

## **WSU Radio JOVE Campus Test**

**Esther Stutesman**

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### **Introduction**

The Radio JOVE Project is a project through NASA for “Students and amateur scientists from around the world [to] observe and analyze natural radio emission of Jupiter, the Sun” (NASA’s Radio JOVE Project). The project provides you with a kit to build your own radio antenna, and you can choose between assembling it yourself or having them professionally assemble it for you. I got the kit you must assemble yourself. I spent the week of June 9<sup>th</sup> assembling the antennas in preparation for my first set up on June 16<sup>th</sup>. Unfortunately, my spectrograph software was not set up properly, so it was not working to record at the time of my first setup. By the time of my second setup, I had gotten the software working and was able to record the data I have now.

### **Equipment**

- Radio JOVE 2.1 antennas and poles
- Compass
- Laptop with software
- Rope
- Tape measure
- Ground spike
- At least three people

### **Setup**

Setup requires at least two, preferably three people.

- Measure and mark pole locations with a tape measure compass and ground spikes.
  - I mapped my set up ahead of time in Figure 1.
- Lay down the poles next to their marked locations and tie guy lines and antenna wire to poles.
- Measure and place ground spikes for guy lines (make sure you have approval for putting spikes in the ground in your set up location)
- Set up poles:
  - One at a time, have someone place a pole upright and hold it in place for next steps.

- Tie guy lines to ground spikes.
- Keep holding pole in place while second pole is set up with the same process.
- Repeat these three steps with the other dipole.
- Attach phasing cable to appropriate dipole cable.
  - Phasing cable was decided using Figure 2 from the antenna assembly packet. The phasing was chosen based on Jupiter's maximum elevation angle for the year. In my case it is 66 degrees north, so I used a 10 ft cable shown in center panel of Fig 2.
- Attach phasing cable and other dipole cable to power combiner.
- Attach power combiner to receiver using receiver cable and proper adapters.
- Attach receiver to laptop using USB cable.
- Run software to begin gathering data.

The assembled dipoles are shown in Fig 3.

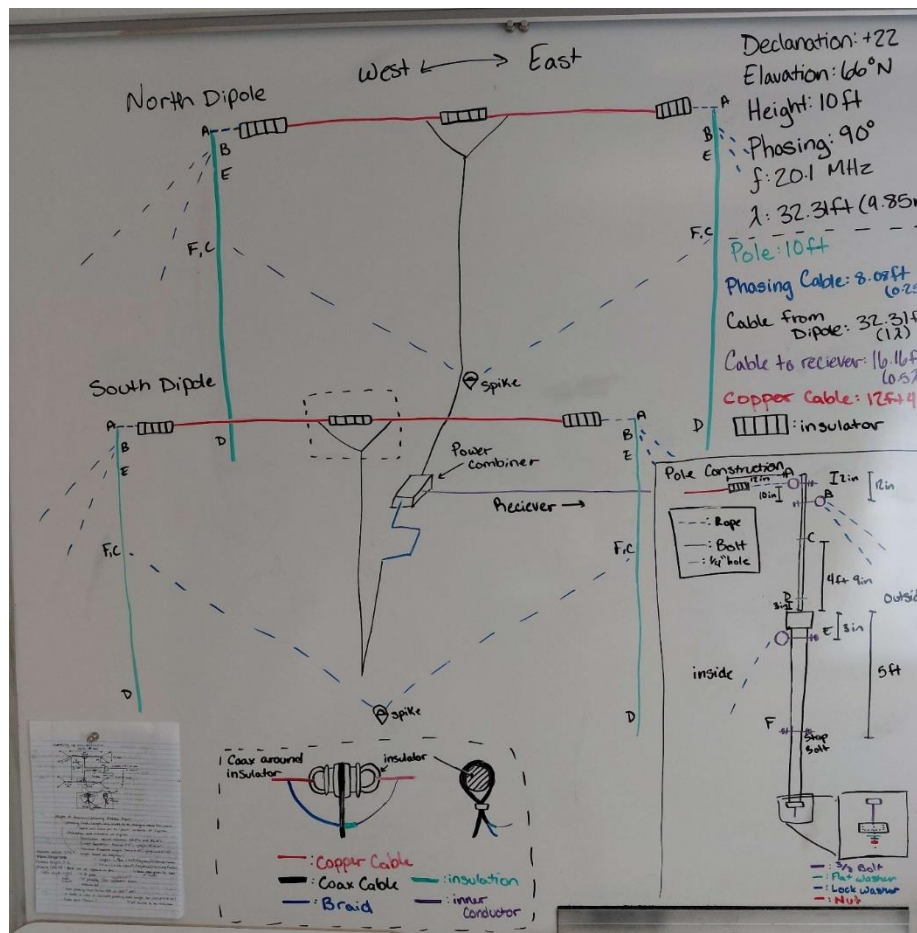
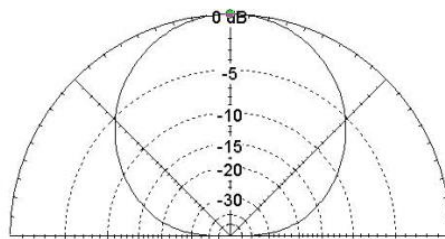
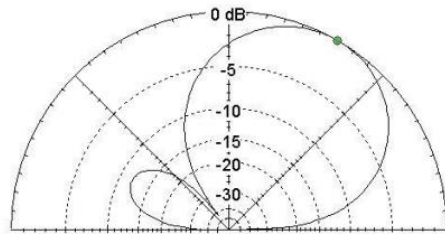


