# Designing of Circularly Polarized Microstrip Antenna for Various Wireless Applications

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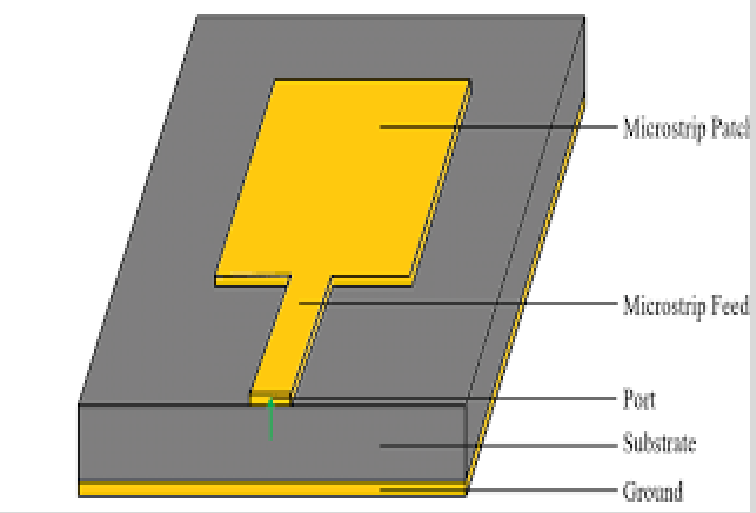
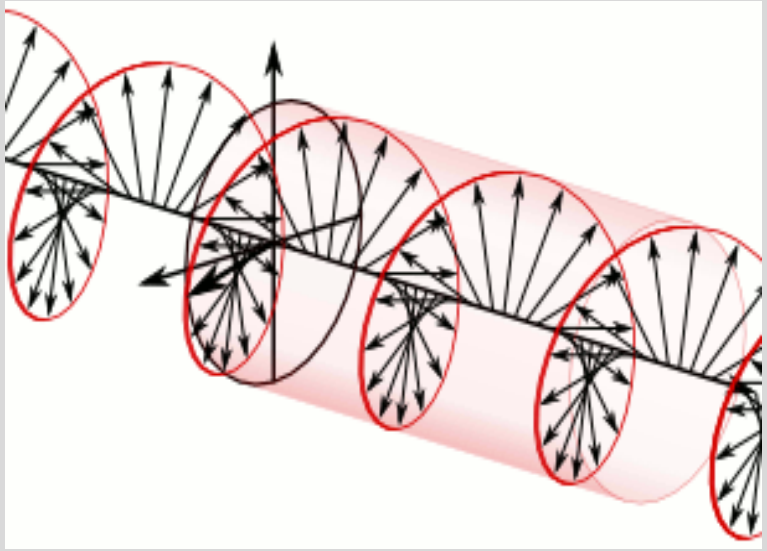
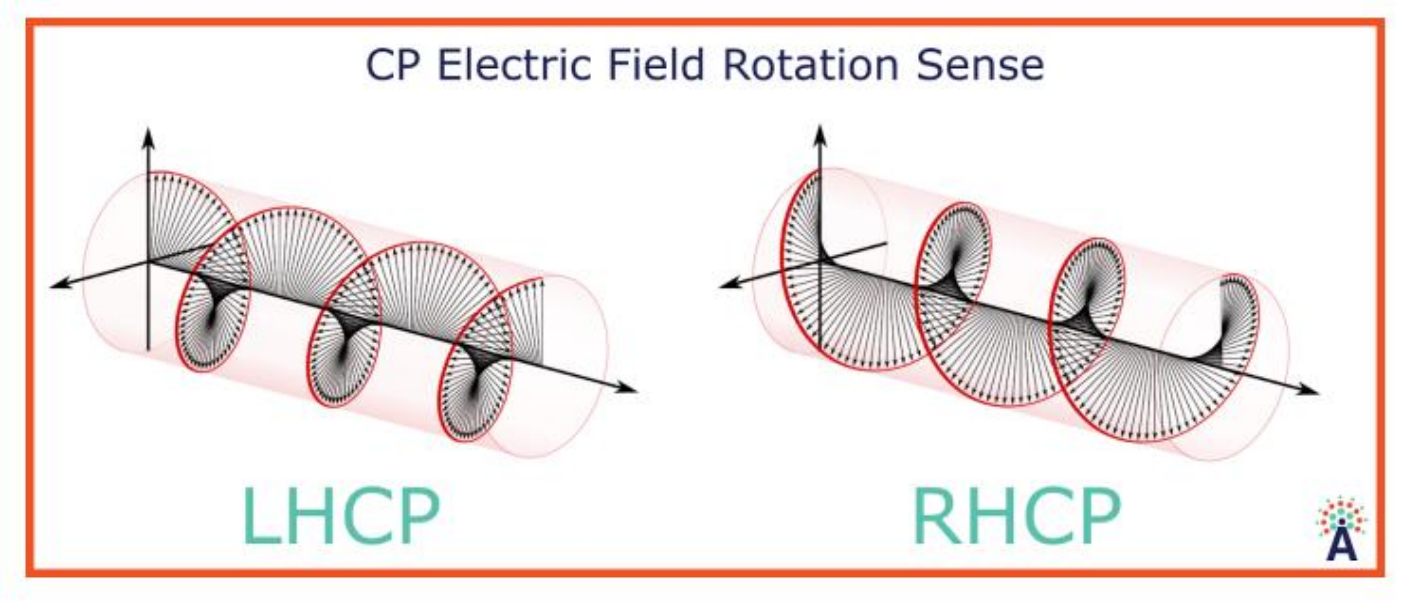
# Introduction

- **Microstrip** is a type of electrical transmission line, which can be fabricated with any technology where a conductor is separated from a ground plane by a dielectric layer known as the substrate.
- The power to radiate the signal waves is provided by microstrip feed line connected to it (i.e. Microstrip lines are used to convey microwave-frequency signals)
- **Circularly polarized(CP) antenna** is an antenna that radiates circularly polarized waves, which are waves in which the electric field vector rotates in a circle as the waves travel.
- Circular polarization of an electromagnetic wave is a polarization state in which, at each point, the electromagnetic field of the wave has a constant magnitude and is rotating at a constant rate in a plane perpendicular to the direction of the wave.



