



NAKUJA INTERNSHIP AVIONICS PROGRESS REPORT WEEK 7

MUCHIRI IAN NGETHE

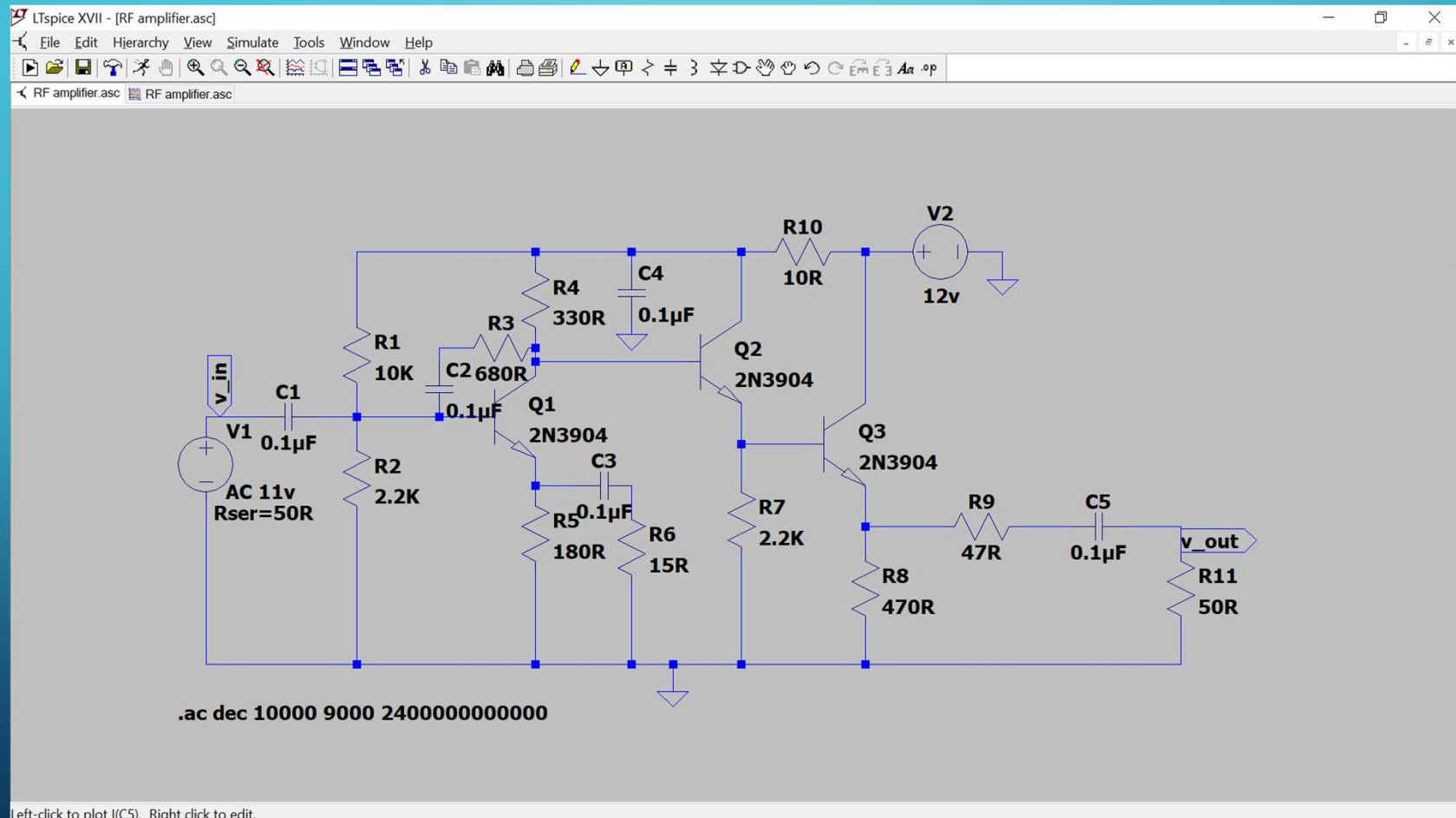
TASKS COMPLETED THIS WEEK

- [# issue 112] : ground station and onboard antenna design
- [# issue 103]: build wi-fi amplifier