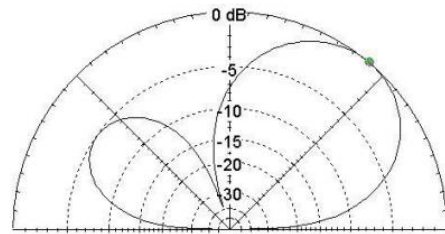
Figure 1 – Set up diagram



**Dual dipole, 10 ft, no phasing, gain = 7.8 dBi at el = 90**



**Dual dipole, 10 ft, 90 deg phasing, gain = 8.5 dBi at el = 60**



**Dual dipole, 10 ft, 135 deg phasing, gain = 8.5 dBi at el = 50**

**Figure 2 – Phasing options**



Fig 3 – dipoles assembled on WSU campus on June 30

### **Tear Down**

- Have someone hold on to each pole while the guy lines are untied from one side.
- Carefully lower pole while the other pole is held up.
  - Do the same for the other pole.
  - Repeat for the other dipole.
- Gather tent spikes.
- Detach antenna cables from poles.

### **Procedure**

The procedure for gathering data is simple. Once everything is set up, plug in the receiver to your laptop, and let the program run for as long as you plan to gather data for. Once you press “stop” the data will automatically be saved in your documents if you have to software set up correctly.



## Data/ Analysis

Set up on campus has been done twice. During the first set up, the spectrograph software had not been set up properly, so it was not working. However, for the second time it was working, so all the data gathered is from June 30<sup>th</sup>. The plan for the second set up was to try to catch a storm from Jupiter as there was one predicted for that time, which was 19:58 UTC time.

All the data I gathered I put into Figure 4. Figure 4 is 3 parts put together. This was due to my laptop running out of battery and having to switch devices and accidentally ending the recording early. Lines are drawn in the approximate sections.