- The field of a CP antenna is always rotating (unlike a linear polarized antenna).
- It can rotate in two possible directions, and this “sense” of rotation is referred to as Left or Right Hand Circular Polarization



# Advantages Of Designing a Circularly Polarized Antenna

- Circularly Polarized(CP) antennas have better weather penetration and mobility than linear polarized (LP) antennas.
- Its ability to overcome polarization mismatch when acting as a transmitter and as a receiving antenna.

# Abstract and Objectives

- We wish to design circularly polarized microstrip antenna for various wireless applications like GSM band (933 - 960 MHz), ISM band (2.4 – 5.5 GHz), Wi-Fi, WLAN, WiMAX, LTE Bands, 4G/5G and satellite communications.
- These antennas are very useful for devices like Mobile (cell phones), Palmtop, Laptops, and many more as circularly polarized antenna ***prevents the device from dropout of the signal coming from any direction*** because of having equal distribution of E-field in the E-plane and H-plane.
- The Axial ratio Ex/Ey (in dB) required is less than 3 dB for operational purposes.
- We will be using substrates like FR-4, Rogers, and RT-Duroid for designing the microstrip antenna.
- We’ll work towards, reducing the mutual coupling, compactness and also want to have a High Gain.

# Literature Review

| Sr. No. | Author Name (Year) | Title | Source |
|---|---|---|---|
| 1 | Mr. Amit Kumar,<br>Mr. Abdul Quaiyum Ansari,<br>Mr. Binod Kumar Kanaujia &<br>Mr. Jugul Kishor<br>(April 1st 2019) | Dual Circular Polarization with Reduced Mutual Coupling Among Two Orthogonally Placed CPW-Fed Microstrip Antennas for Broadband Applications | Publication on Springer Link |
| 2 | Mr. Prashant Ranjan &<br>Dr. Amit Kumar<br>(March 28th 2021) | Circularly polarized ultra–wide band filtering antenna with controllable band-notch for wireless communication system | International Journal of Electronics and Communications |
| 3 | Yong-Chang Jiao<br>(2008) | A novel design of dual circularly polarized antenna fed by L-strip | Publication on Research Gate |

# Software & Hardware Utilized

CST(Computer Simulation Technology) STUDIO SUITE 2016

## About CST

It is utilized for virtually :

- Designing Different Components.
- Analyzing the Circuit Behavior.
- Optimizing the Electromagnetic (EM) Components and Systems.

The fabrication will be carried out using PCBMATE/LPKF PCB design tool/machine using the DXF/Gerber file.

# Methodology

- First, design the required microstrip antenna using the CST Studio Suit 2016.
- Axial-ratio bandwidth calculation needs to be validated through simulation.
- Then the S-parameter measurement will be carried out using the Vectored Network Analyzer (VNA) after soldering the required SMA connector(generally operating b/w 1-10GHz & is of size 3.5mm) to the antenna.
- Radiation pattern (E & H - plane) measurement will be done using the anechoic chamber.
- And we'll finally validate our simulated results with the measured ones. And will try to go for real-time applications
  (if possible).

