Design Hydrogen Line signal receiving system

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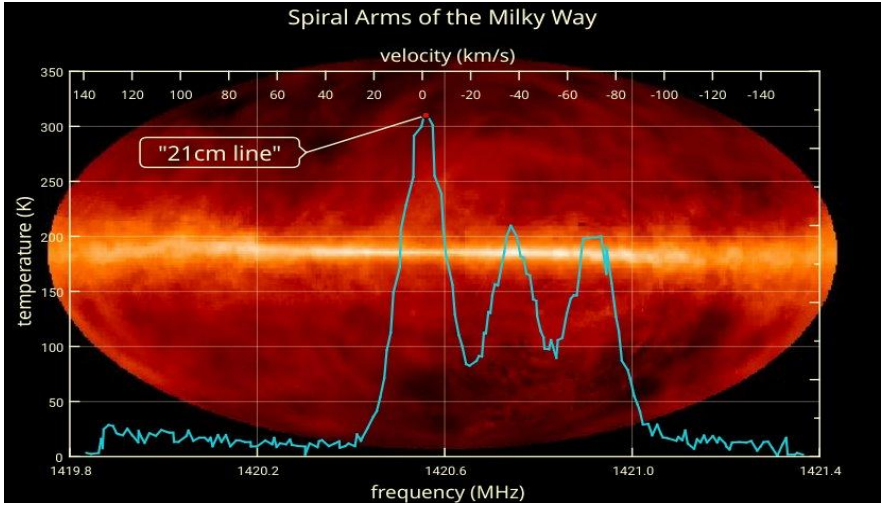
Overview

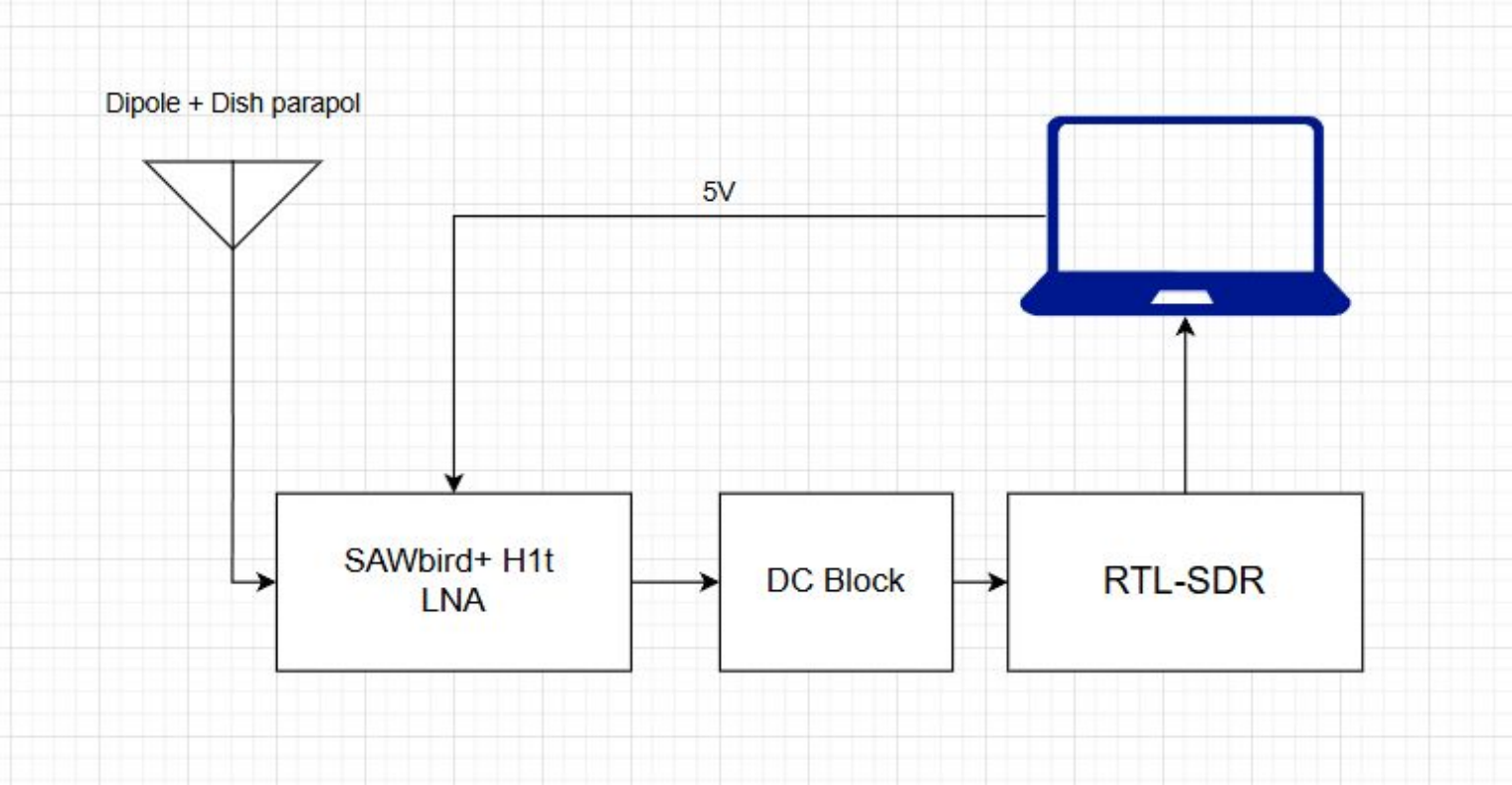
- Hydrogen Line
- System Design
- Antenna Design
- GnuRadio Software
- Data Processing
- Reference