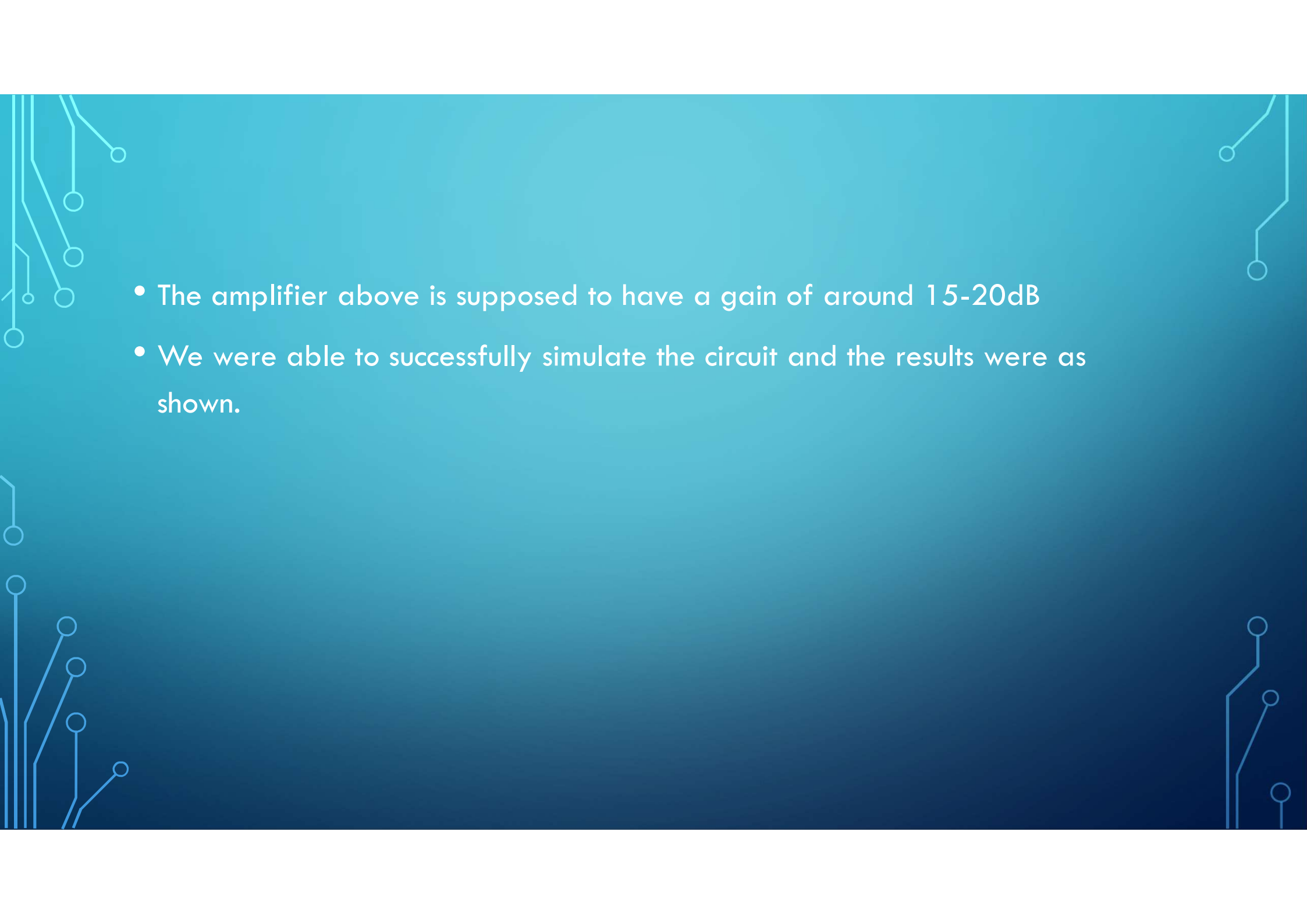
BUILD WI-FI AMPLIFIER

- The issue at hand was to improve on the power if the signal produces by the esp32.
- I did research on power amplifier design. Most were for frequencies in the MHz region.
- In our case we required an amplifier for 2.4GHZ.
- We were to design a power amplifier that was able to convert low power frequency signals to high power frequency signals.
- We decided to go with rf power amplifiers.
- We designed a unidirectional rf power amplifier as shown below.