# Data Collection

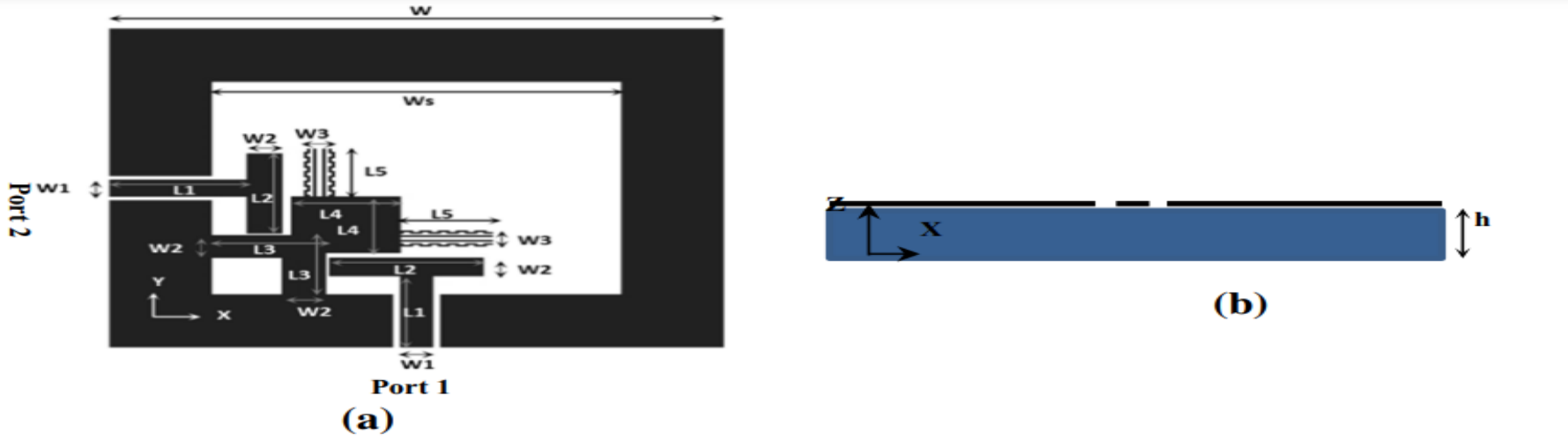



**Fig. 1** Proposed antenna structure and dimensions. **a** Front view, **b** side view, **c** back view, **d** MML structure. [W = 60, Ws = 40, W1 = 3.2, W2 = 3.5, W3 = 9.75, W4 = 0.4, W5 = 0.6, W6 = 1, W7 = 1.2, W8 = 0.3, L1 = 13.4, L2 = 15.1, L3 = 9.75, L4 = 10.7, L5 = 9, L6 = 8.4, L7 = 5.4, L8 = 6.4, L9 = 9, L10 = 3] (Unit: millimeter)

