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Construction and use of Radio-telescope

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CONSTRUCTION AND USE OF A RADIO TELESCOPE

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DESIGN OF SYSTEM

- I decided to use a double cross antenna design because it responds well to both vertical (FM) and horizontal (SSB and CW) polarization,
- This design ensures that I would receive a signal from any direction

SYSTEM PARAMETERS

- I then had to determine the lengths of each antenna to properly receive the signals I wanted by following this chart,
- The NOAA satellites exert signals at 137 MHz

Table 1

Dimensions of Double Cross Array (Inches)

Operating Frequency (MHz)	*137*	*145*	*435*
Dipole length	38.25	37.125	12.125
Dipole diameter	0.375	0.375	0.25
Dipole spacing	21.5	20.5	6.75
Poly coax $\lambda/4$ phasing section	14.25	13.5	4.5

BASE CONSTRUCTION

- I initially wanted to form my base out of wood, but concluded PVC would be much more stable.
  - I measured the proper lengths of each PVC pipe to ensure each antenna would be spread out according to the guidelines for the frequency I wanted to receive, and then cut a long piece of PVC 9 (about 6 feet) for the base to ensure the receiver would be high enough to avoid extraneous signals from below.
  - To ensure my network of internal cables would fit into my PVC body frame, I chose thick PVC pipe.

BASE CONSTRUCTION

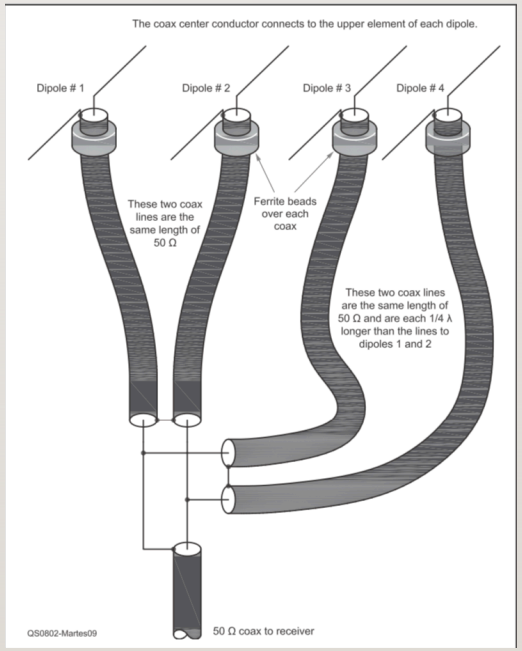
- This is what the final base looked like,

CABLE NETWORK DESIGN

- I had to cut 5 pieces of Coaxial cable
  - One piece for dipole 1
  - One piece for dipole 2
  - One piece for dipole 3
  - One piece for dipole 4
  - One piece where all dipole signals combine and are transferred into the Software Defined Radio

CABLE NETWORK DESIGN

- The two cables receiving the signals from dipole 3 and 4 had to be ¼ wavelength longer than the two cables receiving the signals from dipole 1 and 2 to account for the phase difference.
- All the cables were connected as shown,



ANTENNA DESIGN

- I initially used galvanized gardening wire as my dipoles, but later found this was not sturdy enough to collect the signals I need, and that it was

  challenging to make electrical connections to the cable

  due to the protective coating of the wire

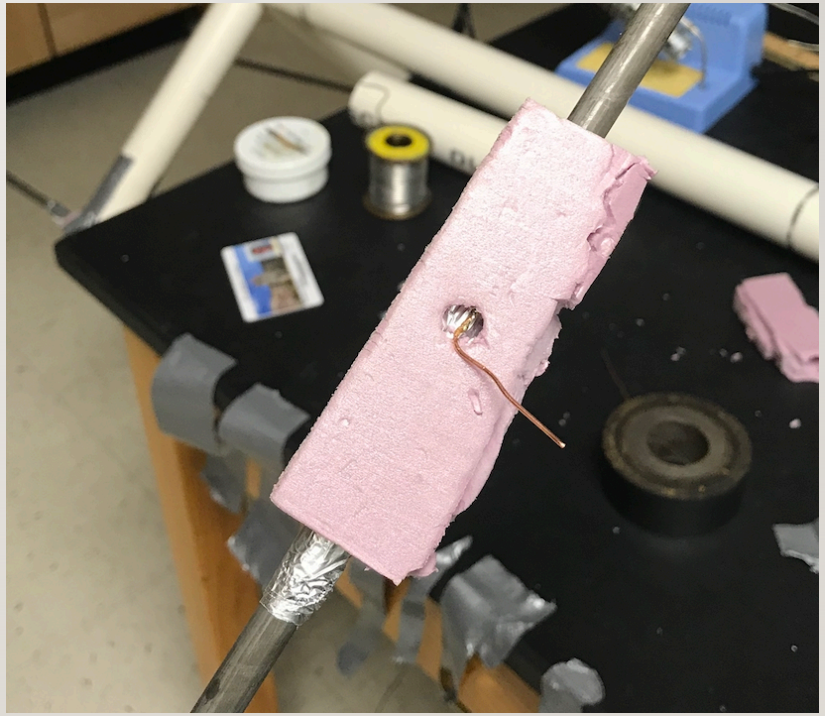
- After this, I replaced the thin wire with thicker,