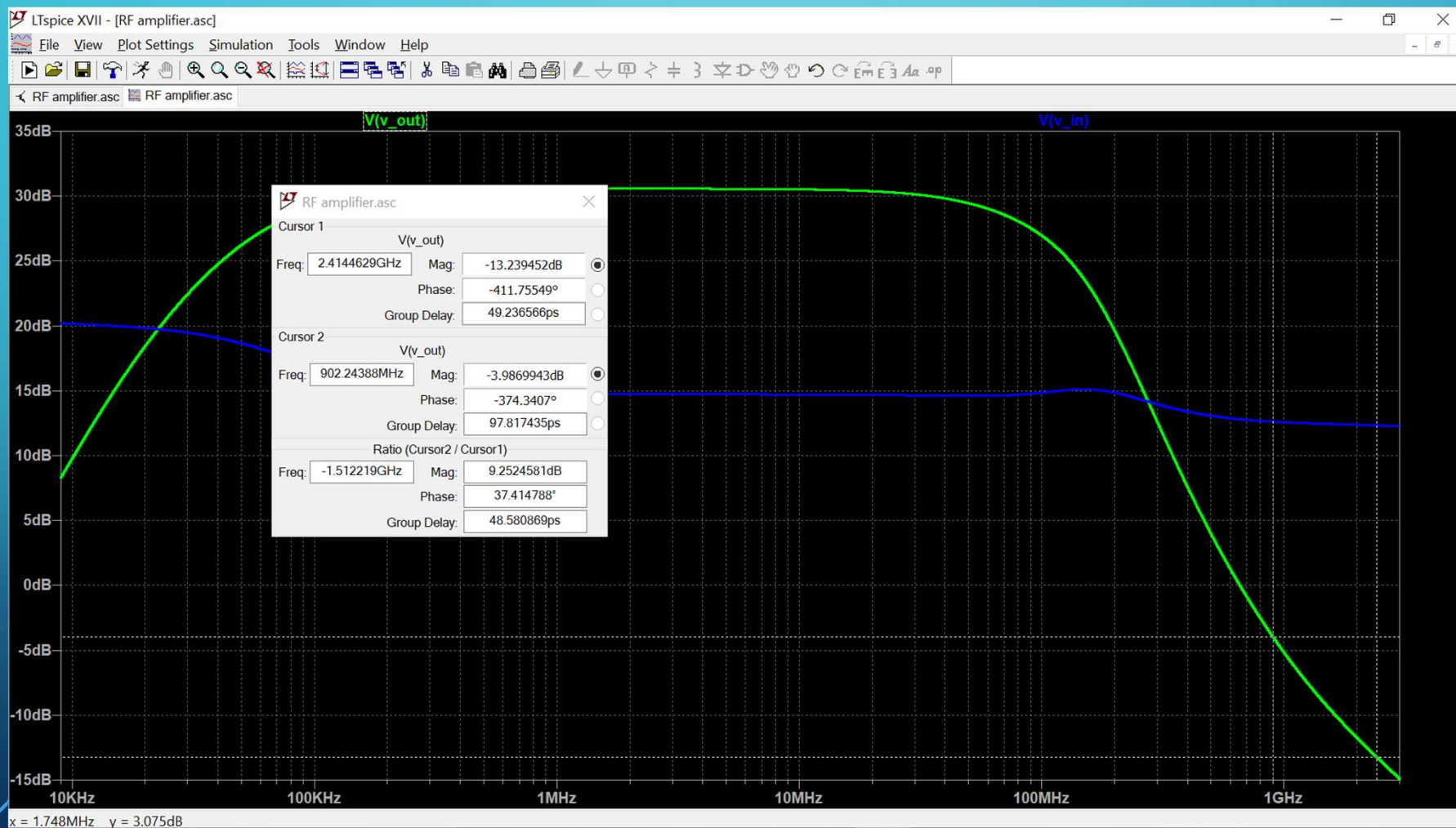
- Design:

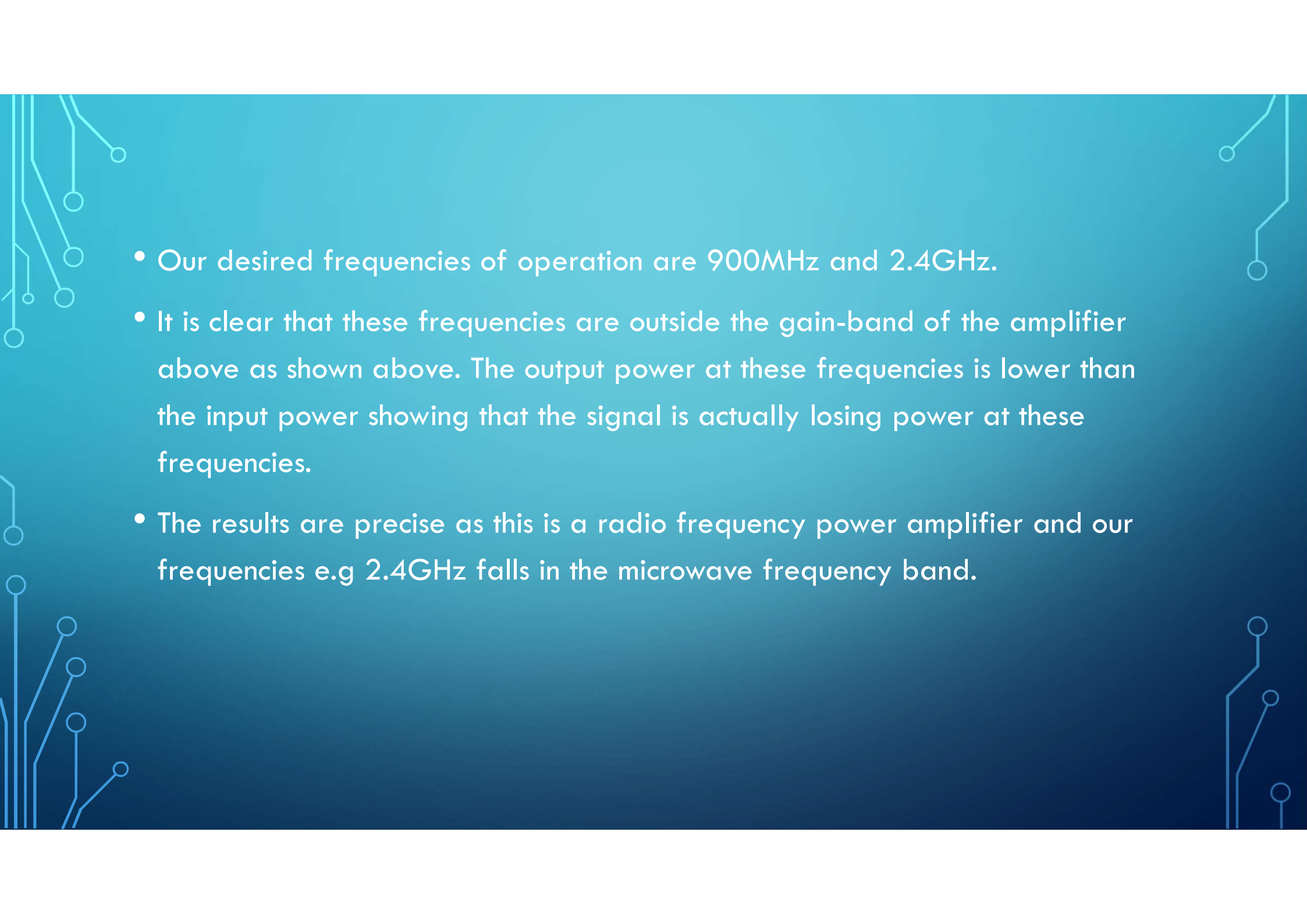


Left-click to plot I(C5). Right click to edit.

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- A decorative background featuring a blue gradient with white circuit board traces and circular nodes along the left and right edges.
- The amplifier above is supposed to have a gain of around 15-20dB
 - We were able to successfully simulate the circuit and the results were as shown.

SIMULATION RESULTS



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- A decorative background featuring a light blue to dark blue gradient. Overlaid on this are stylized white circuit board traces and circular components, primarily located along the left and right edges of the slide.
- Our desired frequencies of operation are 900MHz and 2.4GHz.
 - It is clear that these frequencies are outside the gain-band of the amplifier above as shown above. The output power at these frequencies is lower than the input power showing that the signal is actually losing power at these frequencies.
 - The results are precise as this is a radio frequency power amplifier and our frequencies e.g 2.4GHz falls in the microwave frequency band.

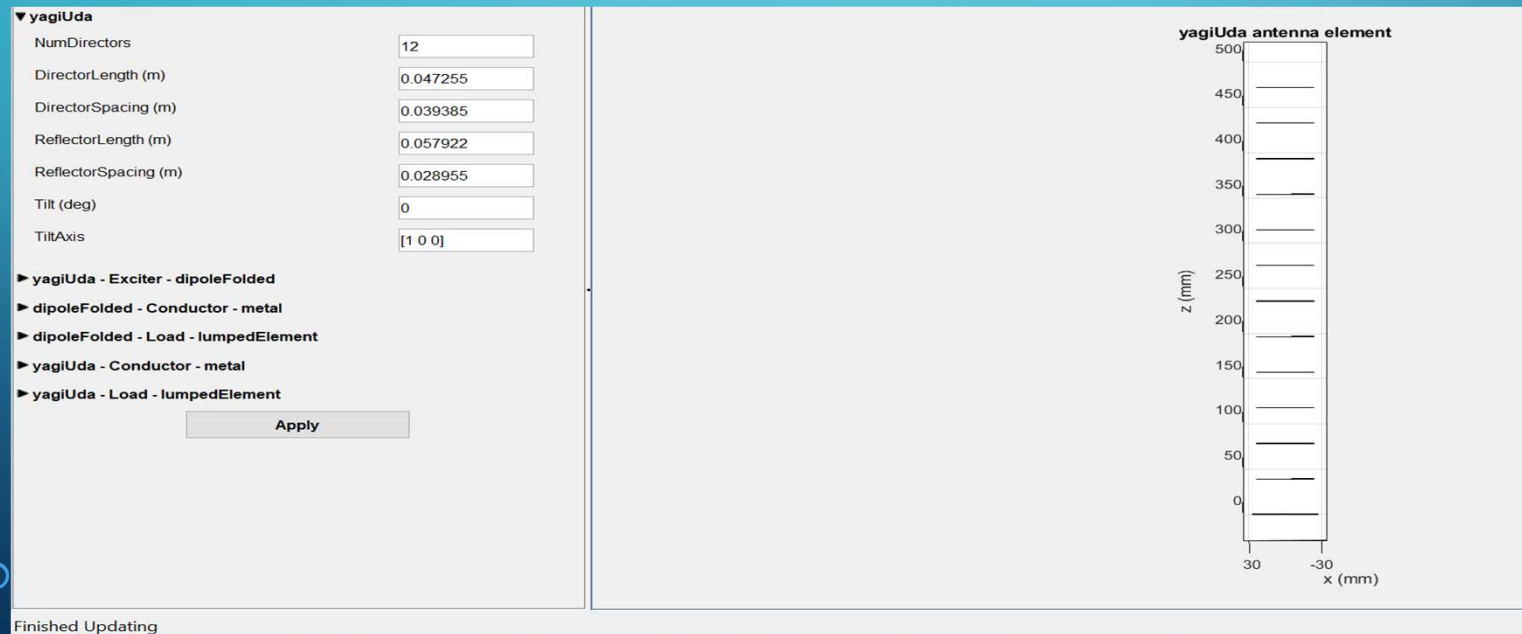
- This amplifier is no good for the frequencies we want to operate in.
- We need to design a power amplifier for higher frequencies.
- We decided to go with a store bought power amplifier SKY65405-21 which is an ultra-low-noise amplifier (LNA) intended for 2.4 GHz wireless receiver applications
- https://www.skyworksinc.com/-/media/SkyWorks/Documents/Products/501-600/SKY65405_21_201446l.pdf
- The power amplifier above will be incorporated onto the pcb.