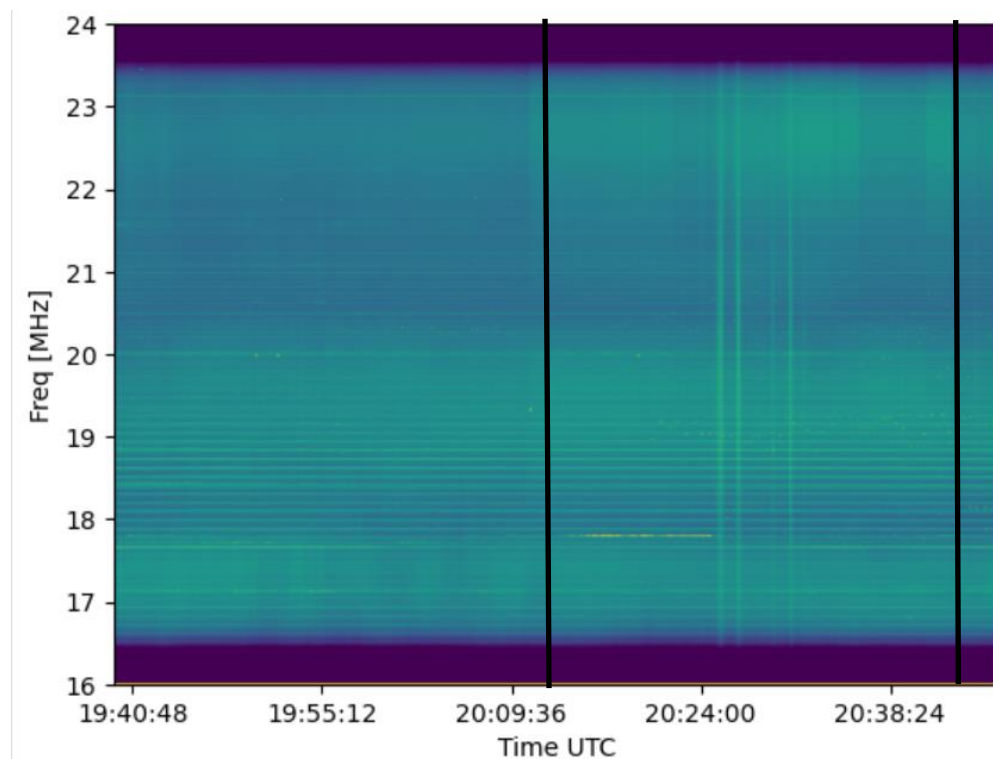


Figure 4 – Combine Data - 19:39:23.4-20:46:43.8

The first thing I noticed while gathering data was that diagonal lines I was seeing on the Radio JOVE live stream on YouTube were not unique to just the live stream, I was seeing them at well (Figure 5). Typinski (2010) explored these “Sweepers” and determined they were likely from a Relocatable Over the Horizon Radar (ROTHR) emission. I came to this conclusion due to the periodic nature I saw that matched the paper. Times I saw the sweepers are noted in Table 1.