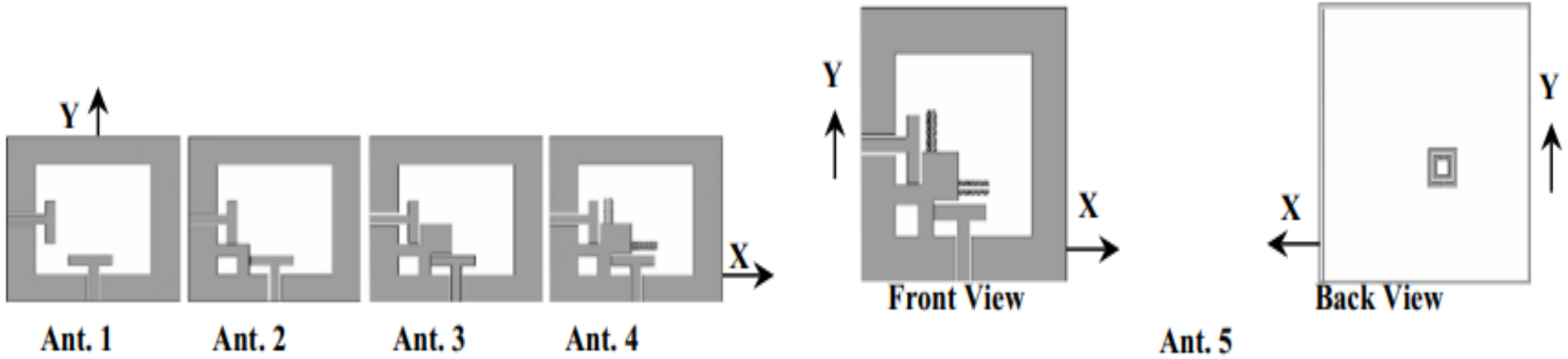
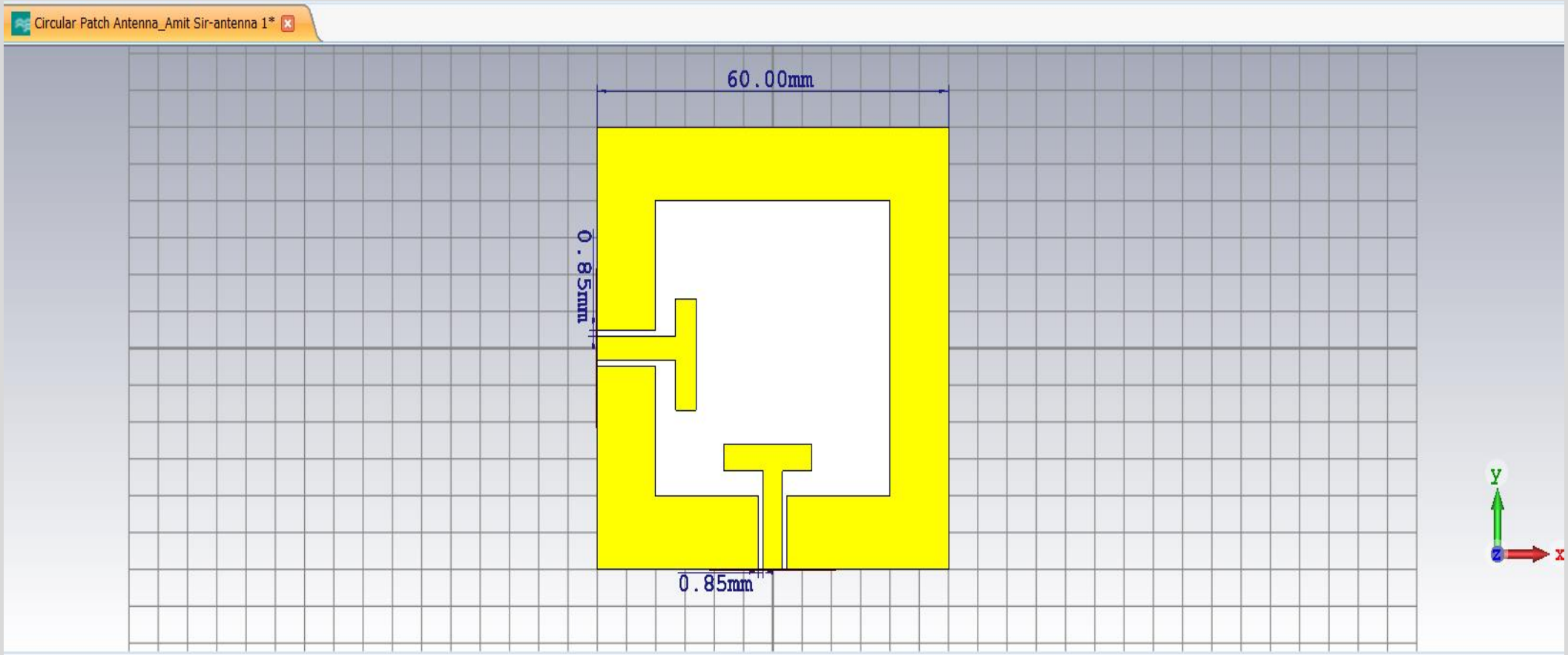
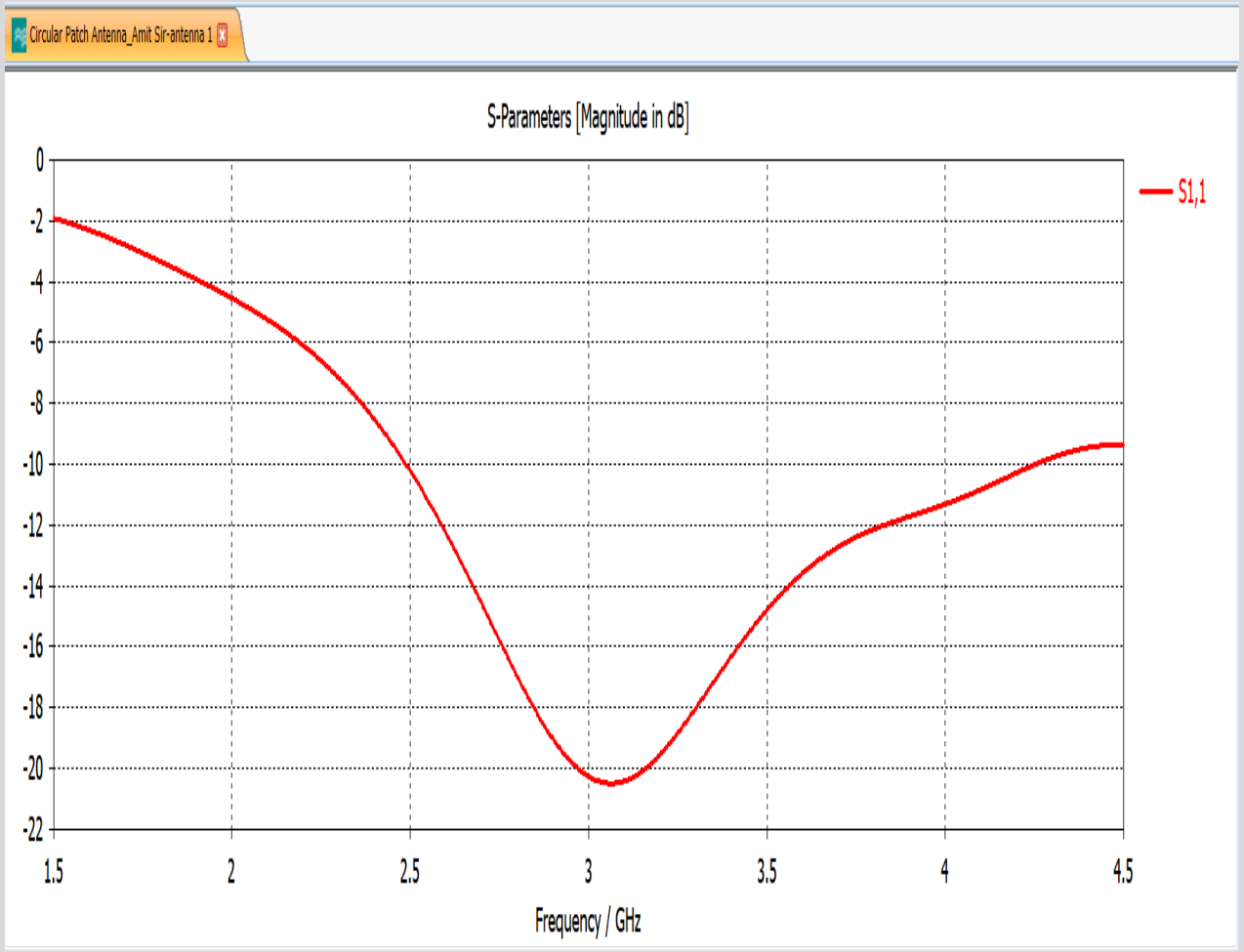