  dowel rods

ANTENNA DESIGN

- I also had issues with connecting the dowel rod, but was able to determine a solution
- My solution was to coat the rods with foil, and insulation
- Between the foil and insulation, I secured wire

  to connect to the coaxial cable network

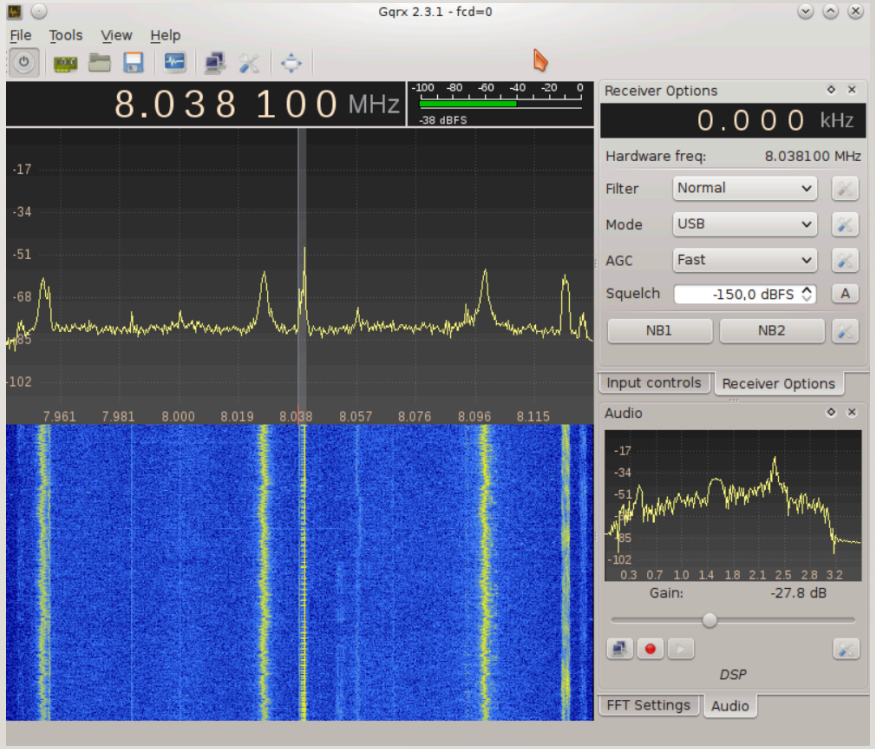


ANTENNA DESIGN

- I repeated this procedure for all four antennas
- After electrically connecting each antenna to the system, I duct taped the insulation to the four wings, ensuring each rod was tilted at 30 degrees from the base pipe
- This was the final step in completing the antenna system

ELECTRICAL OUTPUT

- The output wire that connects to all four dipole cables and travels through the base is connected to a Software Defined Radio (SDR).
- The SDR processes the signals and connects to computer
- I can then view signal in program called GQRX



PROCESSING SIGNAL

- Upon getting a signal within the range of 137 MHz, I would record the audio received
- Then I would alter the audio using Audacity to ensure it is a strong enough signal
- After, I would use a program called WXMTOIMG to convert the audio file to an image
  - This image should be a map of the Providence area

DATA COLLECTION (TBD)

- Unfortunately, due to the COVID-19 Pandemic, I was not able to collect and analyze data.
- Hopefully, Students will be interested in continuing the project into the future, as Spring 2020 is my last semester at Providence College