Hydrogen Line

Hydrogen is the most abundant thing in our universe, and mapping the neutral hydrogen using the radiation it gives off can give us a pretty accurate view of what our galaxy looks like.
The hydrogen line can also give us information on how the galaxy is moving. When we're viewing an object that's moving towards or away from us, the light that we can observe blueshifts or redshifts

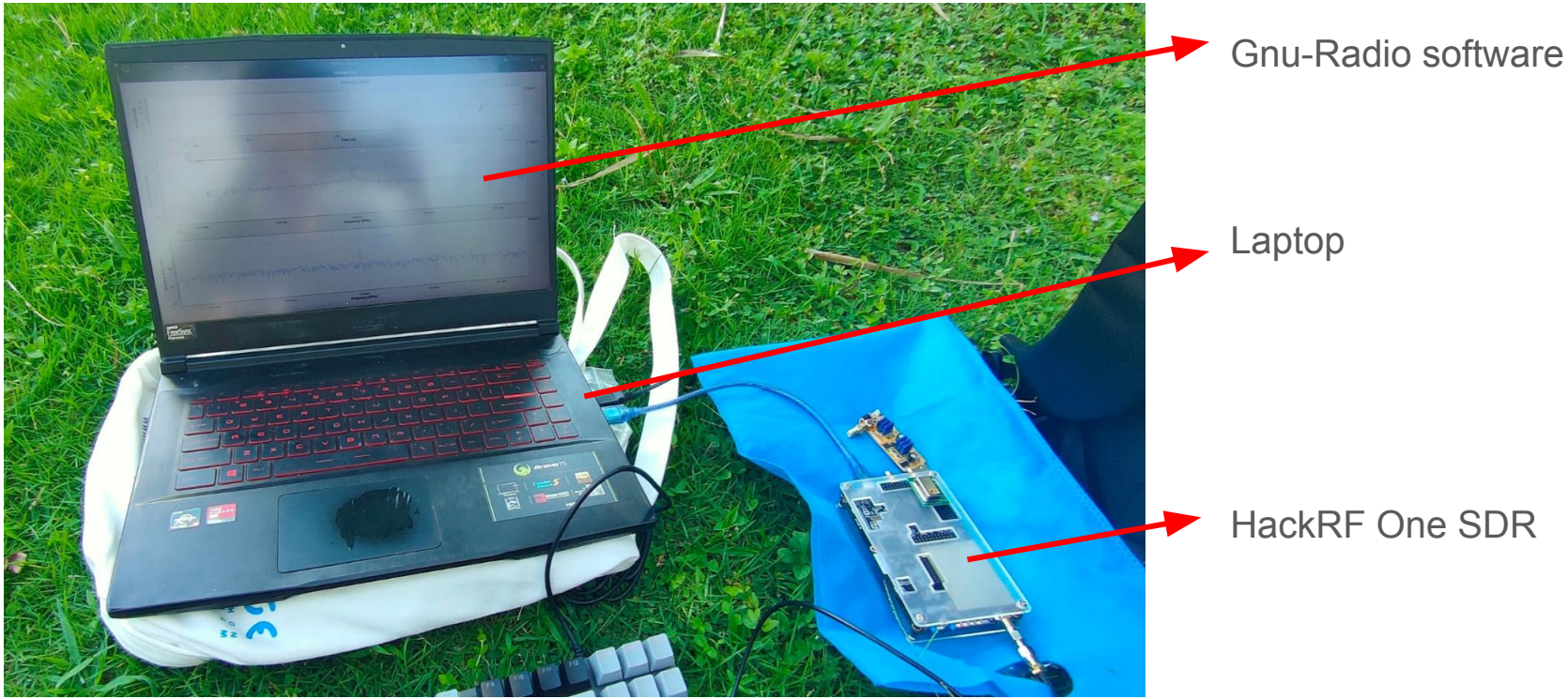


System Design - Block diagram



System Design

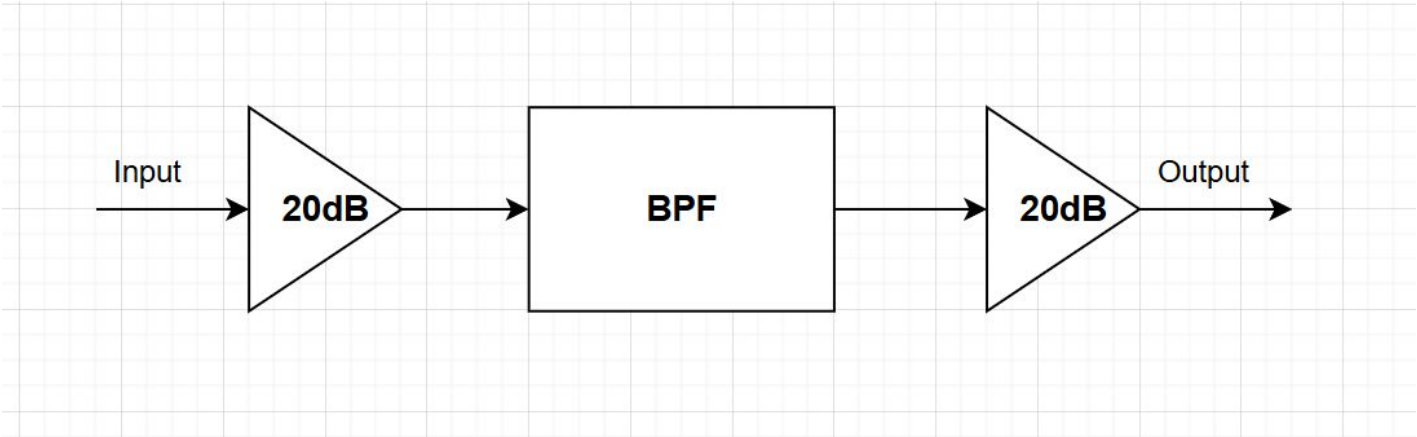
System Design



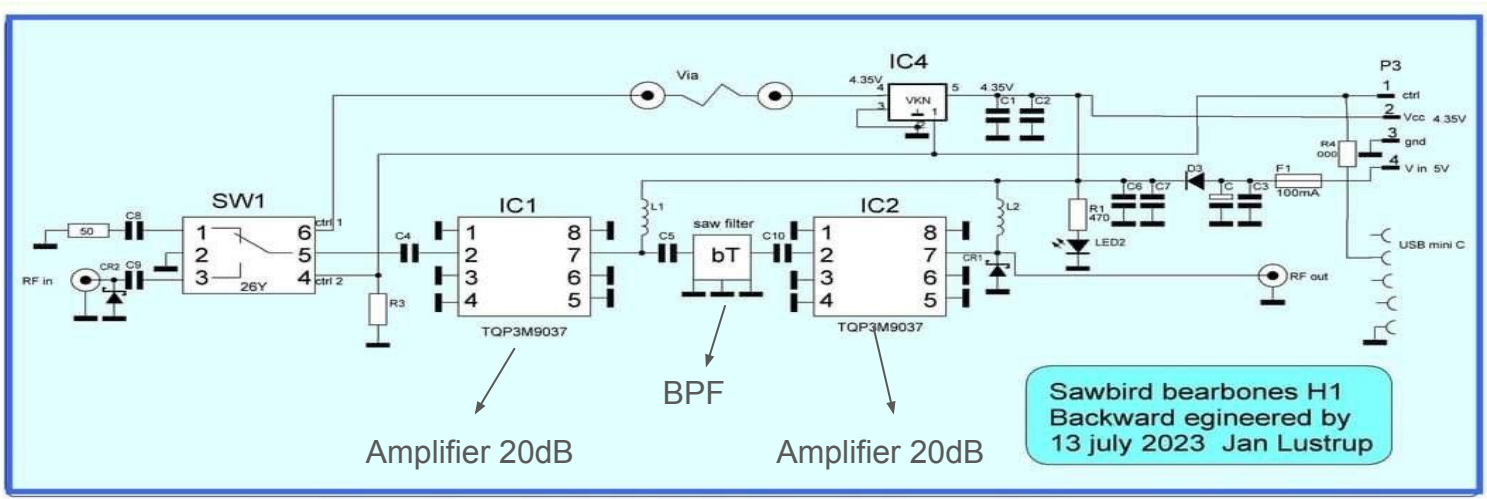
System Design - LNA

LNA SAWbird+ H1t

- Center frequency: 1420MHz.
- Gain ~40dB at 1420MHz.
- 3dB Bandwidth: 65MHz.
- Power supply: 5V DC



System Design - LNA



System Design - LNA

Checking power supply for LNA(5V).

