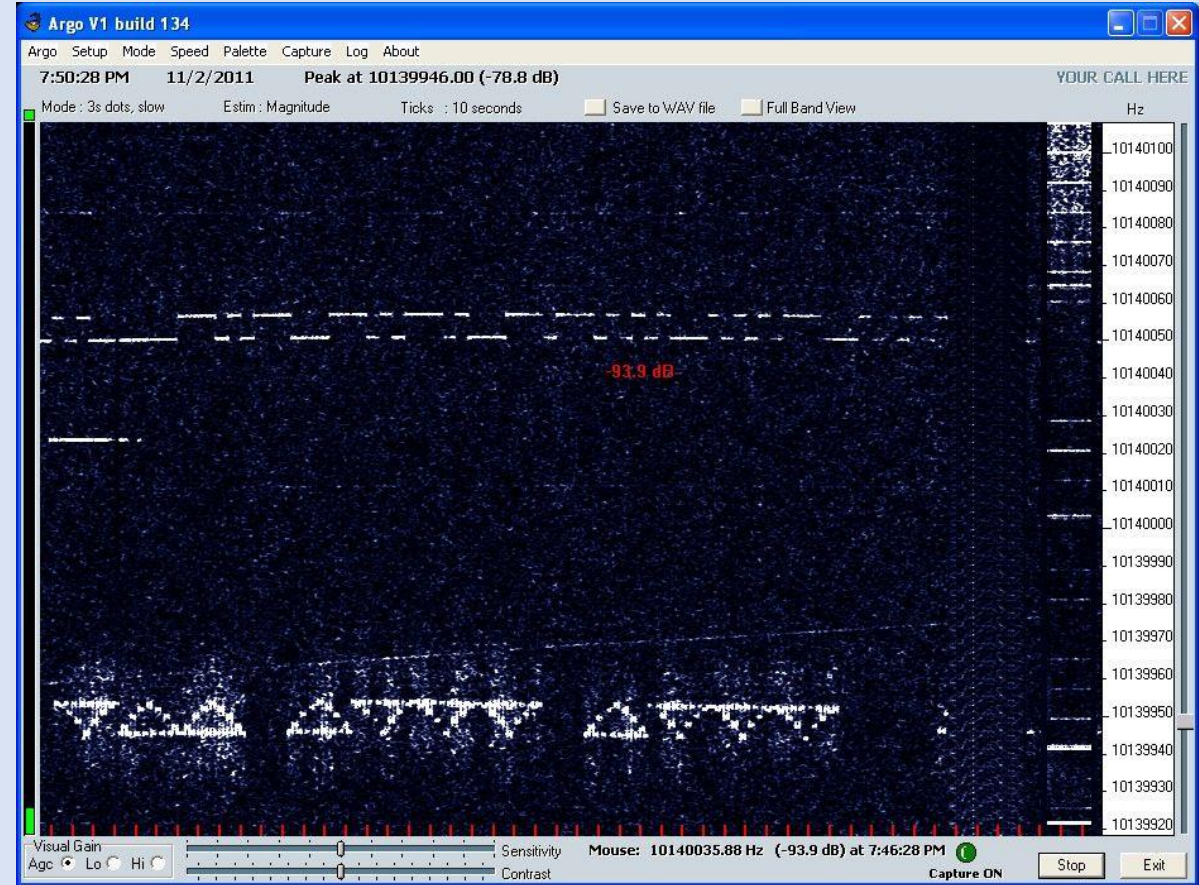
FIRST – What is QRSS?

It is sending your call sign on an Amateur Radio Frequency using various transmission modes so that it can be displayed on a GRABBER receiver somewhere in the world. OH! How hard can that be!

(In 2008 it was a lot harder than it is today)

First: Learn to RECEIVE QRSS!

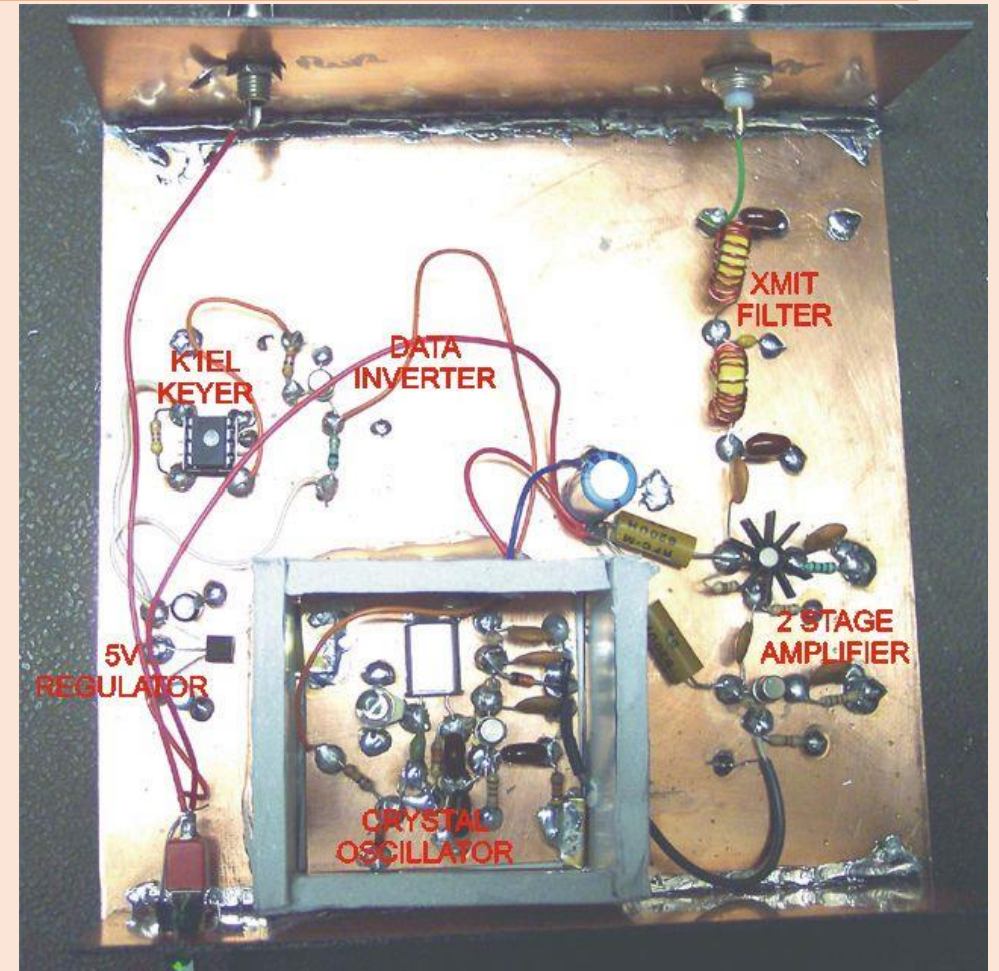
How hard can that be? You hook your receiver up to your computer and it appears on the screen. Well, not exactly. You search the Internet and find a special QRSS spectrum analyzer program like ARGO, SPECTRAN, or SPECTRUM LAB and then spend 1 to 3 days learning the program and your radio but you finally get a picture that looks like this. First Lesson Accomplished.



