EHF MICROWAVE ACTIVITY MARCH 1, 2023

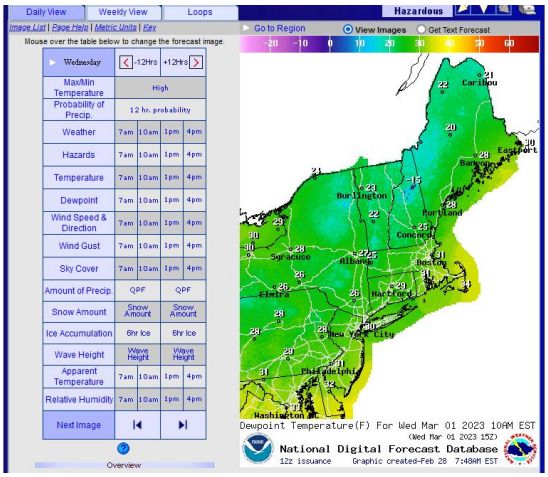
MIKE SEGUIN N1JEZ

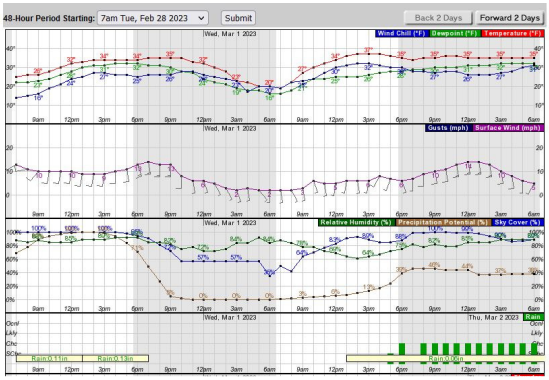
[*Note from W1GHZ – Mike and Henry, KT1J, have been trying for at least 12 years to make a 241 GHz contact of at least 1 km.*]

On Wednesday March 1, a group of 5 hams met at the QTH of Henry, KT1J in Addison, Vermont. Our goal was to try and make successful contacts on 134 GHz, 241 GHz, 322 GHz and possibly 403 GHz.

Operators included Brian, WA1ZMS Henry, KT1J Paul, W1GHZ Chip, W1AIM and Mike, N1JEZ.

The conditions were fair with average temps in the low 30's and a dewpoint in the low to mid 20's as the day progressed.





We planned on working along a 1.12 km path on Town Line Road in Addison which is about 0.5 miles from Henry's QTH. It is a lightly traveled dirt road which allowed easy setup. The path is LOS.

Brian provided the rigs we used. Two for 134 GHz and two for 241/322/403 GHz. A quick overview of the rig design follows.

-A low phase noise 10MHz OCXO drives a direct frequency synthesizer, whose output is used as the reference input for a Frequency West PLL.

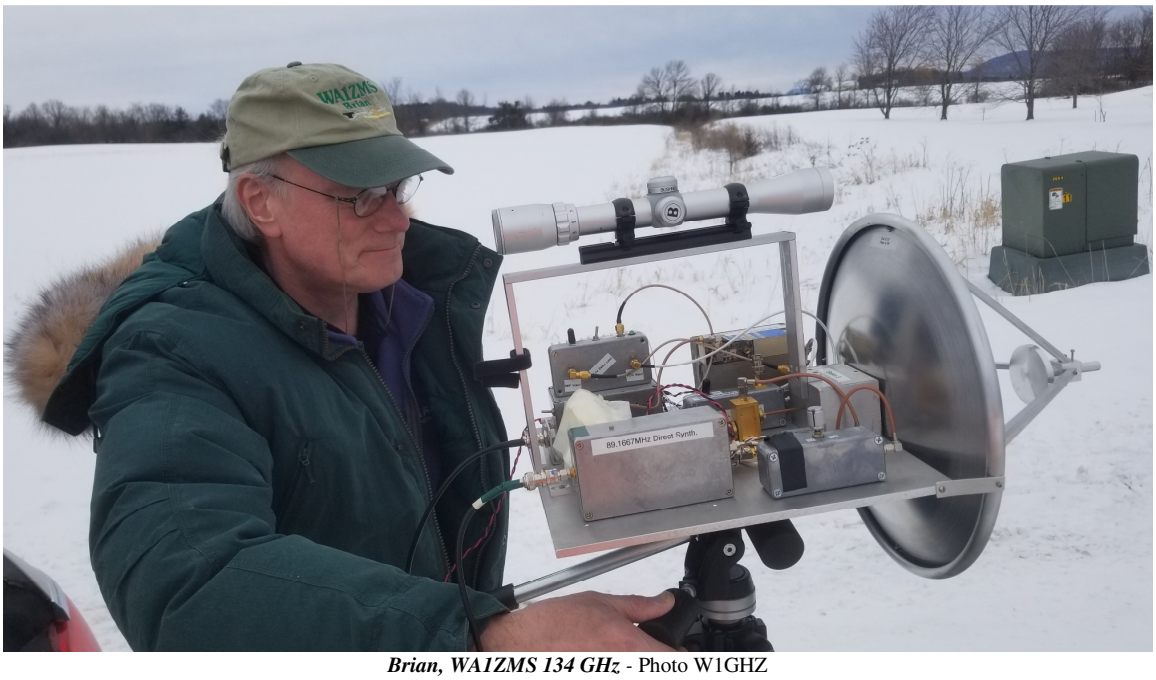
-Both the VCO and step recovery diode outputs of the Frequency West PLL are used to phase lock a Gunn oscillator. The Gunn output then drives a GaAs Shotkey diode frequency multiplier.