System Design

DC Block(a capacity): Function: block DC signal between 2 LNA and SDR.

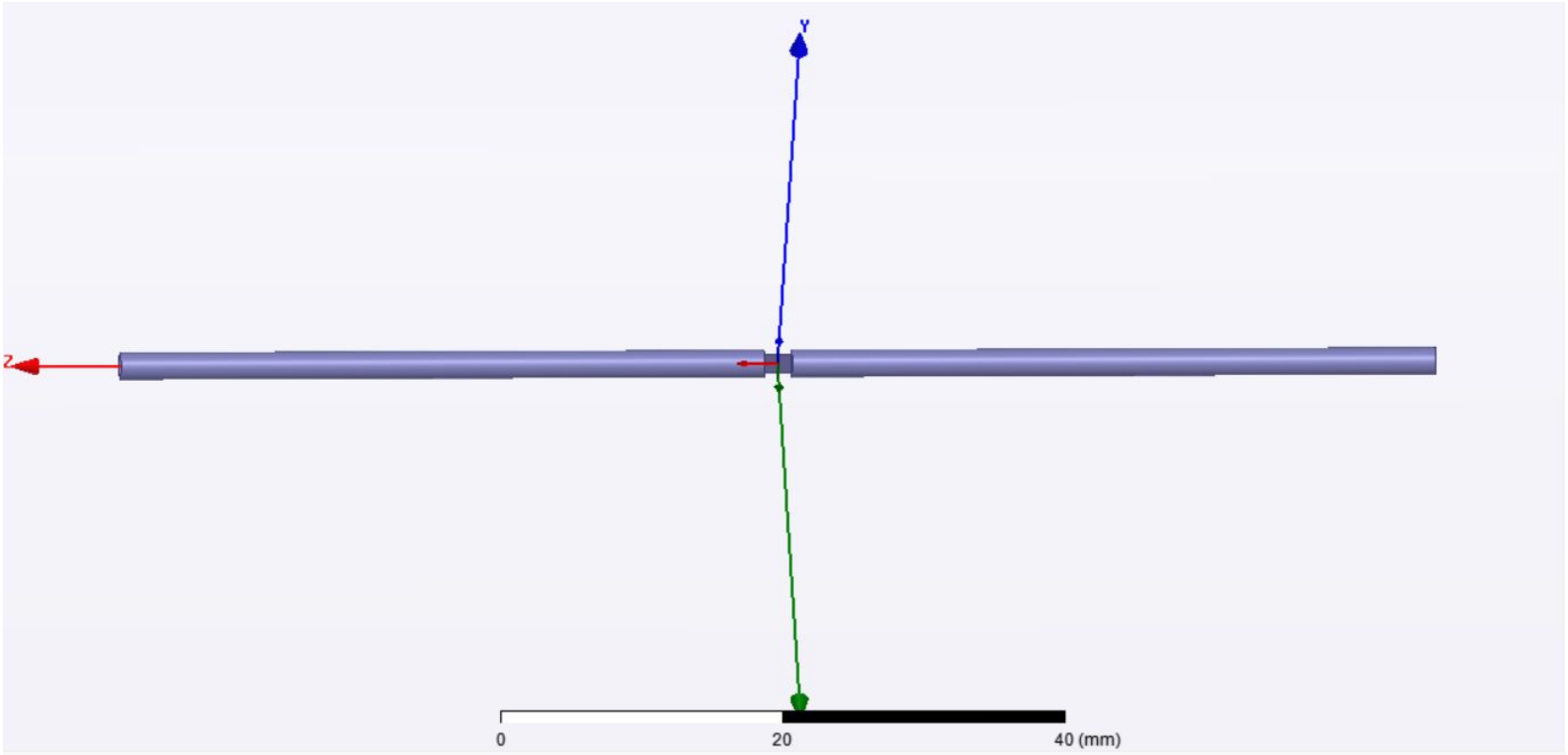
Antenna Design - Dipole Antenna

Simulate a dipole antenna for 1420MHz with HFSS software.

We perform simulation at different dimensions of each arm of the dipole antenna:

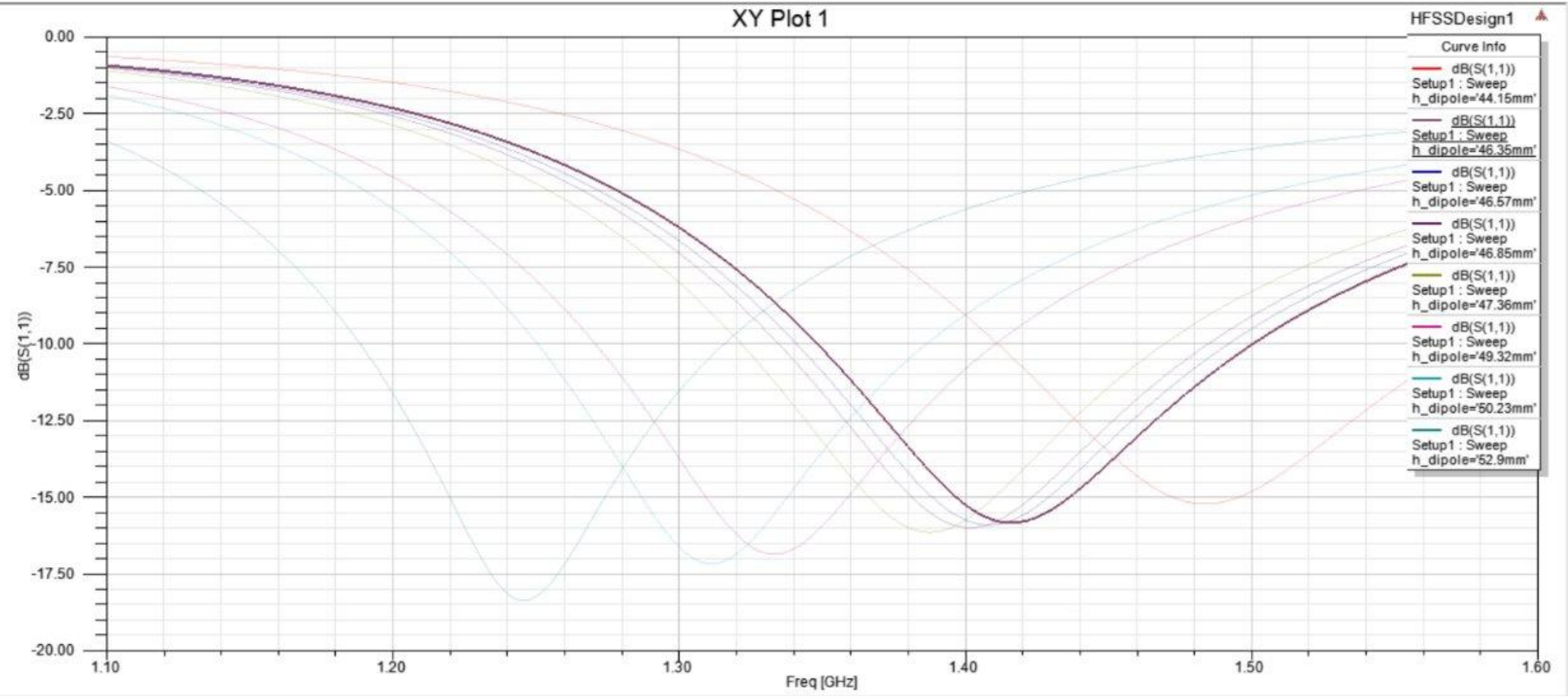
- 52.9mm (calculate follow theory, λ/4).
- Some other values range from 46.15mm to 52.9mm.