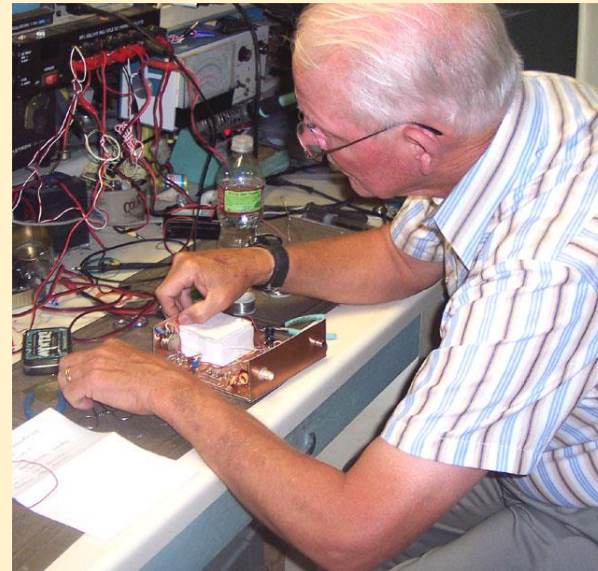
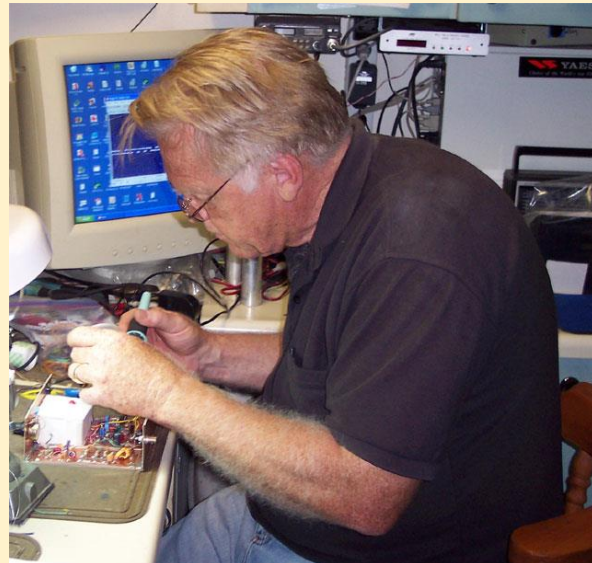
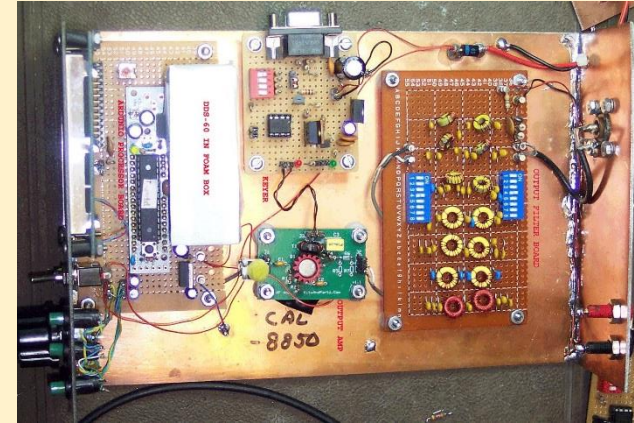
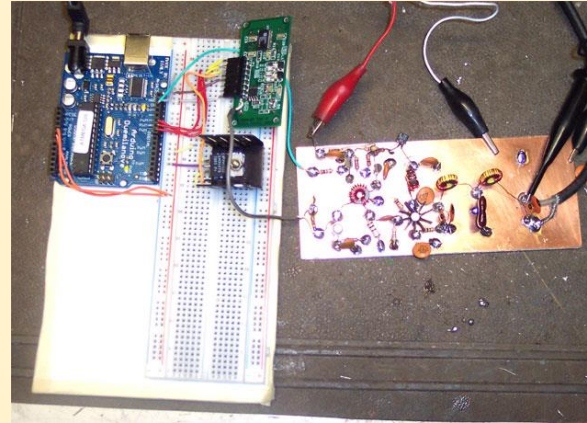
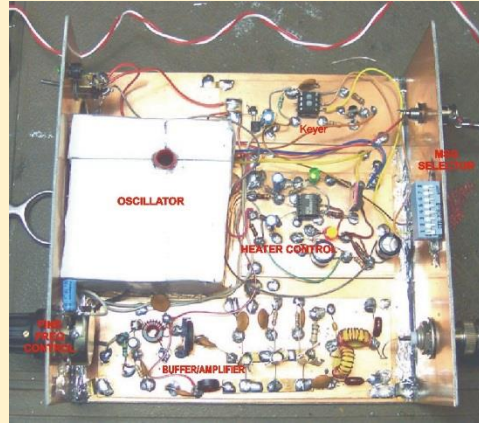
Second: Learn to Transmit!

THE MODEL 1:

You would think this would be easy but in 2008 there were no QRSS transmitter kits. To have one, you had to build it from SCRATCH! I found a simple transmitter schematic on the internet, bought some 10.140MHz crystals and proceeded to build a simple transistor transmitter. I used a K1EL keyer chip to key the callsign. I was on the air with a whopping .05 watts and a dipole antenna on 30M. My first contact was VE1VDM in Nova Scotia, Canada (2,482 miles) using this Transmitter. The bug had bitten and I was off and running.



Then came a succession of transmitters: The model 2, model 3, model 5 were my transmitters that I built:



The Model 2 and the Model 5 were the most popular of my hacked designs. The model 3 was actually dreamed up in our club's builders group and was the first microprocessor controlled DDS card transmitter I built. KD5SSJ and others helped write the software for it and it provided the knowledge to build the Model 5 which was my first all band FSKCW transmitter. My friends KC7VHS and KF5OFK also built themselves a Model 2 on my workbench. I think there were about 7 of them built. But that was progress and a bunch of Learning of new techniques like Oven temperature control of crystal oscillators and very slow CW keying.

Then came the KITS: Around 2010 came the kits for QRSS transmitters:

About 7 companies started making kits for QRSS Transmitters. At first they were crystal controlled but soon started using microprocessors for keying control and frequency control using expensive DDS Oscillator boards. QRSS grew by leaps and bounds as the kits made it easy to get and build a transmitter and the number of signals increased dramatically. The leader in this group was Hans G0UPL and Steve G0XAR. They went on to build the ULTIMATE, ULTIMATE 2, Ultimate 3, and then the Ultimate3S which is now the surviving kit of choice. It has a number of add on kits to make it do 6 bands, a GPS unit to stabilize both Keying and frequency, It transmits the WSPR propagation mode, a 5 watt amplifier and uses the SI 5351 Synthesizer IC for Frequency control. Basic kit costs \$33 plus shipping from Turkey. This is the one I use with all the modules and the GPS. They have been deployed on balloons and sea buoys providing very interesting data sources of amusement.

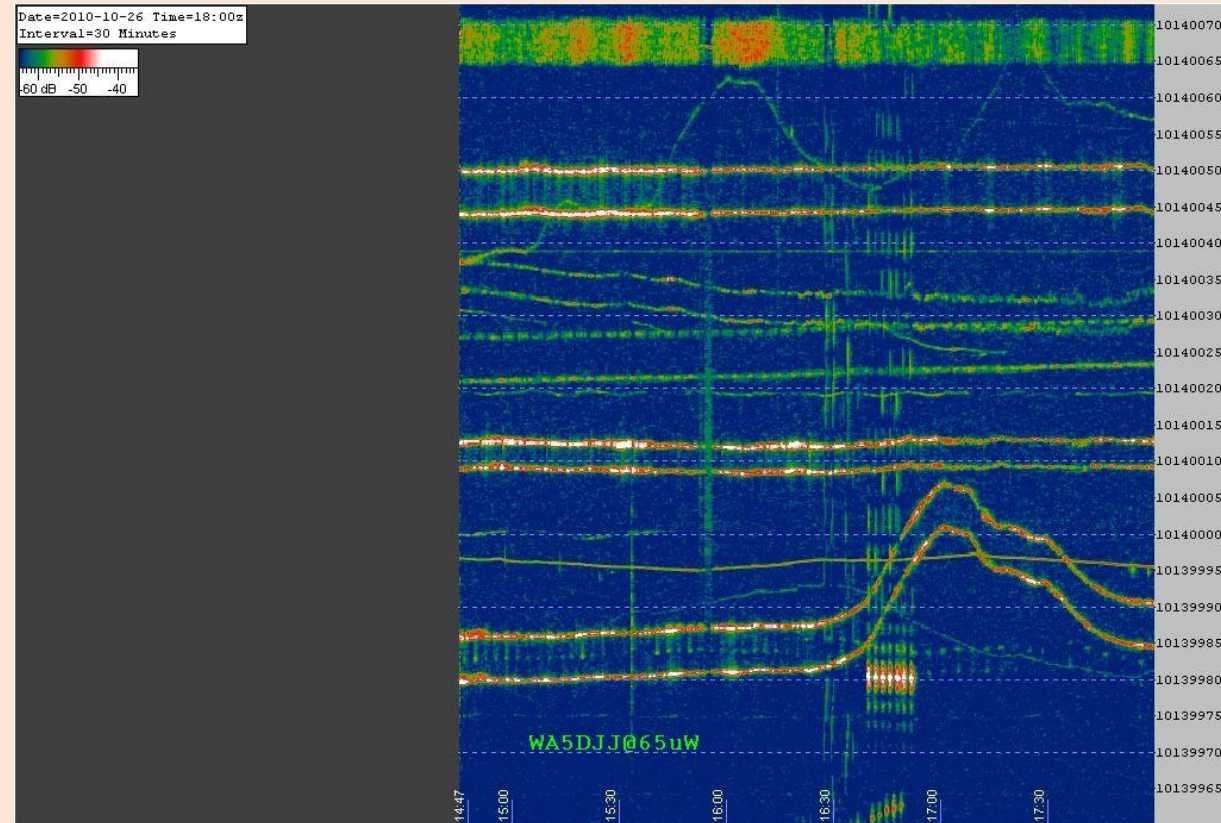


The Low Power Tests.