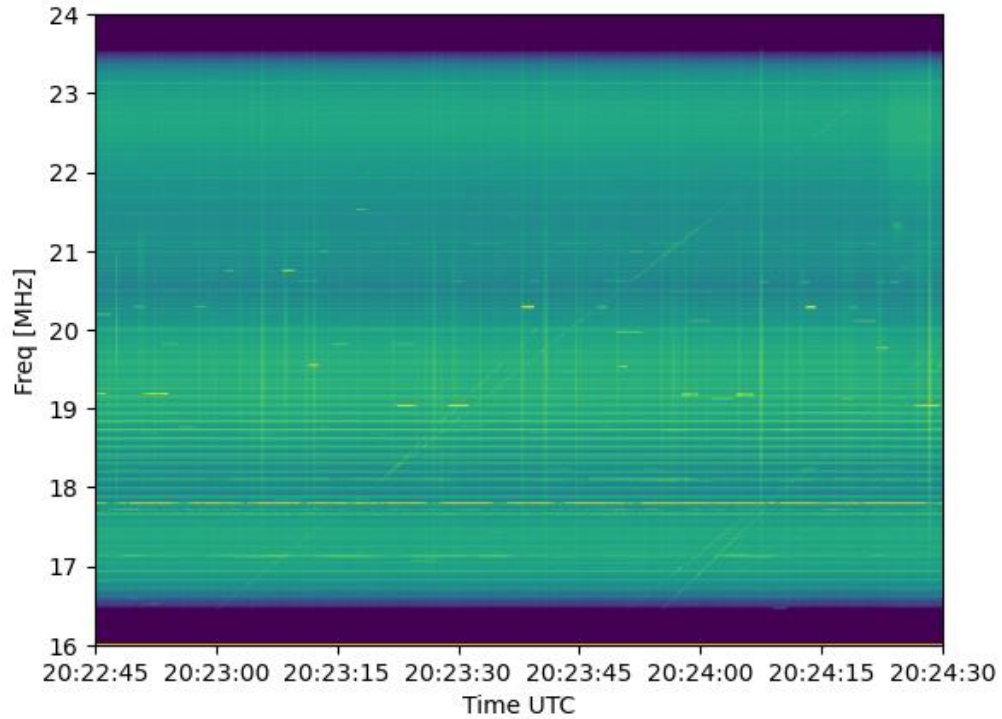


Figure 5 – “Sweepers” – 20:22:45-20:24:30 Raw Data 2

Of the eleven observed sweepers, ten fall into a predictable pattern of two groups. The first group starts at 19:47:00 UTC and repeats every twelve minutes. The second group starts at 19:47:50 UTC and also repeats every twelve minutes. Based on Typinksi’s analysis, these are likely two ROTHER stations. Sweeper number 3 seems to be an outlier and is perhaps a third station from which I only saw one sweeper.

Table 1: Start and end times of twelve observed “sweepers.”

Sweeper number	Start time (UTC)	End time (UTC)
1	19:47:00	19:48:25
2	19:47:50	19:49:00
3	19:51:45	19:52:45
4	19:59:00	20:00:25
5	19:59:50	20:00:55
6	20:11:00	20:12:25
7	20:11:50	20:12:55
8	20:23:00	20:24:25
9	20:23:50	20:24:55
10	20:35:03	20:36:27
11	20:35:55	20:37:05

After looking at the entire length of data and seeing what others were sharing on the Radio JOVE group, I believe the only activity I saw was Solar. The Solar activity can be seen in Figure 4 along with a “zoomed in” (about 10-minute section) version in figure 6. I am still trying to figure out a quantitative difference between a Solar burst and a Jupiter burst. As of right now, the only data I have gathered is Solar, so I cannot make a definitive distinction other than being told “I’ll know it when I see it.”