Antenna Design - Dipole Antenna



Antenna Design - Dipole Antenna

S(1,1) at different dimensions

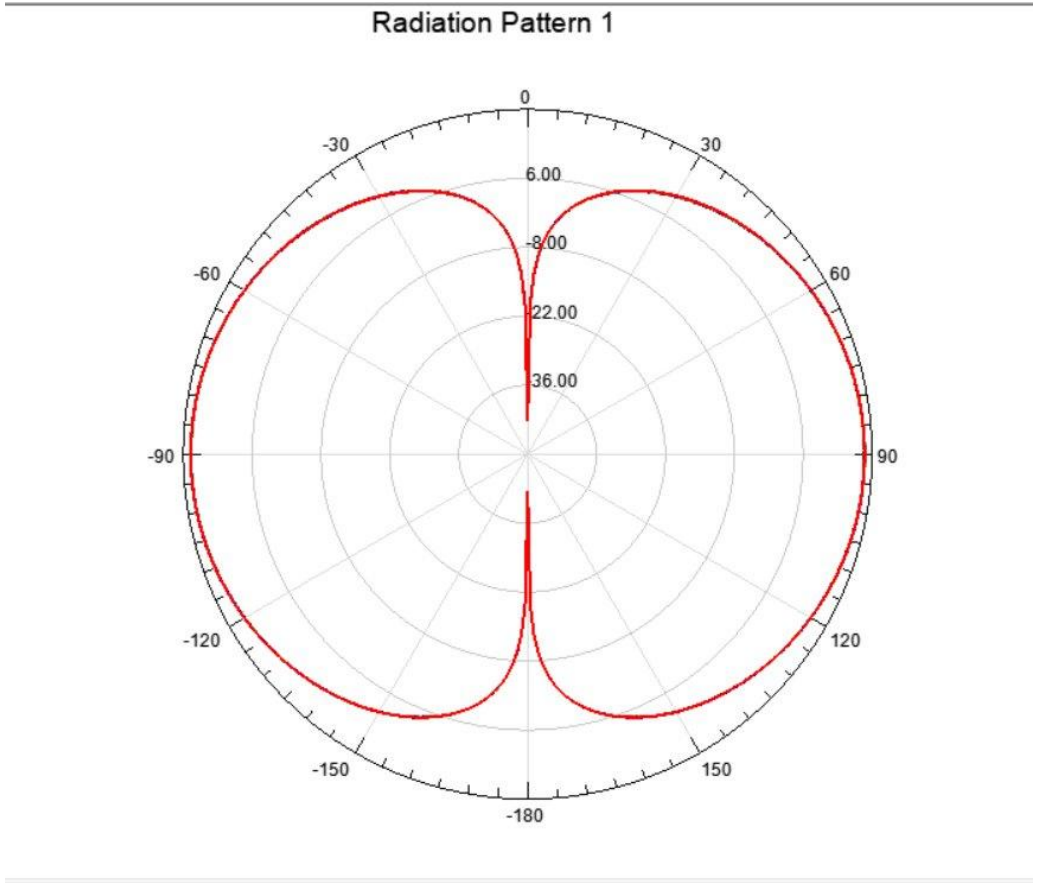


Antenna Design - Dipole Antenna

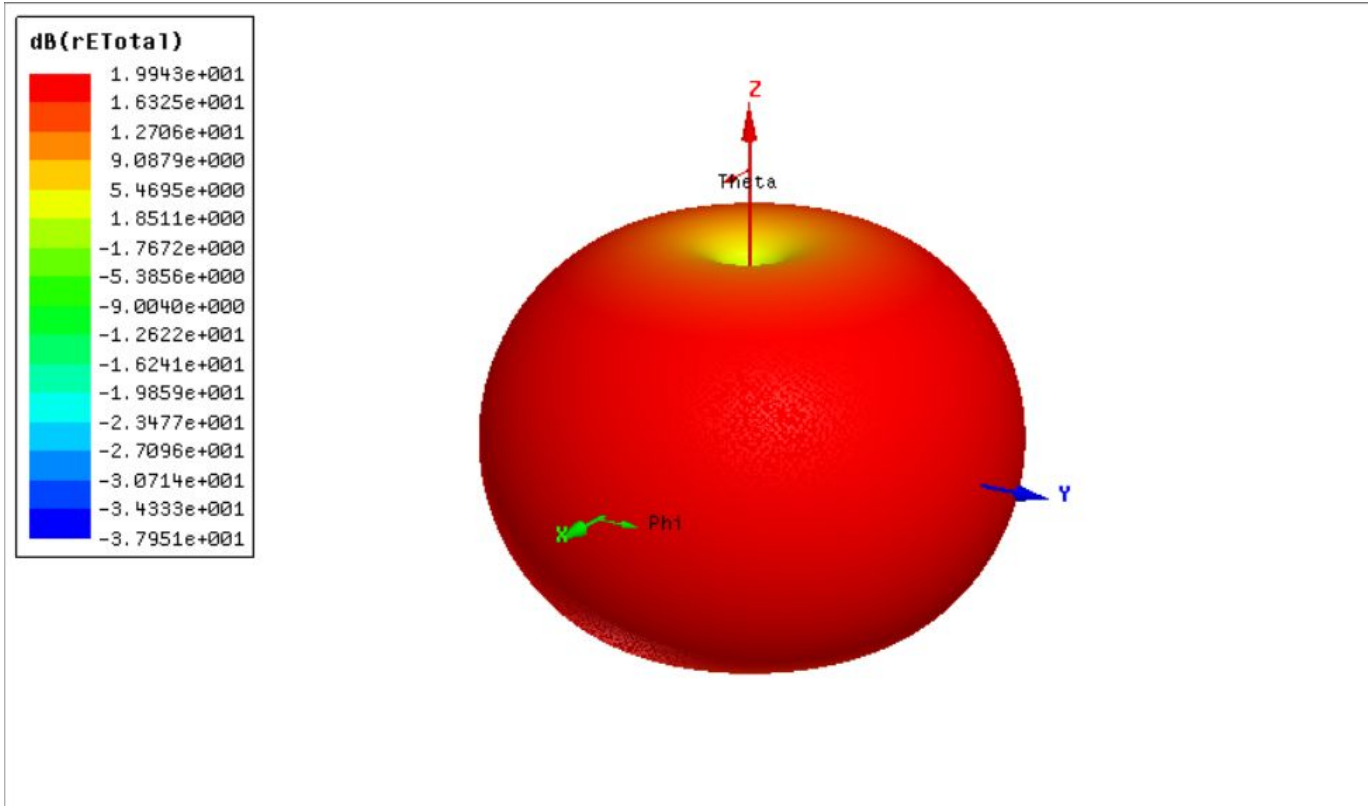
About S(1,1) parameter:

- The best length at 46.85(mm).
- In that case S(1,1) ~16dB.