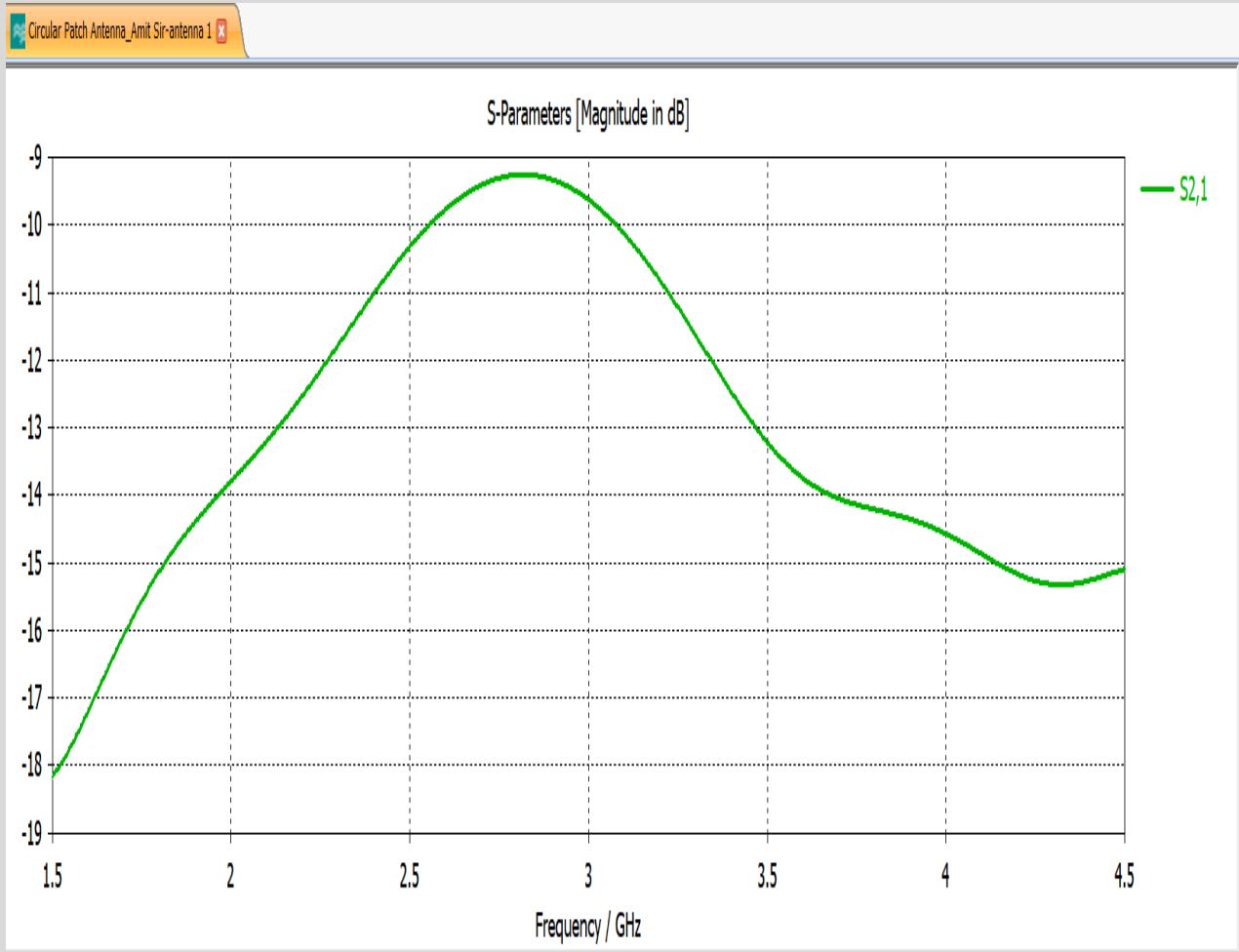

**Fig. 2** Steps of improvement in proposed antenna

# Data Analysis

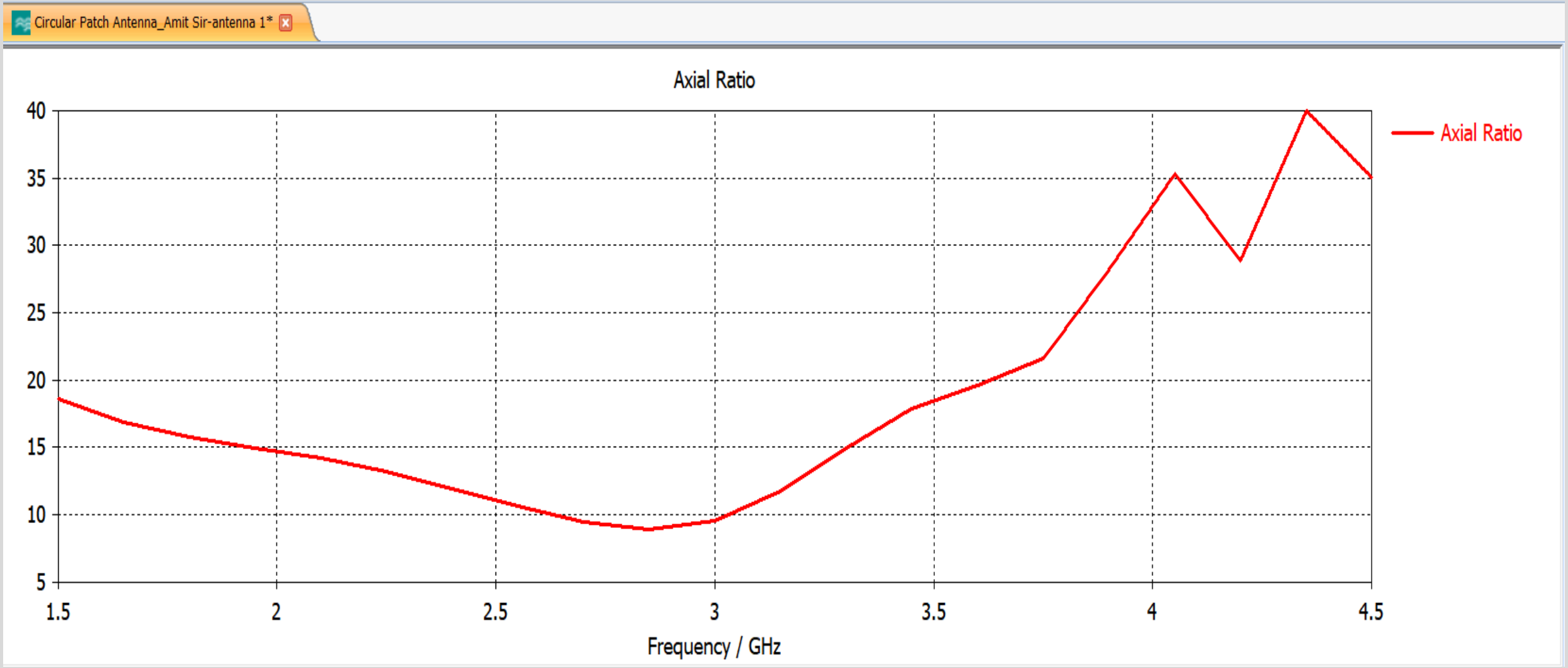



**Antenna 1 : Front View**

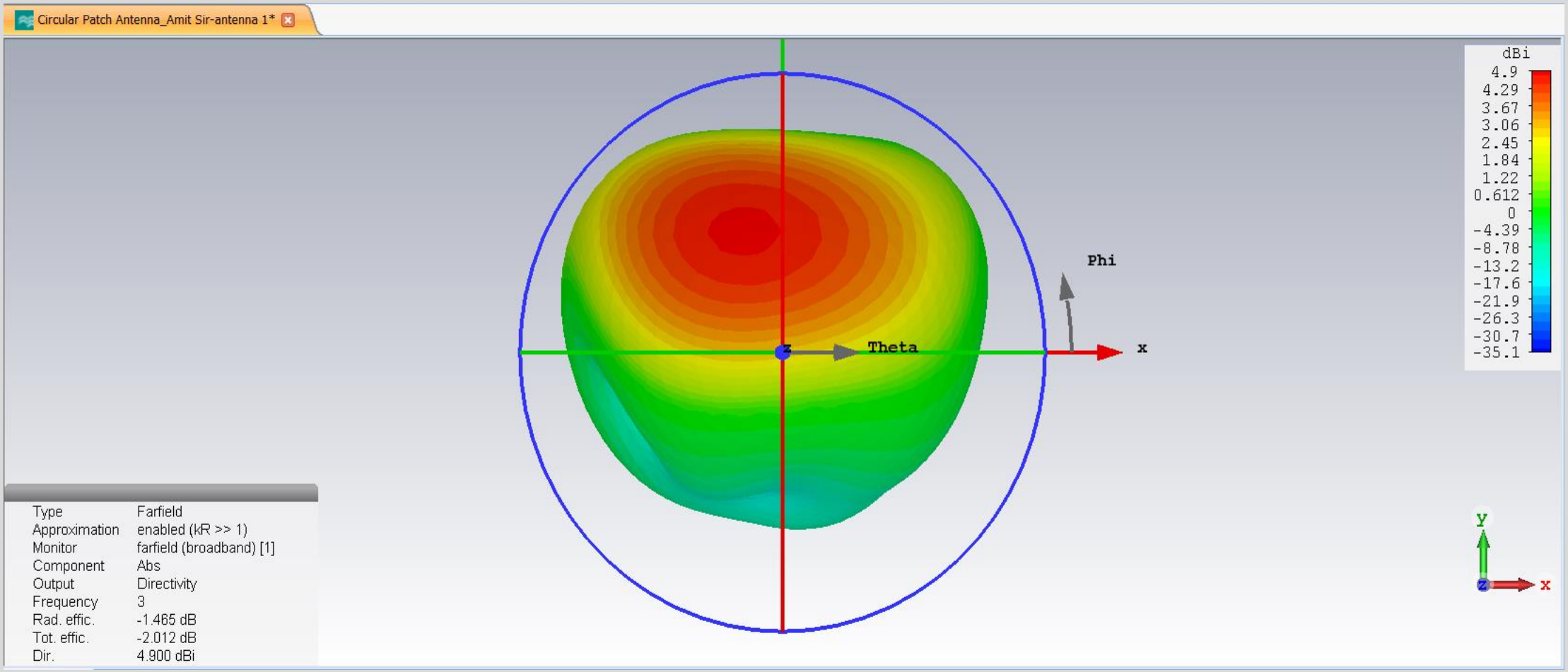


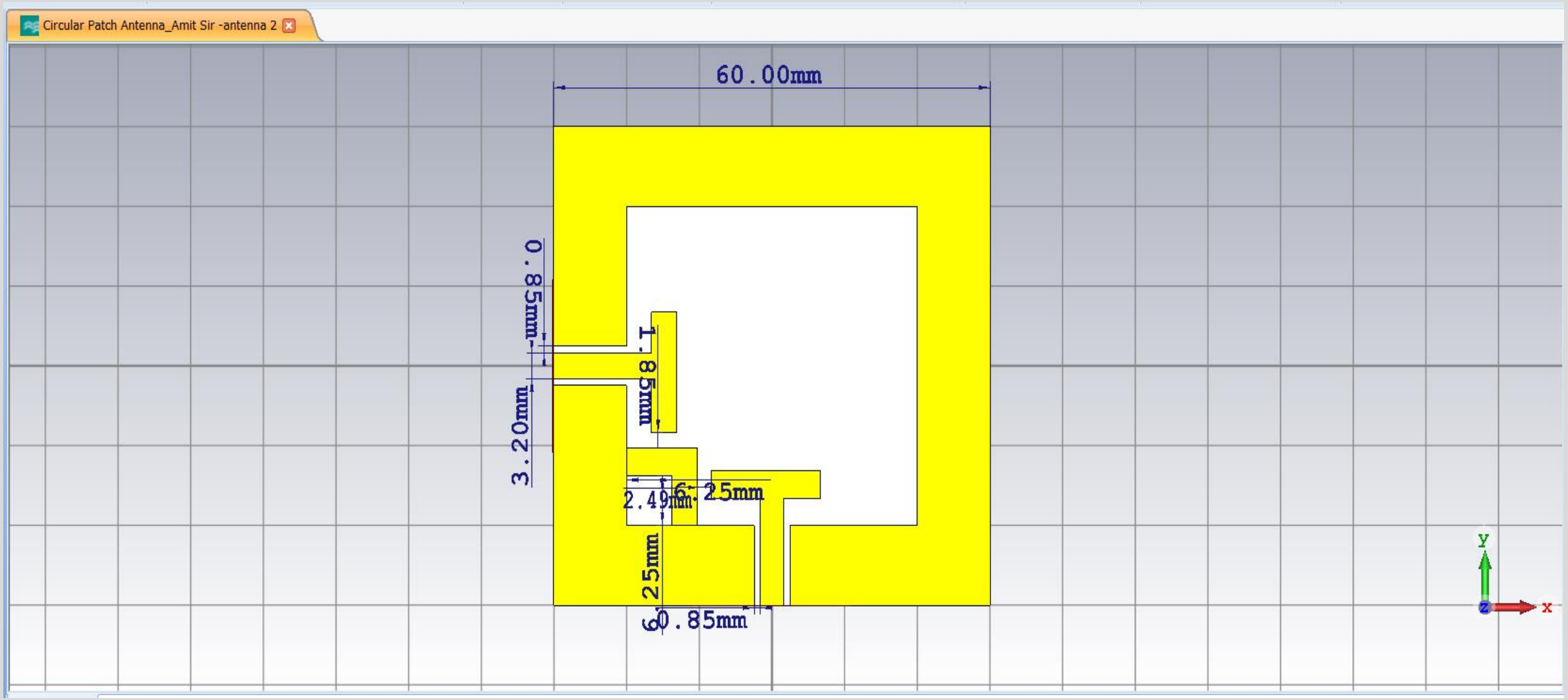