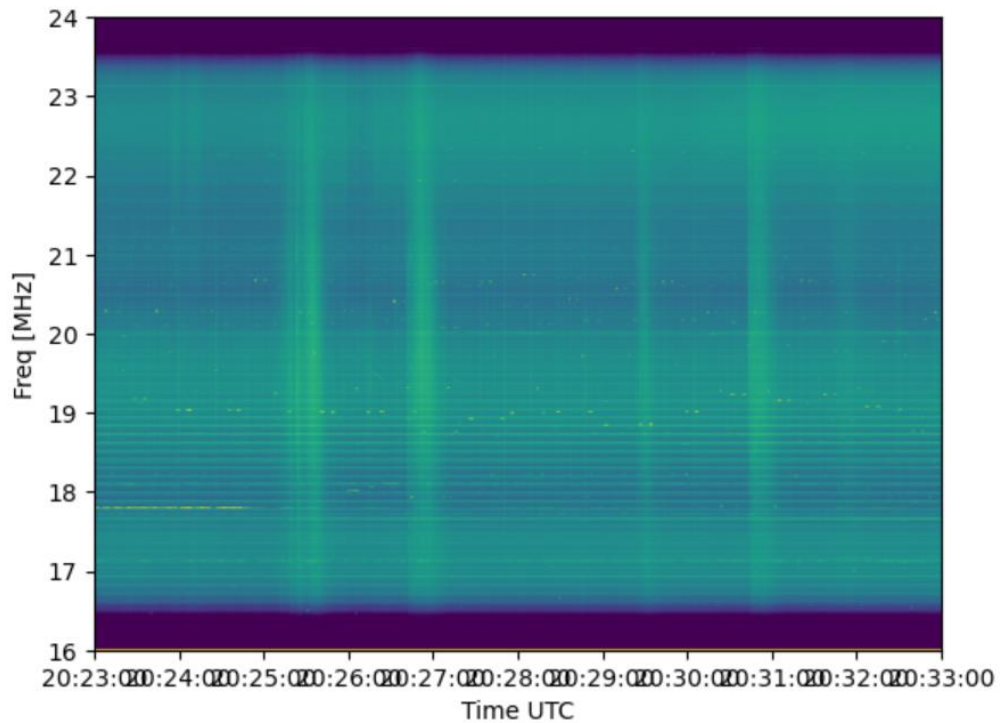


Figure 6 - Solar Bursts, 20:23:00-20:33:00, Raw Data 2

A very bright vertical strip was seen at 20:44:57 UTC, shown in Fig 7 and too narrow to see in Fig 4. After some discussion with individuals in the Radion JOVE group, I have concluded that it is most likely random radio interference from where I was set up and not anything from Jupiter or the Sun. This was decided because of how short the “burst” was and that it did not repeatedly happen. There was a suggestion that it could have been distant lighting, but that was decided against because the line only appeared once.

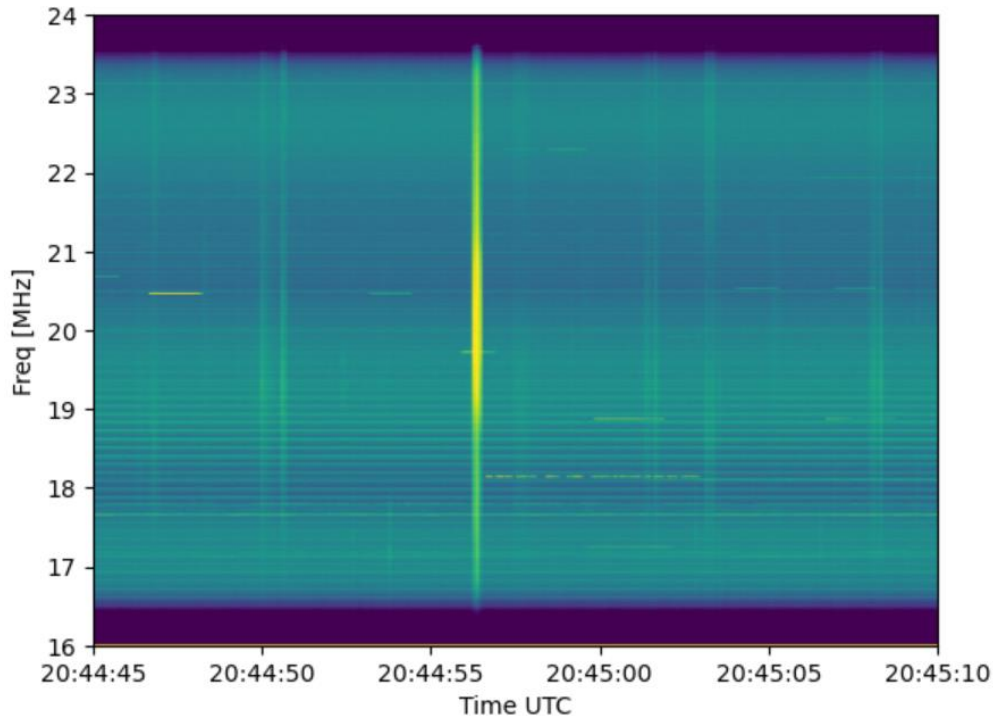


Figure 7 - Short burst, 20:44:45-20:45:10, Raw Data 3

## Conclusion

In conclusion, the second set up on campus was successful. Even though I did not record data the first time, it allowed me to learn how to use the software so that I was able to successfully capture an event the next time I went out. In the future I plan to try and set up when a storm is predicted to happen again, so that I may start looking into a more quantitative difference between Solar and Jupiter events. For next time, I would like to try and figure out how to get a power cord to my laptop so there are no gaps in my data. I would also like to be more mindful of what buttons I am pressing so I do not cause my recordings to end early.

## Sources

Typinski, Dave. *Sweepers - The Radio Jove Data Site*,  
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