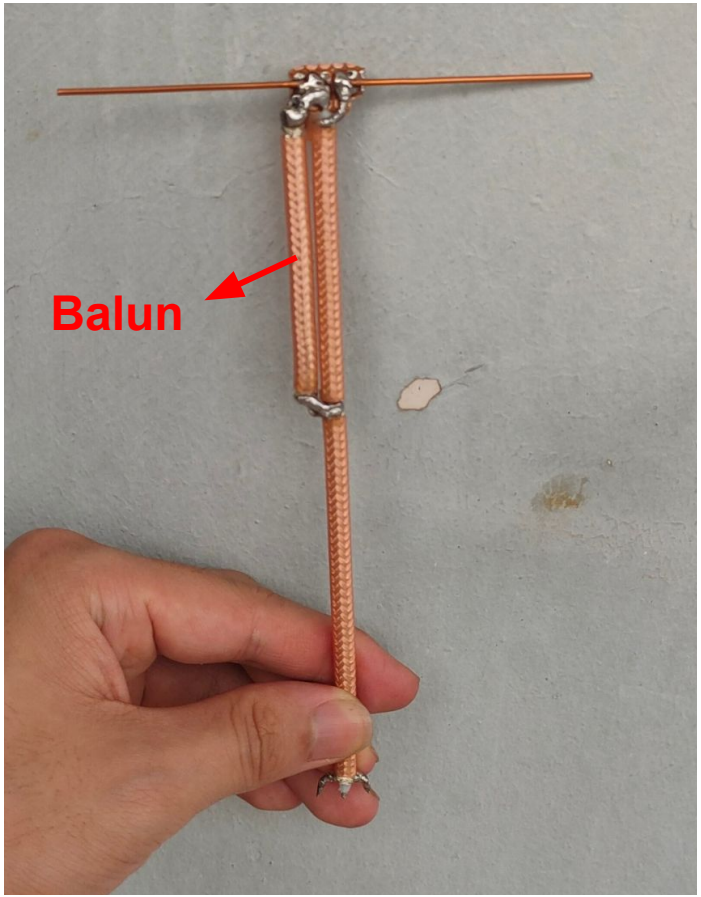
Antenna Design - Dipole Antenna - Radiation pattern



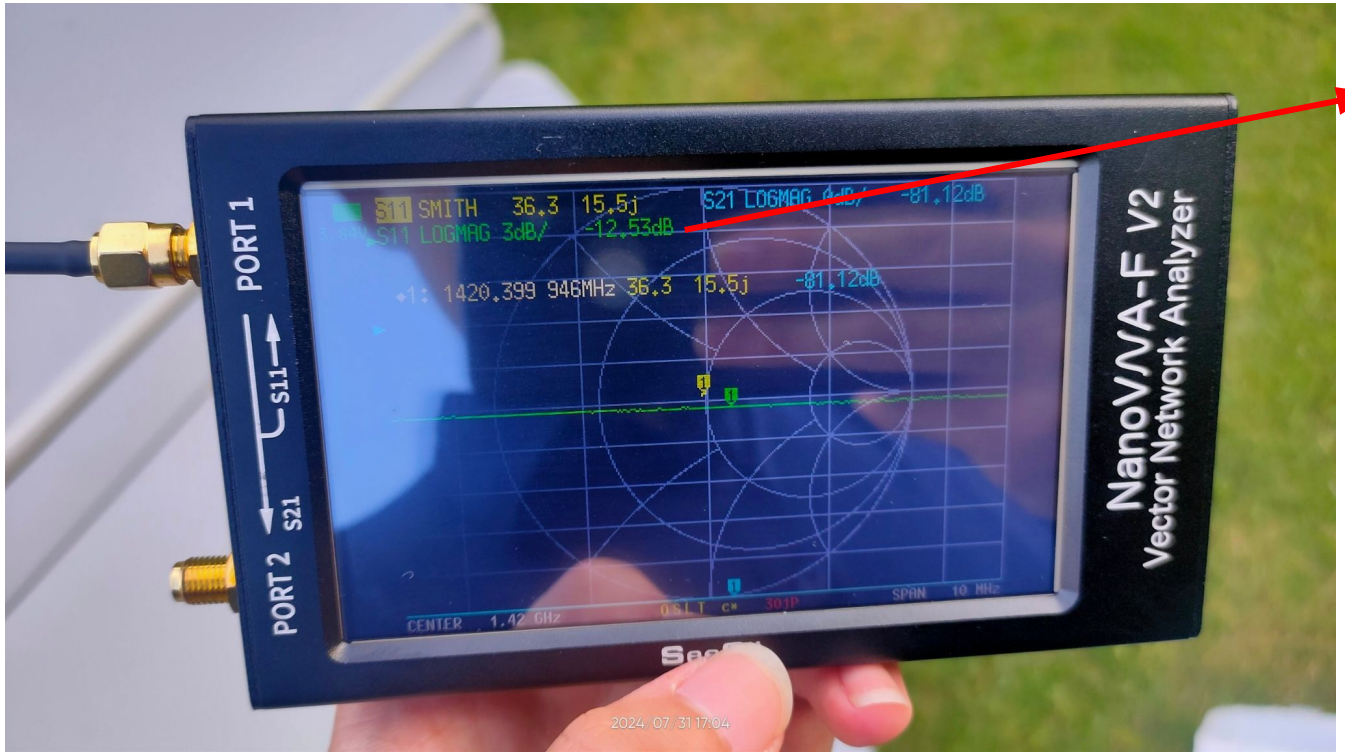
Antenna Design - Dipole Antenna - 3D Polar plot.