GROUND STATION AND ONBOARD ANTENNA DESIGN.

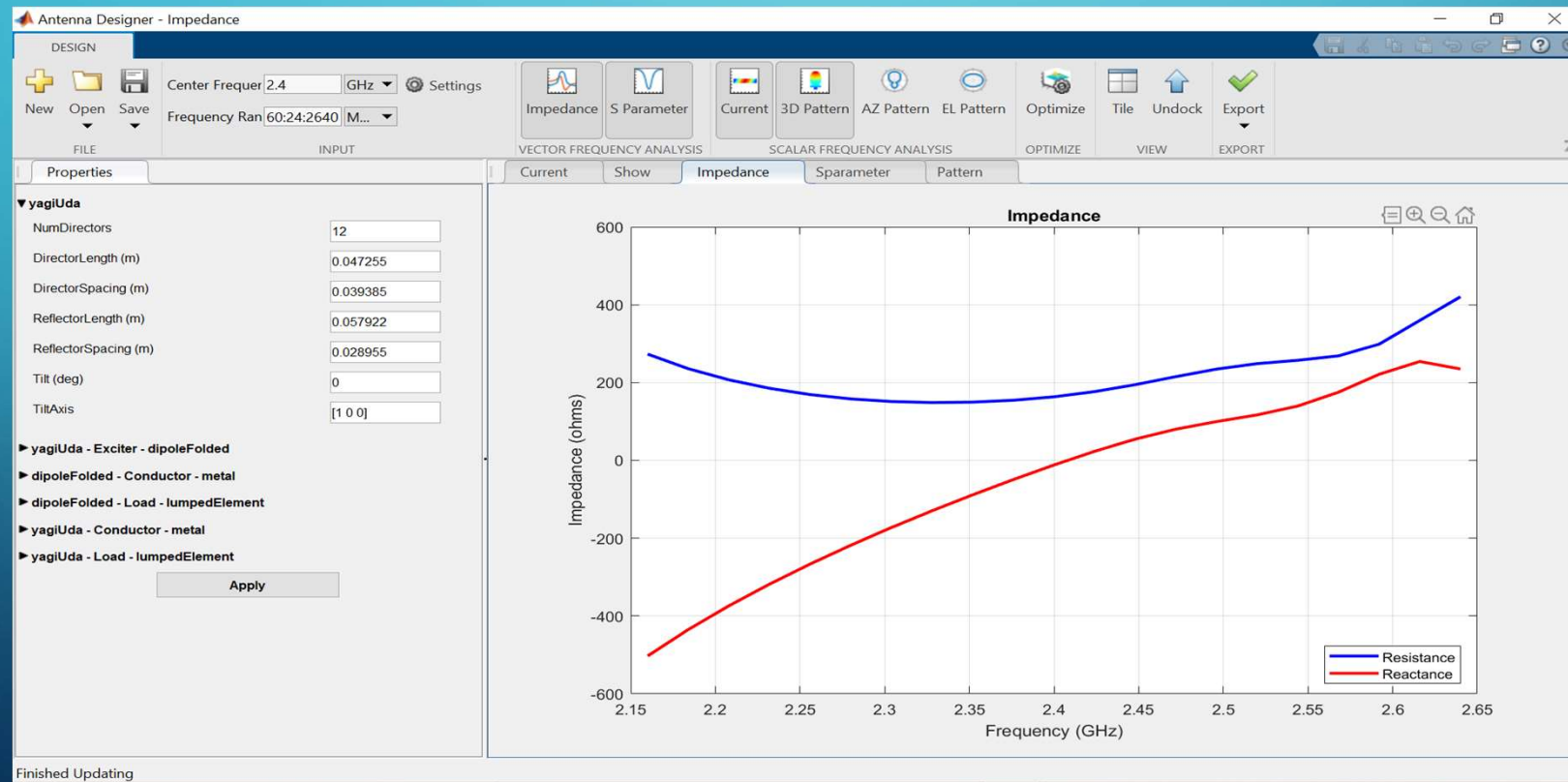
- The task is to design and fabricate an antenna for the ground station (receiving antenna) and an antenna to be used by the onboard system in the rocket(transmitting antenna)
- For the receiving ground station antenna we decided to go with a Yagi Uda antenna operating at a frequency of 2.4GHz
- For the rocket antenna we decided to use a patch antenna which will be mounted on the surface of the rocket.