-The multiplier's output is used as the TX signal and the antenna is a 30cm parabolic dish with a Cassegrain feed.

-For a given band, each station of the pair transmits on a slightly different frequency. Doing this allows for the TX diode multiplier to also serve as a receive mixer. (This is reminiscent of a Gunnplexer system, as the difference between the two transmit frequencies is the receiver IF frequency.)

-The 241GHz stations also include variable attenuators and DC bias circuitry to intentionally shift the mode of operation of the power multiplier diodes from varactor-mode to varistor-mode to exploit higher harmonics such as 322 and 403GHz.

-Contacts are made using FSK CW which is generated by slightly shifting the 10 MHz reference oscillators via their EFC pins.



Brian, WA1ZMS 134 GHz - Photo W1GHZ

Henry, KT1J Mike, N1JEZ Brian, WA1ZMS 241 GHz - Photo W1GHZ

We tried 134 GHz first. We set up the rigs about 15' apart to verify operation.

Initial rig set up and test - Photo W1GHZ

We ran into an issue with the N1JEZ rig where it didn't want to hold lock in the cold. After the application of a few hand warmers, some 'tweaking' by Brian and a power supply change, we were set to go. The initial power was from the car, but it had enough noise to affect the locking. Clean power from a hefty gel cell cured the problem.

PLL locking in the cold - Photo W1GHZ

Brian carefully placed his rig in the trunk of his car, with it still powered and slowly drove to the end of the 1.1km path. As soon as he got the rig on his tripod at the far end, I was able to see a trace in the waterfall on my SDR. The IF on 134 GHz works out to be 522.667 MHz. I used a Funcube Pro+ and HDSDR. Brian used AirSpy. Brian and Paul operated at one end and Henry, Chip and I were at the other end. Signals were easy copy about 30 dB+ out of the noise.

Contacts in the log:

1. KT1J WA1ZMS 17:13z FN34 134GHz
2. W1AIM WA1ZMS 17:20z FN34 134GHz
3. N1JEZ W1GHZ 17:26z FN34 134GHz

Following these successful contacts Brian and Paul stowed the 134 GHz rig and drove back down to our end.