# S11(in dB) & S21(in dB) for Antenna 1



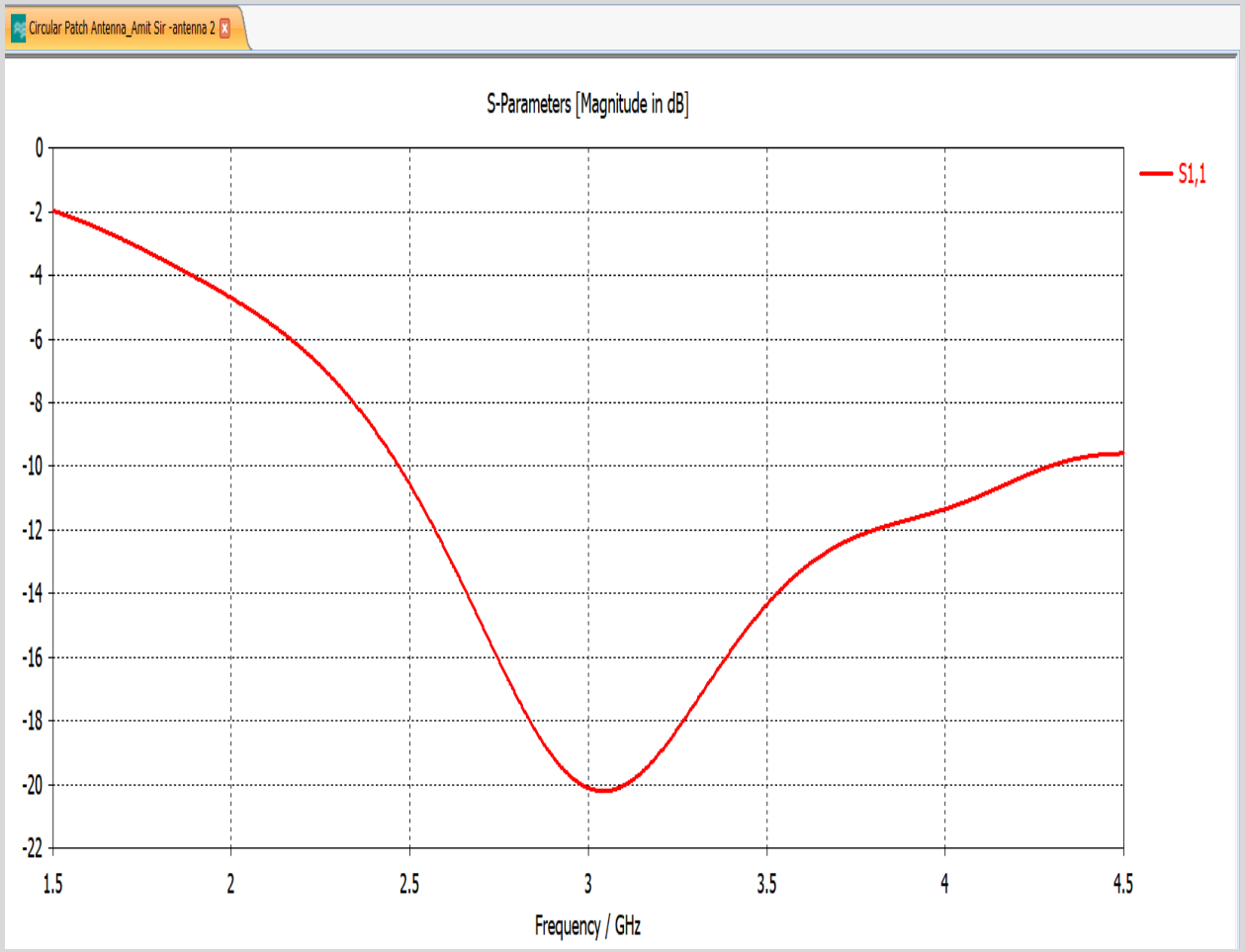

# Axial Ratio for Antenna 1

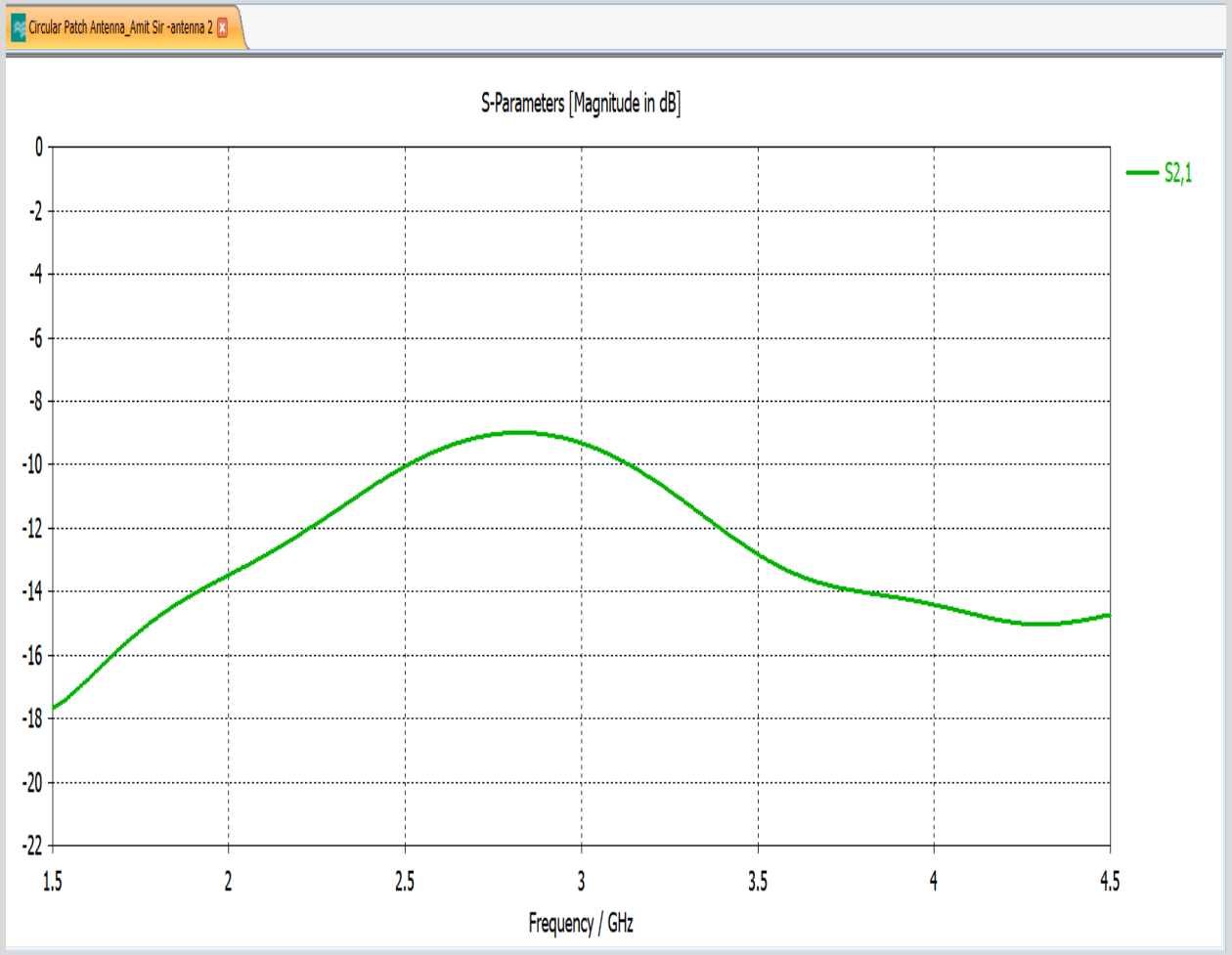



# Radiation Pattern for Antenna 1




# Antenna 2 : Front View




# S11(in dB) & S21(in dB) for Antenna 2

# Expected Outcomes & Future Scope

- In the future we will be implementing the complete antenna design for Circularly Polarized Antenna of the collected data sheet(Research Paper).
- Furthermore we'll be working towards reducing the **Mutual Coupling** and **Compactness**.
- We also have to have a **HIGH GAIN**. So we'll be working towards that as well.

# References


- https://antennatestlab.com/wp-content/uploads/2017/09/CP-Explained-Without-Math.pdf
- https://link.springer.com/article/10.1007/s11277-019-06298-x
- https://www.researchgate.net/publication/239528411_A_novel_design_of_dual_circularly_polarized_antenna_FED_by_L-strip

# THANK YOU