- Bill W4HBK and I tried to determine how far could a signal be detected and at what power level. We conducted 3 major tests.
- My job was to supply a frequency and power stable signal and to radiate it continuously. I had to maintain a frequency tolerance of about +/- 1 Hertz for 6 hours.
- Bill W4HBK was the receiving end of the path at 1,164 miles. He had what I considered the harder task of devising ways to hear my very weak signal through the noise and his receivers had to be as stable as my transmitter. Starting with the FSK CW test, He developed the technique of Stacking 10 minute QRSS Pictures to improve the signal detection. This technique was the key to accomplishing the goal of 1,164,000,000 Miles/watt.

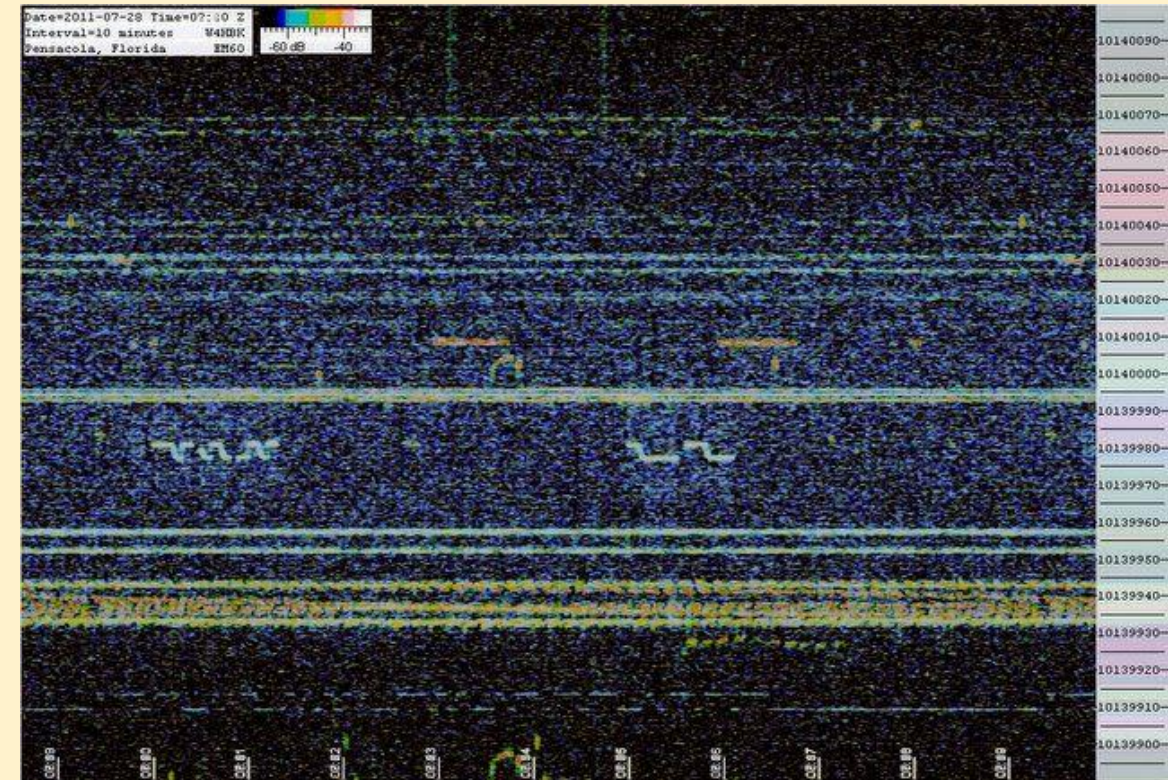
THE 80 SECOND DIT TEST: or how to watch grass really grow.

I modified my model 5 QRSS transmitter with long term cw keyer that put out 80 second dits and 240 second dahs. To send the letter A took 360 seconds (6 minutes). We ran this test on W4HBK's 8 hour grabber. It was to test the theory that longer dits and dahs could be detected at a distance better than the 6 second dits we were presently using. We were really playing QRSS LIMBO. How low of a power output can you still detect. The result was 65uW (0.000065 Watts) as the lowest we could detect with no other processing. This test was done in the fall 2010



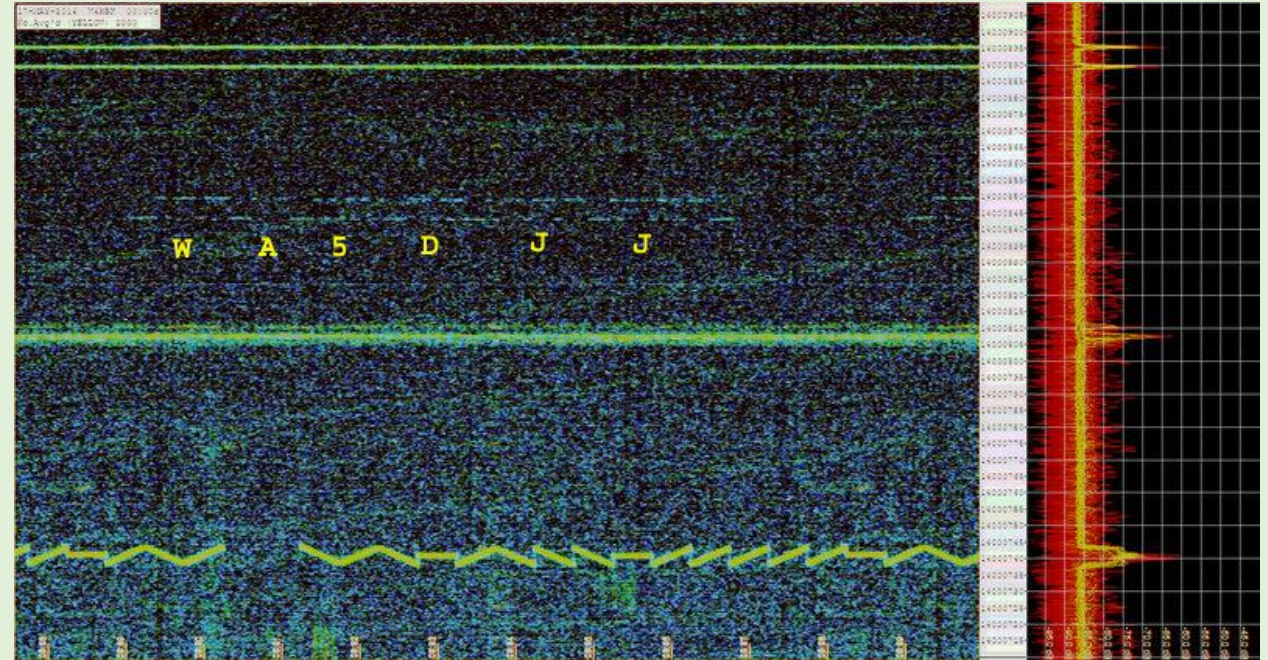
The FSKCW TEST: TRYING TO RECEIVE A LOWER SIGNAL

In the Summer of 2011 W4HBK and I tried to do a FSKCW mode test at 6 second dits and 18 second dahs (27 seconds to send the letter A) to see how low we could go and still detect and read a signal. Another difference this time, Bill W4HBK deployed a technique of stacking the spectrum analyzer pictures to increase the sensitivity. It is a technique borrowed from the astronomy guys to make stars brighter by stacking multiple views and the washing out the noise electronically. This test got us to a level of 8.51uW (.00000851 Watts) for the 1,164 mile path.



The Holy Grail of 1.164 Billion miles per Watt! (Actually 1,164 miles using 1uW)

Bill W4HBK kept insisting that we can do the same distance at 1 microwatt. So we waited until 11/2013 to try again. It was a long test. Frequency stability has to be solid because we had to stack 3 hours of signals (18 frames) to see it. During the test we had physical problems with storms, freezing weather, power outages and the raccoons wanted to rewire antenna connections. But we finally accomplished it on May 17, 2014. We stacked it twice just to make sure. This wouldn't have happened without Bill W4HBK's expertise and perseverance.