Antenna Design - Dipole Antenna

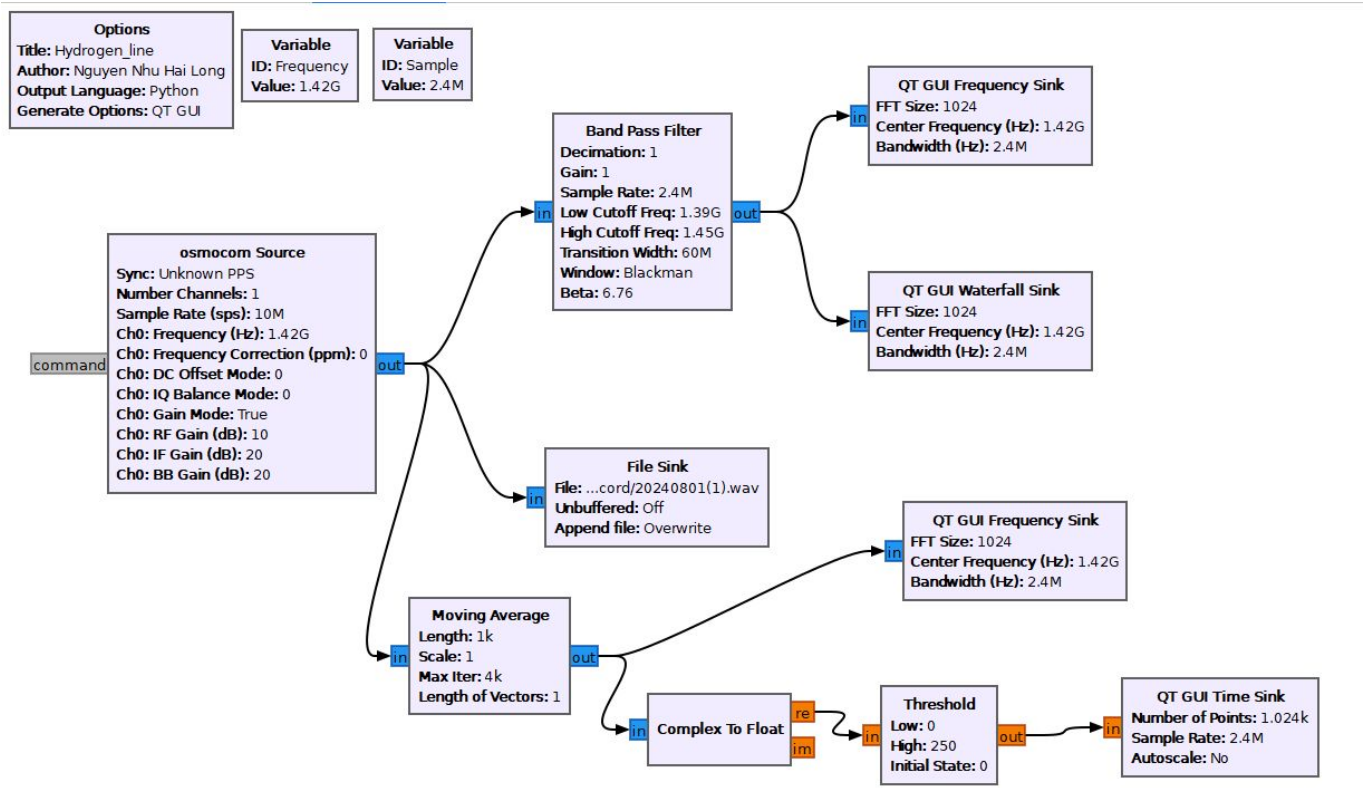


Antenna Design - Dipole Antenna



S(1,1) at 1420.4MHz: -12.53dB

GnuRadio - simple diagram



Reference

- HydrogenLine DIY

Thank for watching