YAGI ANTENNA DESIGN

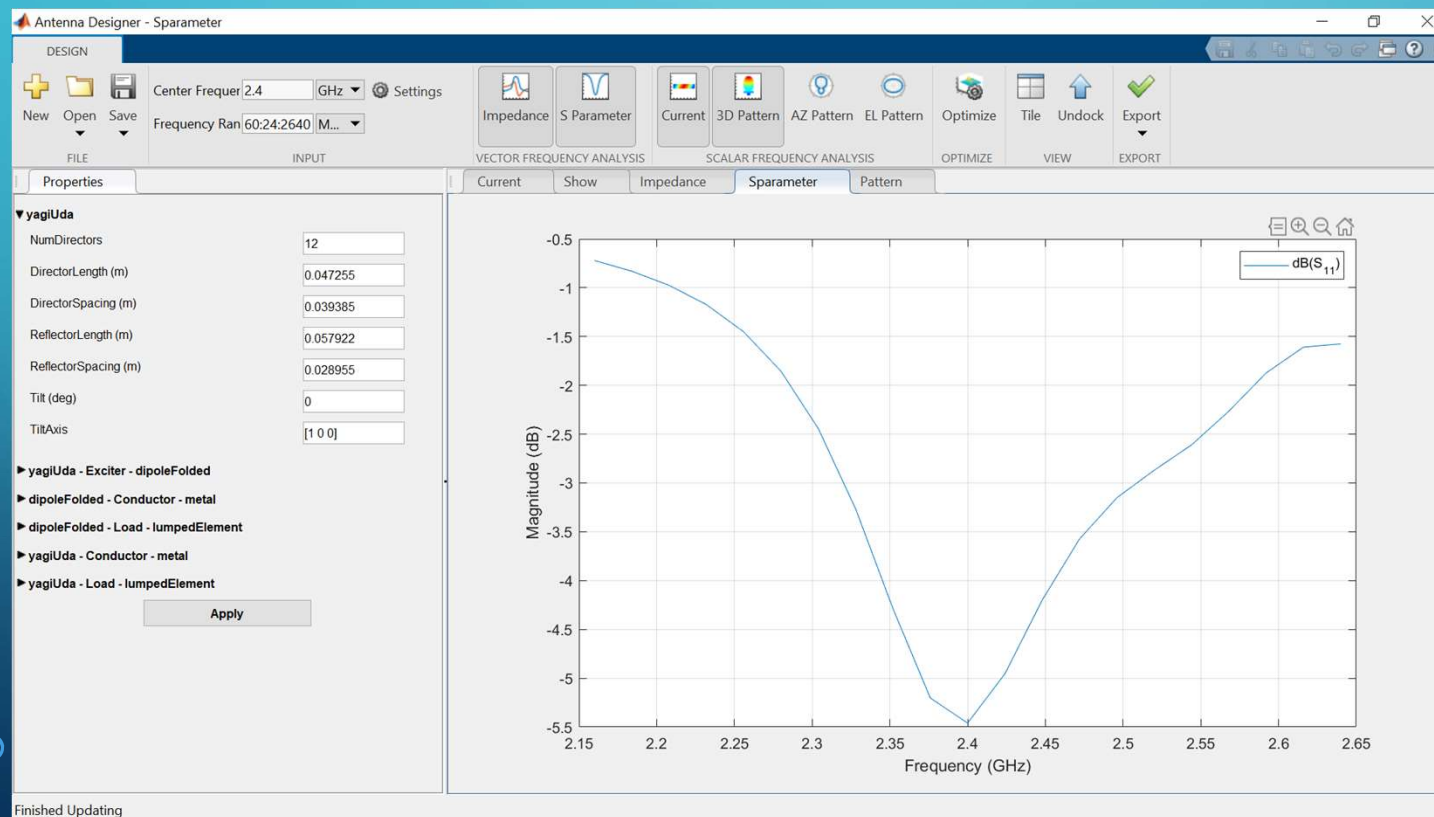
- We were able to design and simulate a Yagi Uda antenna with matlab operating at 2.4GHZ.