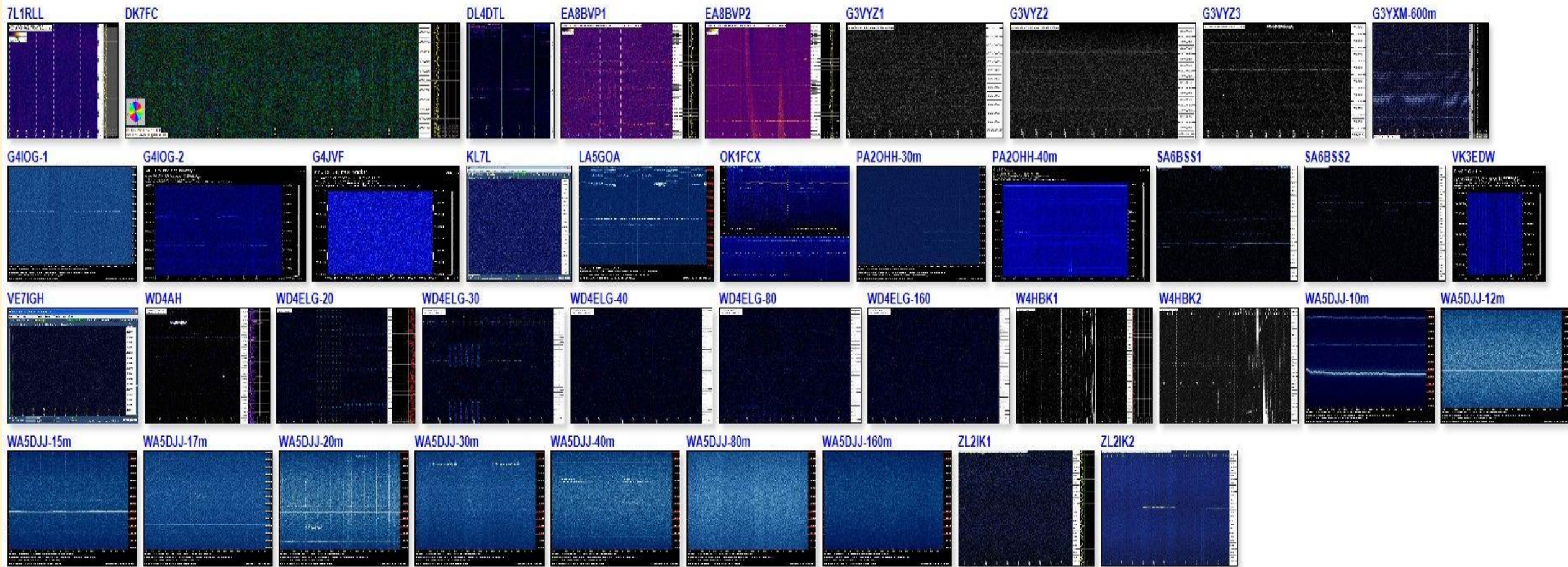


The LIFEBLOOD of QRSS is the GRABBERS

These are the dedicated receiver stations that copy the signals using a GOOD receiver connected to a computer that is connected to the internet where the computer's spectrum analyzer display is available for anyone to view or download. These signal grabbers operate 24/7 and the operators work very hard to make them sensitive and reliable. If you think that is easy try leaving your radio on for months at a time through good and bad weather. It is a BIG JOB BEING A QRSS GRABBER. Here is a picture of W4HBK's grabber during the 1uW test. (Please notice that it is just standard Amateur Radio Equipment MODIFIED for the task)



QRSS GRABBERS WORLD WIDE



This is a thumbnail picture of the QRSS Plus website and shows a real time image of the active QRSS grabbers that are presently on line in the world and any given time. This website <http://swharden.com/qrss/plus/> is extremely useful in spotting your signal on the various active QRSS grabbers throughout the world. This screenshot was taken on 9/7/2018

Building a QRSS GRABBER

The basic building blocks of a QRSS grabber are a GOOD receiver and antenna on the frequency you have chosen to operate. A computer sound card. A processor that is capable of running a audio spectrum analyzer program and a website to display it on so others may access it and view it. This can be an expensive and time consuming endeavor but really rewarding when you see the signals from all over the world appear on your spectrum analyzer screen. It is also a REAL asset to the hundreds of QRSS transmitter operators who are trying to see how far their signal has traveled or the results of their experimental transmitter design of a new circuit they are trying out for the first time.

WE DO NOT HAVE ENOUGH QRSS GRABBERS IN THE WORLD TO FILL THE NEED OF THE AVAILABLE QRSS TRANSMITTERS. WE ALSO NEED MORE QRSS SIGNALS ON ALL OF THE AMATEUR BANDS FOR THE GRABBERS TO HEAR.

The SUPER GRABBER CONCEPT:

Now imagine of being able to have a QRSS grabber on EACH Amateur Radio Band in which QRSS is transmitted. That would be one receiver, soundcard, computer processor for each amateur radio band along with a website for the displays of the spectrum results received.

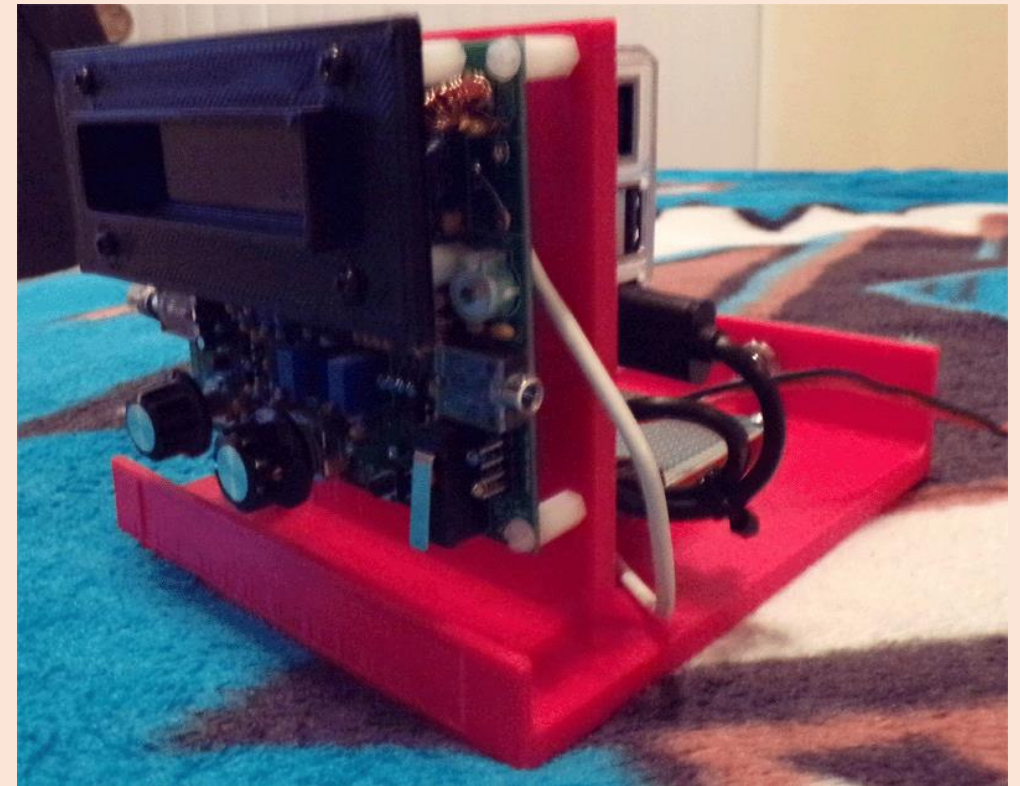
(<http://www.qsl.net/wa5djj>) Over the years, receiver technology and computer processors have become smaller, more powerful and LESS EXPENSIVE to make the SUPER GRABBER concept possible. So, this is my third attempt to build something like this and it is the only one in the world. (This Super Grabber also processes WSPR signals and reports them to WSPRNET.ORG)



The Receiver modules

Each Receiver module contains all the electronics required to be a QRSS grabber. It has a antenna connection, power connection and where required a 10MHz frequency standard connection. The Receivers are QRPLabs QCX single band transceiver kit @ \$49 each. The USB sound card @ \$8 each and a Raspberry Pi 3 microprocessor with WIFI @ \$35 each. (Total cost about \$100) This greatly reduces the cost of building a QRSS GRABBER and makes a SUPER GRABBER within the realm of reality. (My first grabber using a commercial receiver and a PC cost me about \$1,500 for one frequency) The Raspberry Pi runs the LOPORA program for QRSS developed by PA20HH who provides it free to the QRSS community.