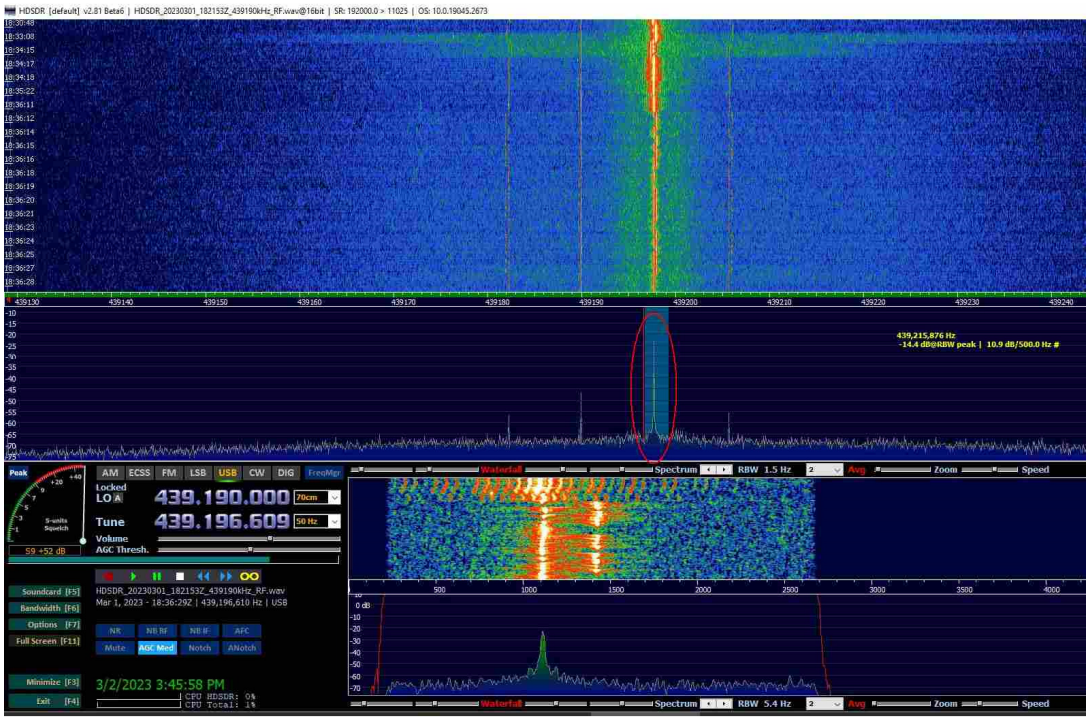
We repeated the same test procedure for 241 GHz setting up about 15' apart to verify operation. The 241 GHz signal was extremely loud! Brian then placed the 241 GHz rig in the trunk of his car, still powered with the trunk open. He slowly took off and headed to the other end of the 1.1 km path. I could still hear the rig as he was moving and was laughing as the signal doppler shifted all over. Wish I could have caught that on the SDR.

Once set up, contacts were easily made.

1. KT1J WA1ZMS 18:27z FN34 241GHz
2. W1AIM WA1ZMS 18:32z FN34 241GHz
3. W1GHZ N1JEZ 18:38z FN34 241GHz

Here is a screen shot of the signal at 241 GHz at the N1JEZ end. Peaking about -23 and the noise floor ~ -65.

In the bottom 'audio' waterfall, you can see the FSK. Keying speed was about 3 wpm because the oscillators would not shift frequency any faster.



Following this success, we tried 322 GHz. The first contact between Brian and myself was quite weak. I started with headphones, but after I made a slight bias adjustment to the mixer, Henry and Chip were able to copy by ear without headphones as the signals improved.

During our 322 GHz contacts, Dick, W2AAU accidentally showed up. He was out scouting a Rover site for W2SZ and noticed the dishes and stopped only to find Henry, Chip and I. He then traveled up to the far end where Brian and Paul set up and worked W1AIM on 322 GHz.

1. N1JEZ WA1ZMS 18:54z FN34 322GHz
2. N1JEZ W1GHZ 19:00z FN34 322GHz
3. KT1J WA1ZMS 19:08z FN34 322GHz
4. W1AIM W2AAU 19:16z FN34 322GHz

We did try 403 GHz, but we saw nothing in our waterfalls. We knew conditions were not favorable (dewpoint) as the best Brian has done on 403 GHz is 1.4 km. But you never know unless you try!

Here's the setup at Brian and Paul's end on 241 GHz. The rifle scopes were spot on for alignment.

241GHz set up - Photo W1GHZ

Through the Rifle Scope looking towards N1JEZ on 241GHz - Photo W1GHZ

W1GHZ gives the "thumbs up QSL" to the camera while completing a QSO with N1JEZ on 241GHz - Photo WA1ZMS

While we had very good success on Wednesday, this was preceded by dismal failure only a few days before. On the previous Saturday, we set up 134 GHz and could not get one rig to lock. The temps and wind were producing wind chill in the negative numbers. We struggled to get the gear working in the cold, but threw in the towel after many hours of trying. We were all chilled to the bone.

We did not give up. Brian spent a lot of time tweaking/checking the rigs so they would operate reliably within the expected temperature range in advance of our second attempt and Wednesday was a very successful day!