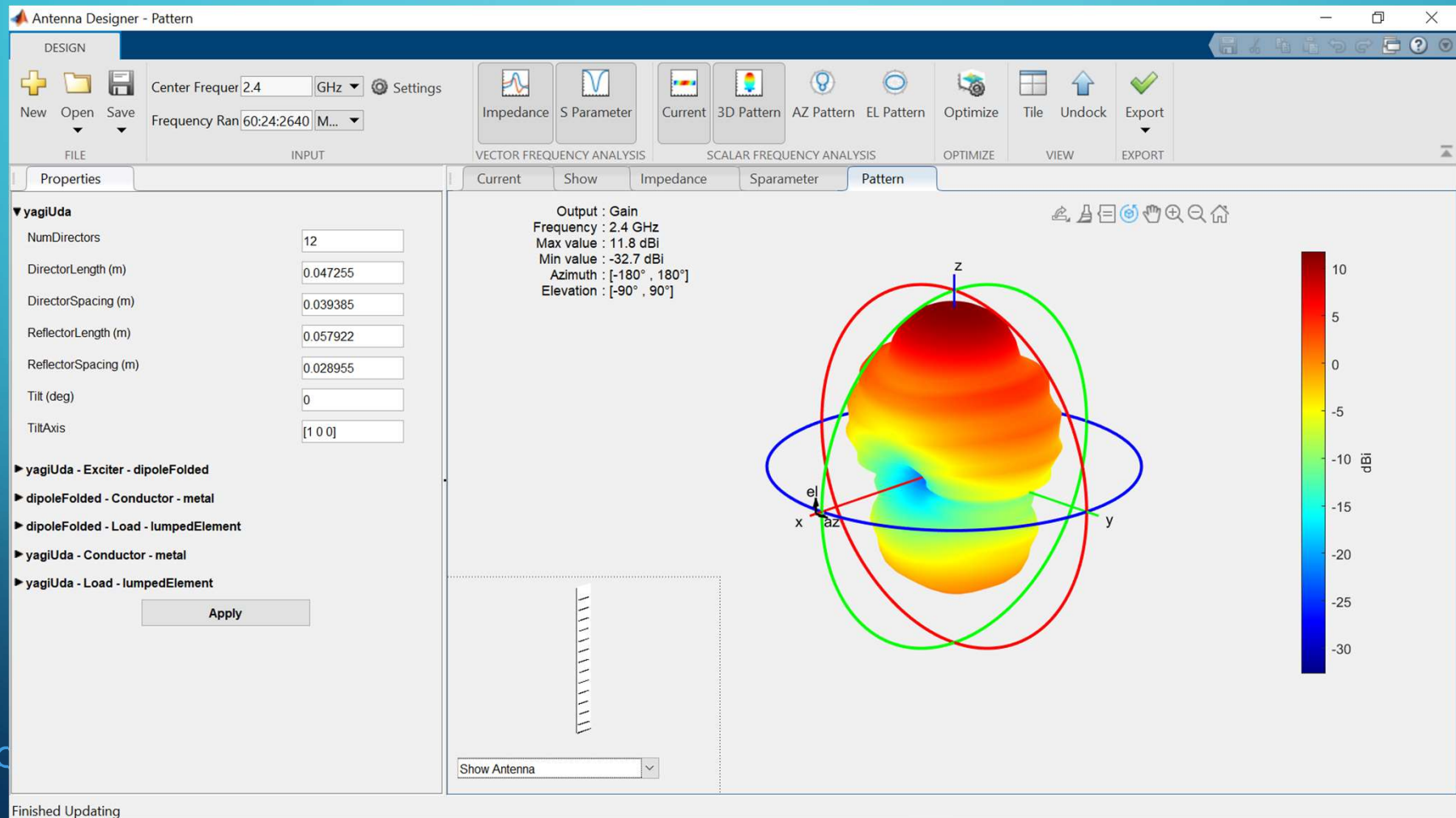
IMPEDANCE PARAMETERS



S11 PARAMETERS

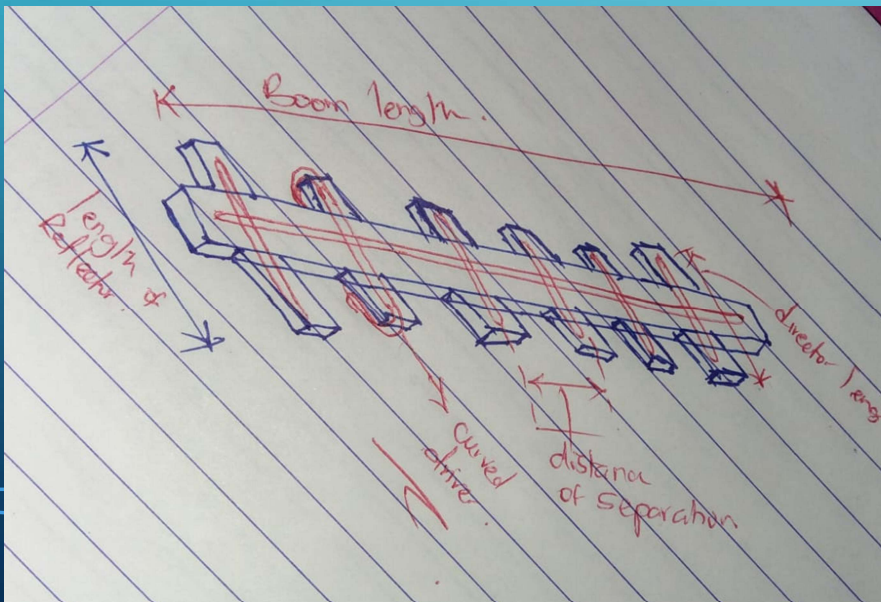


RADIATION PATTERN



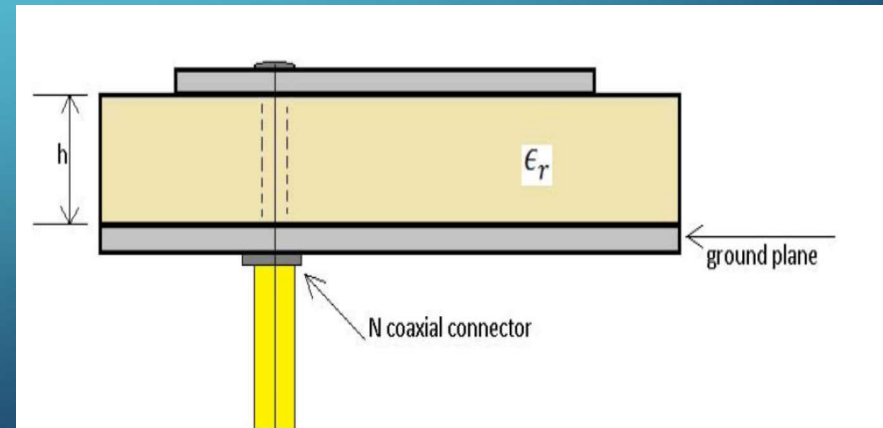
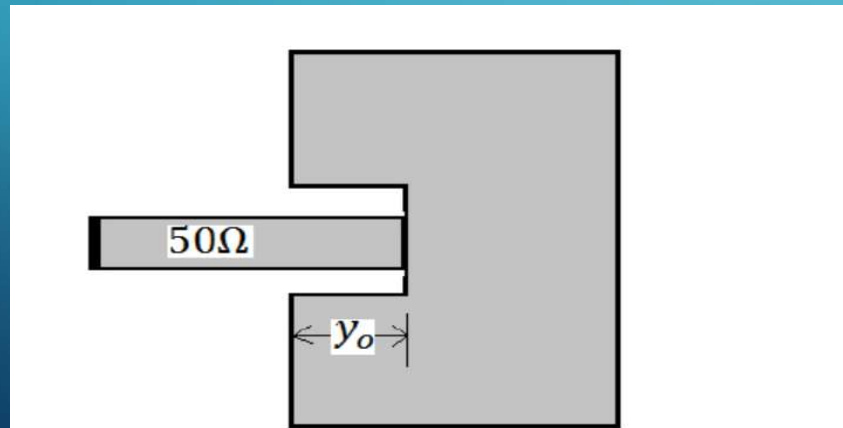
FABRICATION

- We want to use copper cables(1-2mm diameter) for fabrication of the Yagi-Uda antenna with the supporting base being a 3D-printed plastic support for rigidity.



PATCH ANTENNA DESIGN

- For the patch antenna design we are going to use either the microstrip feed line patch antenna or the coaxial feed line patch antenna.
- Design of this is currently underway.



TASK THIS WEEK

- [#112] : ground station and onboard antenna design
- [#77] : esp32 wi-fi range test