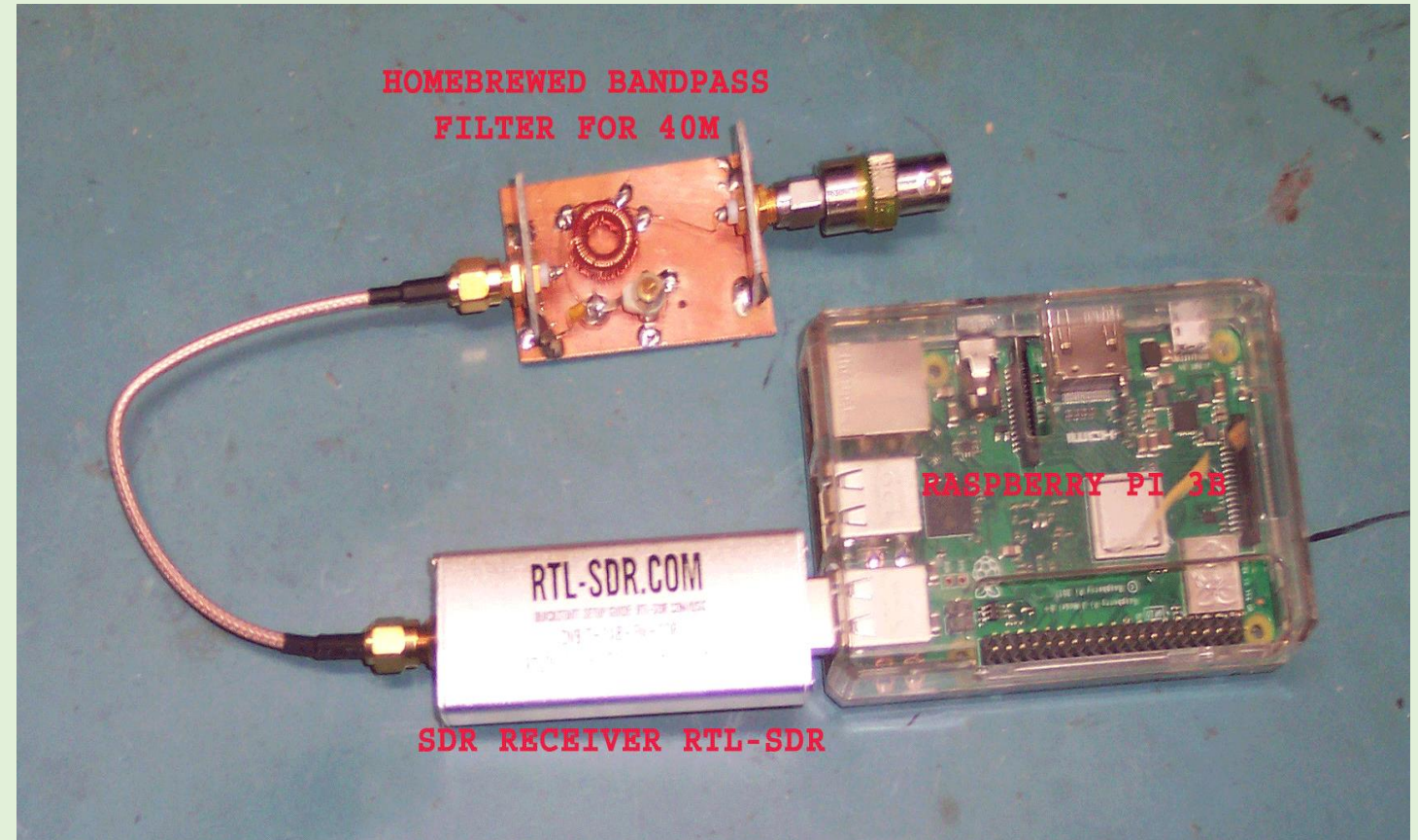
<https://www.qsl.net/pa2ohh/>



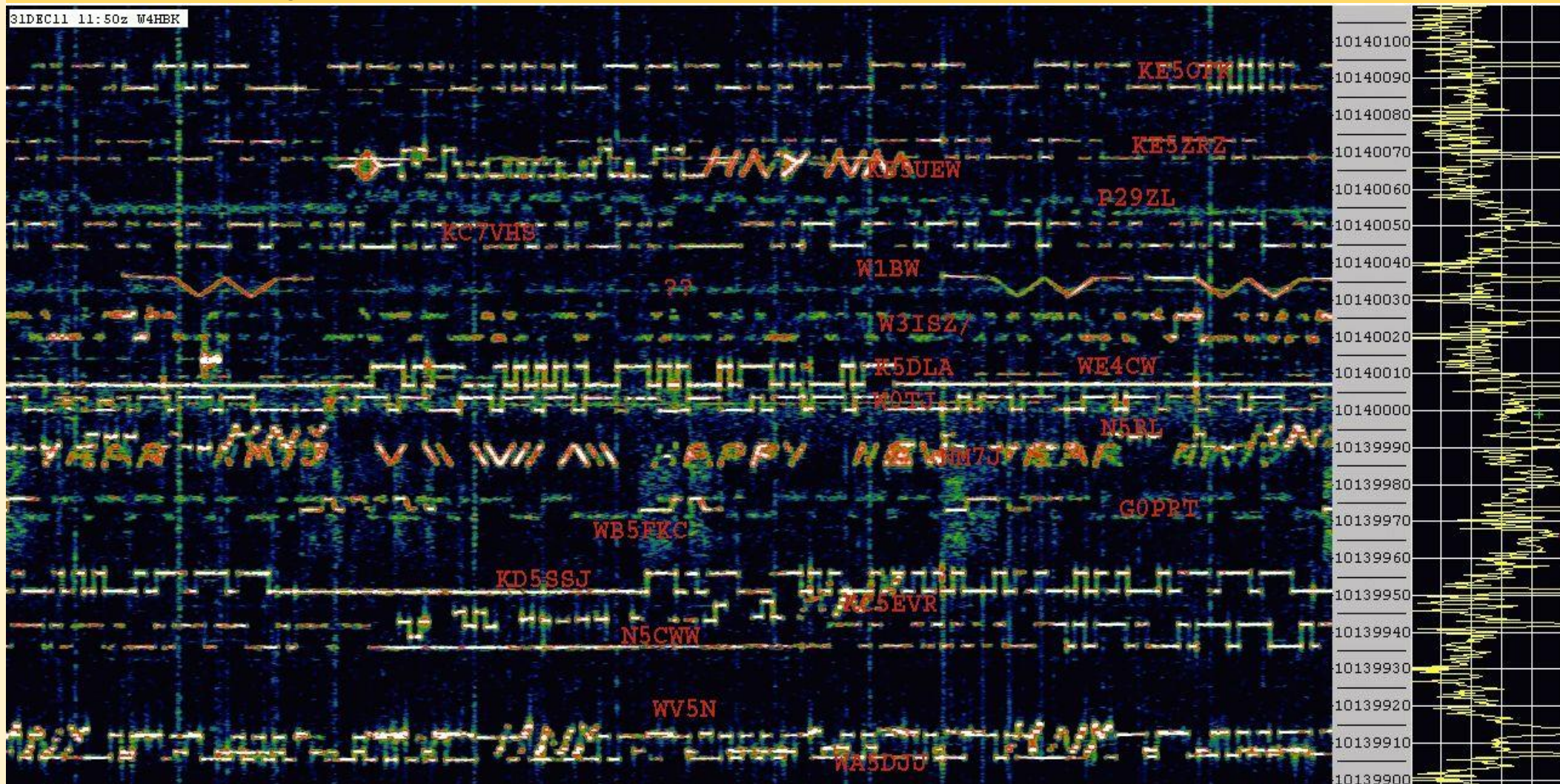
AN INEXPENSIVE “EASY” GRABBER:

This is the least expensive QRSS grabber I have been able to build. It costs about \$65. PA20HH has made a RTL-SDR version of the LOPORA software that also controls RTL-SDR receiver module. With a simple bandpass filter for the band of interest (this one is from the QRPLabs QCX receiver) this QRSS Grabber configuration works amazingly well. The better the antenna the more signals you will receive. The whole grabber runs on a 5VDC @ 2.5 Amp wall wart power supply and the software also contains the ability to upload the pictures to a internet website. It is a good place to start to learn how to build and operate a simple grabber. Checkout this website:

<https://www.qsl.net/pa2ohh/19rtlsdrlop.htm>

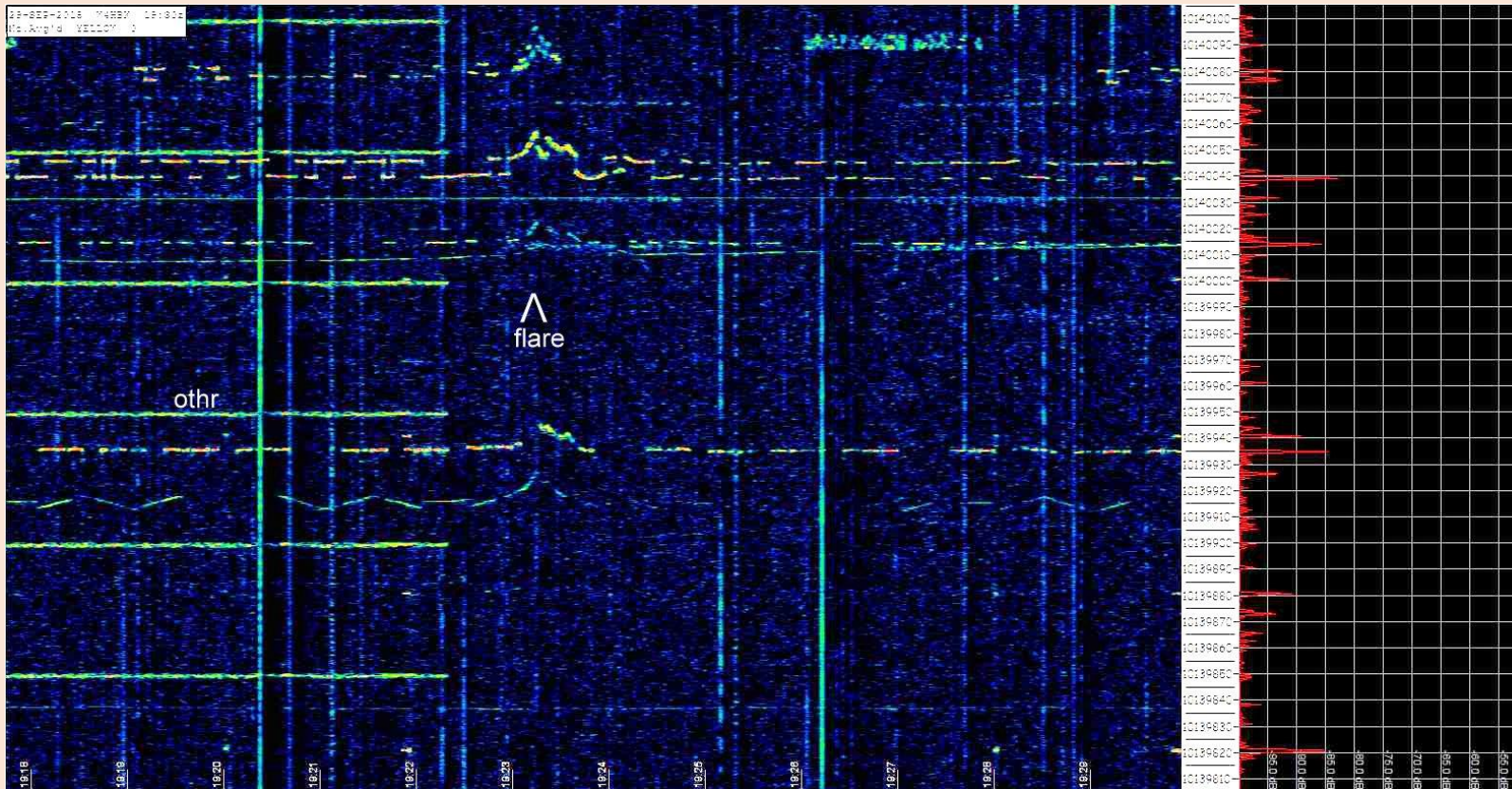


We also just have fun:



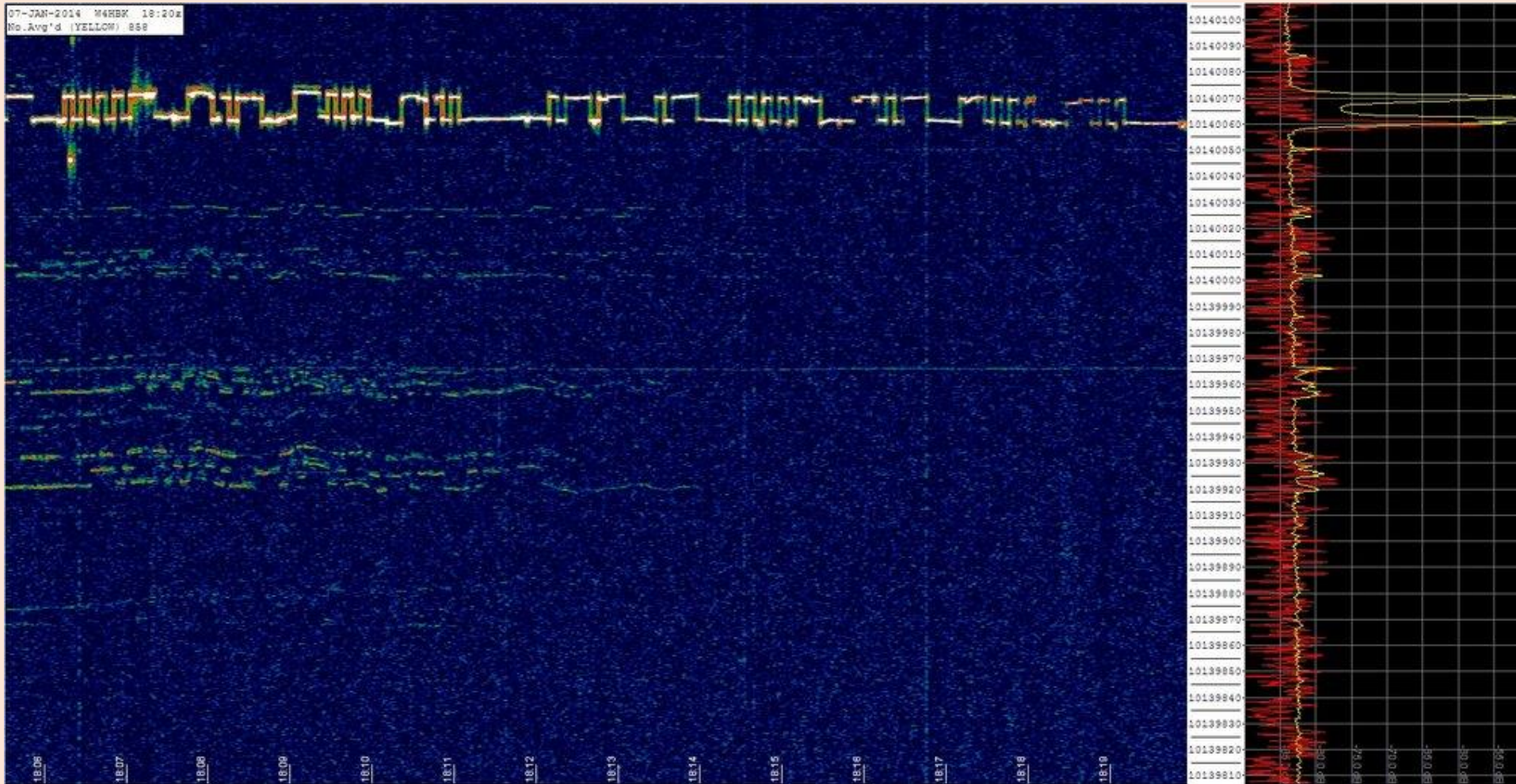
Every Year on New Year's eve we all get together and turn on our QRSS Transmitters in Mass. The original object was to fill all the known grabbers in the world on 30Meters with signals. This was planned by the operators without notifying the Grabber Operators. Imagine the surprise when they looked at the grabber and it looked like the picture above. Most of the signal there came from Las Cruces, New Mexico. The Grabber was W4HBK in Pensacola, FL who named us the Las Cruces QRSS Mafia. There are 22 signals on the screen including 2 DX stations (Papua, New Guinea and England). This is from the 31 December 2011 test and the second year we did this.

Things I have seen on QRSS:Solar Flare 1:



This is a screenshot of the arrival of a Coronal Mass Ejection of particles from the Sun. When it comes in contact with the ionosphere it causes it to distort. Radios signals that arrive the ionospheric layers are distorted. This picture shows some of these distortions. (this is my favorite and most interesting part of QRSS. Most signals are from New Mexico as copied in Florida.

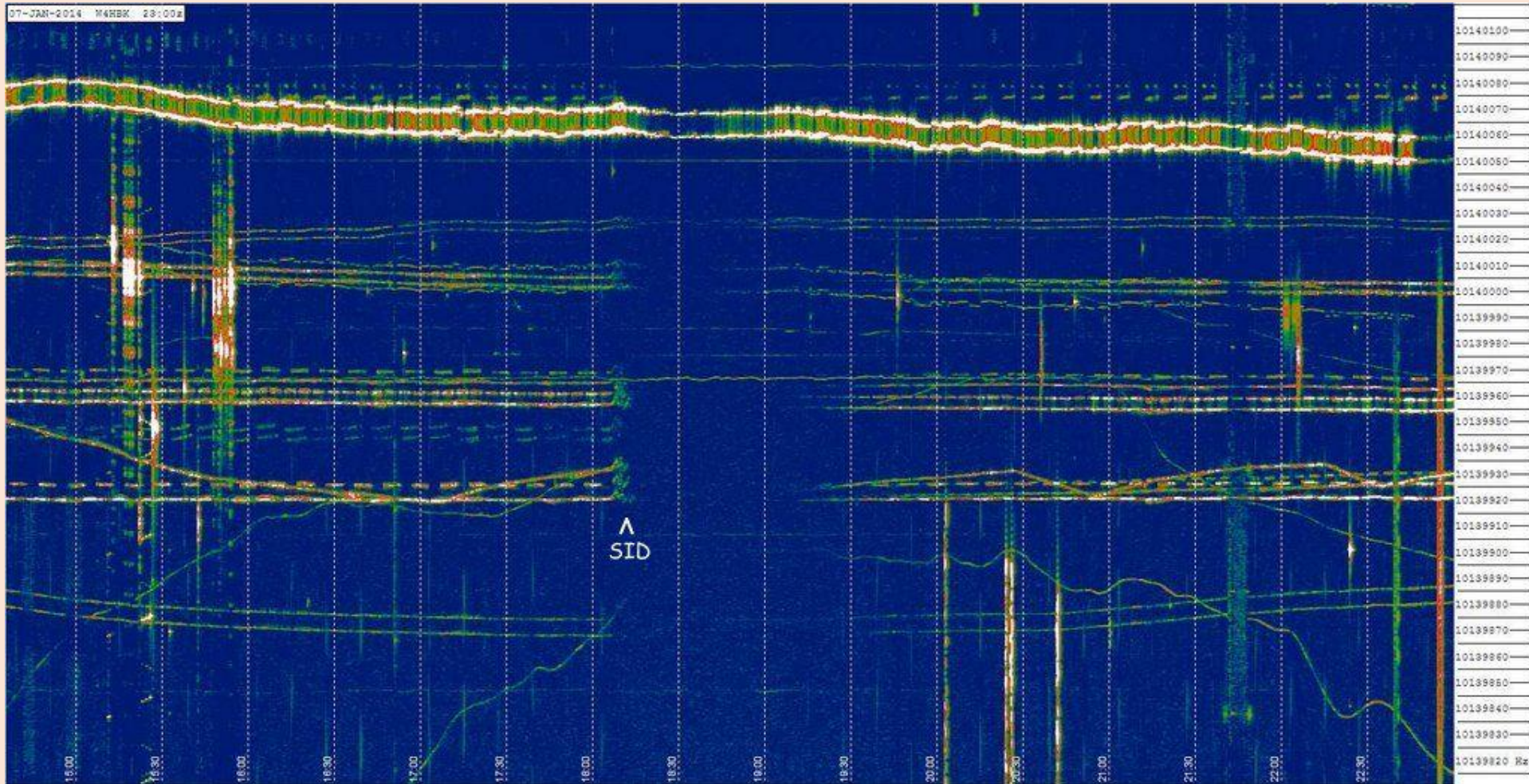
Solar Flare 2: (10 minute view)



This a picture of the arrival of the XRAY emission of a Solar flare. When this happens, the D layer of the ionosphere ionizes and skywave signals are totally attenuated. This is a 10 minute view showing the period of this effect and you can see the distortion of the E and F ionospheric layers as the earth is hit by the XRAY emission from the solar flare.

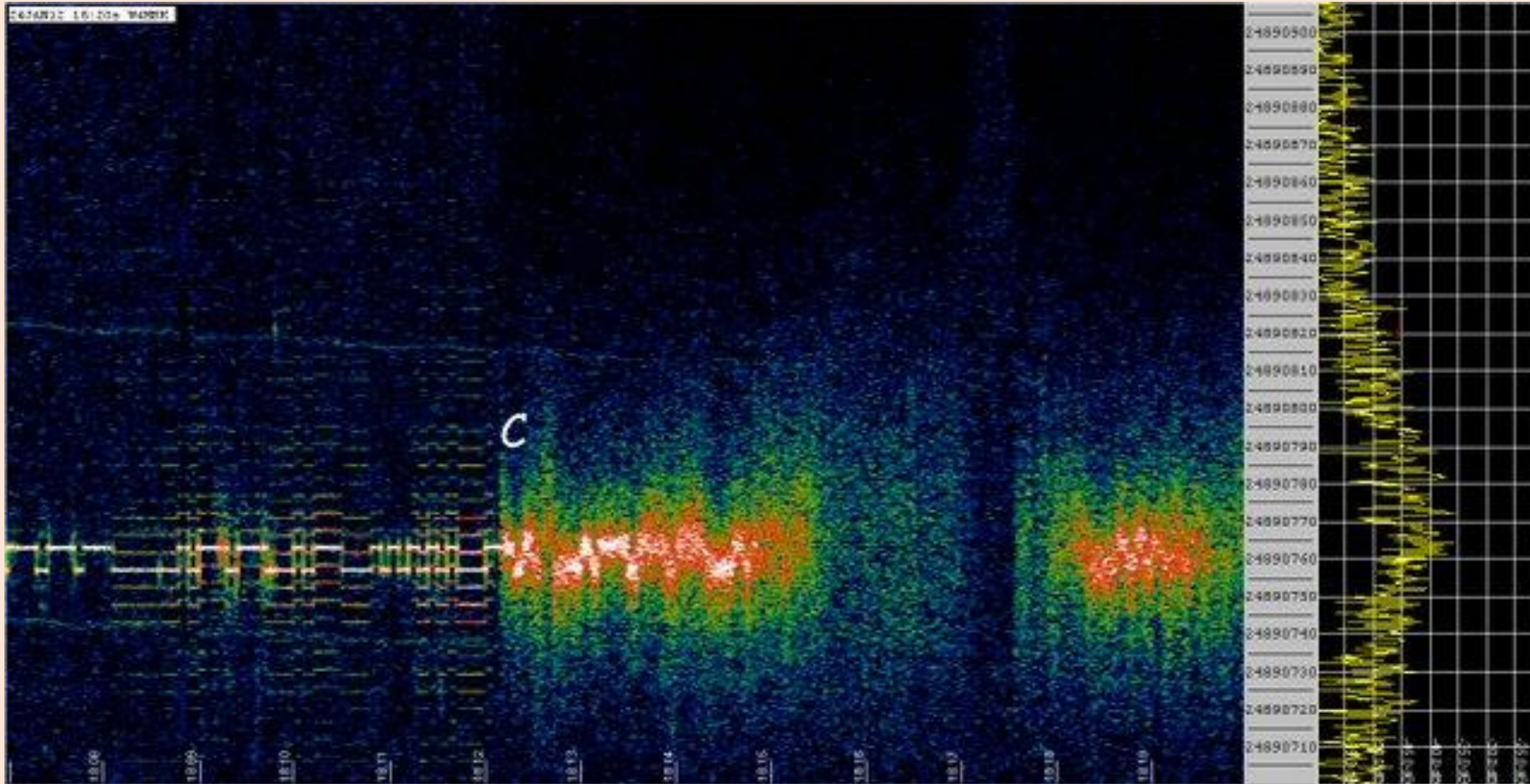
The upper signal of WA4KBD was a ground wave signal that was not attenuated by ionization but was still slightly distorted by the earth's magnetic field fluctuations.

Solar Flare 2: (8 Hour View)



This is the 8 hour picture of the same solar flare. It shows the length of the D layer ionization and attenuation of the skywave signals arriving at W4HBK's grabber. As you can see the period was from about 18:10Z to 19:20Z. You can also see more clearly some attenuation of WA4KBD's signal but that it was still visible through the total blackout period but all the New Mexico signals were totally gone.

THEN THERE IS THIS ONE:
I have no explanation for this one.



This is a 10 minute display of my signal on W4HBK's grabber. The multiple signals appears in the first 4 minutes of the picture. There is not a known explanation of how this happens. Then my signal is greatly amplified and distorted by the ionosphere for the rest of the screenshot. I can't explain what is going on to cause this screenshot other than the only times these effects have been seen are during a Coronal Mass Ejections from the Sun.

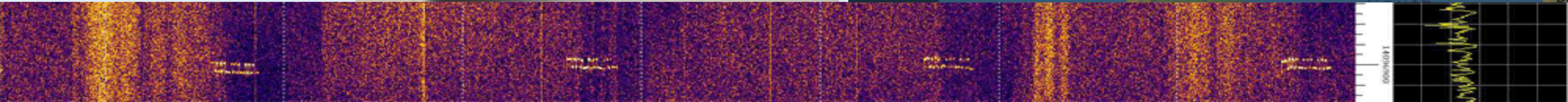
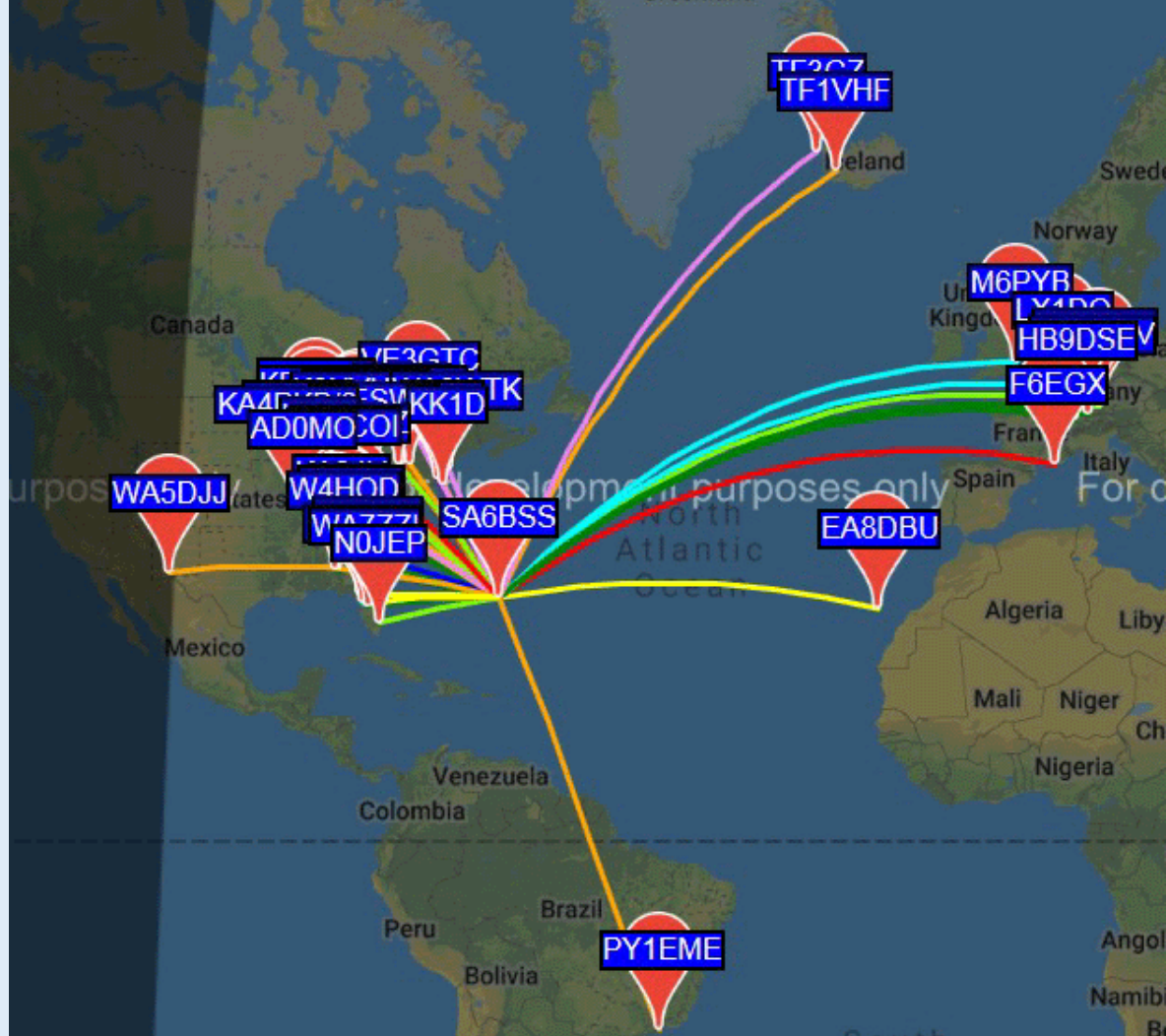
TRACKING AMATEUR BALLOONS

This is becoming an interesting worldwide sport. Amateurs are building miniature free floating balloons that carry a WSPR transponder, a GPS receiver, a control module and a QRSS transmitter. Power output of about .025 Watts.

They are usually powered by 3.3VDC solar panels (from lawn lights) and some have batteries while others do not to save weight . Most use a measured amount of Hydrogen to provide lift and try to hover at a neutral balance point in altitude around 40,000 feet. Many of these balloons have made multiple trips around the earth and provide many Amateur Radio Operators a chance to participate in the tracking and reception of the WSPR and QRSS signals. This is a excellent opportunity to test your antenna coverage and receiver sensitivity of your grabber.

Here are some pictures of SA6BSS's Balloon Hardware

Balloon electronics module on a gram scale with a total weight of 4.26 grams. Power output of 10mW on 20M QRSS and WSPR. No Batteries so it operates only when in the sunlight. Uses a 36" Mylar balloon and Hydrogen gas. Some have made 13 trips around the earth. Total weight of everything is around 13grams.



What you can learn from QRSS?

You can learn the characteristics of antennas and how they REALLY work.

You can learn how to make your own transmitters and receivers.

You can learn a lot of new skills in computer programming, website building, propagation, soldering techniques, improving your station so it gets out farther, interfacing with Amateurs who have the same interests in QRSS, working with small signals can be just as rewarding as big ones, Learning the new technologies can help you go farther than you ever imagined.

I have learned more about Amateur Radio doing QRSS than any other project I have done in the 61 years I have been an Amateur Radio Operator. But you have to work at it.

I have had a lot of Help over the years:

I have been very fortunate to have a great group of Amateur Radio Friends over the past 12 years. Most of them are also QRSS amateurs scattered throughout the world and in my local area. They were the sounding board to present my theories and discuss them. They helped me make software that worked. Most of them joined me building QRSS transmitters and receivers and are HONORED members of the Las Cruces QRSS MAFIA. We have come a long way technically in 12 years together. For me it was a lot of fun, a great learning experience, and a honor to be member of this Outstanding Group. The best way to get started is to try to listen to the signals and then build or buy a QRSS transmitter kit. There is always help on the internet from the QRSSKNIGHTS reflector and others. <https://groups.io/g/qrssknights/topics>

QUESTIONS?

There are no “dumb” questions.

The SUPER GRABBERS WEBSITE: <http://www.qsl.net/wa5djj/>

For expanding information:

Visit my website: http://www.zianet.com/dhassall/QRSS_A.html

Visit QRSS Groups.io: <https://groups.io/g/qrssknights>

For QRSS Kits: <http://qrp-labs.com/>

If you need help getting started, let me know at: dhassall@zianet.com

I welcome visitors to my shack anytime and always available via email.

