NATIONAL INSTITUTE OF TECHNOLOGY SRINAGAR

A PRE PROJECT-REPORT ON

"DESIGN OF CIRCULARLY POLARIZED MICROSTRIP ANTENNA FOR VARIOUS WIRELESS APPLICATIONS"

A pre-project report submitted in partial fulfillment of requirements of the 7th semester of the Bachelor of Technology course during the year 2019-2023

Submitted by:

SHANT RATHOD
(2019BECE049)

ALOK YADAV
(2019BECE033)

Submitted to:

Dr. AMIT KUMAR

Department of Electronics & Communication Engineering

DECLARATION

We hereby certify that the work which is being presented in the thesis entitled "DESIGN OF CIRCULARLY POLARIZED MICROSTRIP ANTENNA FOR VARIOUS WIRELESS APPLICATIONS" submitted by SHANT RATHOD and ALOK YADAV in partial fulfillment of the requirements for the award of the degree of B. Tech. (Electronics Engineering) submitted in the Department of Electronics and Communication Engineering at National Institute of Technology Srinagar. We declare that this written submission represents our ideas in our own words, and where-in others' ideas or words have also been included, we have adequately cited and referenced the sources. We also declare that we have adhered to all academic honesty and integrity principles and have not misrepresented, fabricated, or falsified any idea/data/fact/source in my submission. It is further certified that the work presented in this dissertation has not been submitted elsewhere for the award of any degree.

SHANT RATHOD (2019BECE049)

ALOK YADAV (2019BECE033)

7^{TH} Semester B. Tech 4^{Th} year

ABSTRACT

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 antennae 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 would want to have a High Gain.

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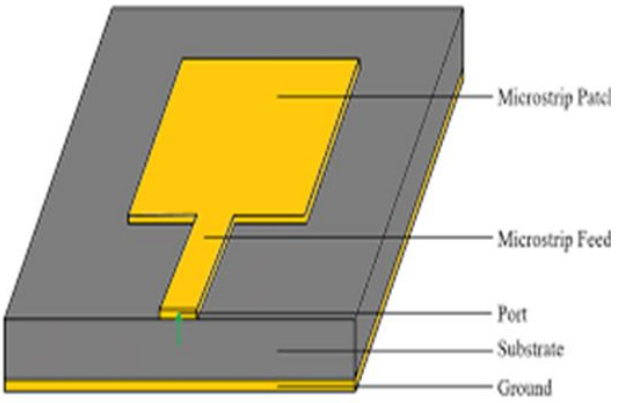
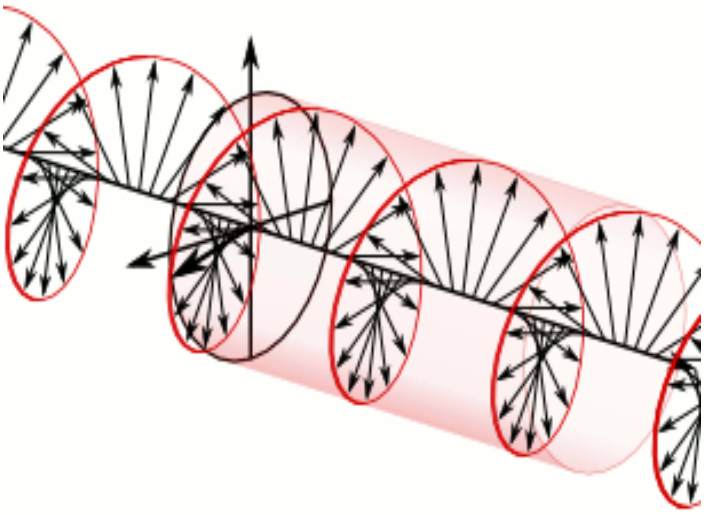
INTRODUCTION

MICROSTRIP:



Any technique can be used to create a microstrip line, ***an electrical transmission line*** in which the conductors are separated from the ground plane by a dielectric layer known as the substrate. The cheapest method of transmitting microwave frequency signals is with microstrip lines, which may be constructed on conventional FR-4 (standard PCB) substrates. Monolithic micro-hop IC/microwave IC technologies may be feasible, but their performance may be constrained by the available dielectric layer and conductor thickness. It is frequently discovered that the dielectric loss in FR4 is too high at microwave frequencies and the permittivity is not sufficiently controlled for these reasons.

CIRCULARLY POLARIZED (CP) ANTENNA:



Circularly polarized waves are waves in which the electric field vector revolves in a circle as the waves travel, and it is an antenna that broadcasts these waves.

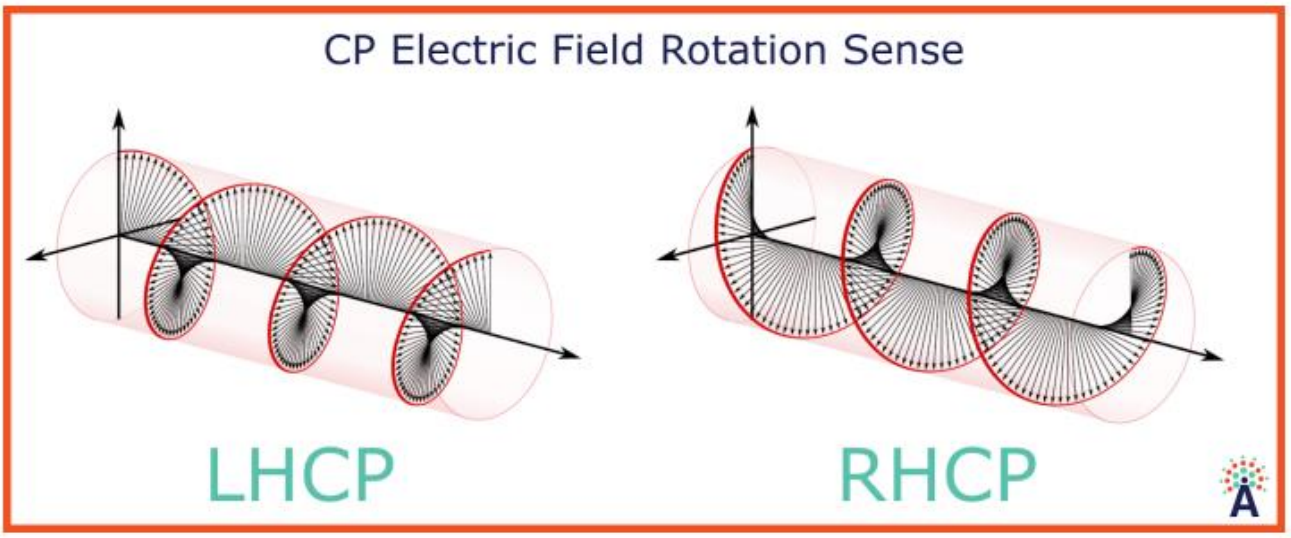
An electromagnetic wave is said to be in circular polarization when its electromagnetic field has a constant magnitude at each point and rotates at a constant speed in a plane perpendicular to the wave's direction.

A CP antenna's field rotates constantly (unlike a linear polarized antenna)

Circularly polarized (CP) antennas can overcome polarization mismatch when functioning as transmitter and reception antennas, making them more favorable than linearly polarized antennas in today's world of wireless communications. Additionally, CP antennas are more transportable and waterproof than linearly polarized (LP) antennas.

The most often used option for high-speed wireless communications is a broadband antenna. Because of their greater bandwidth, low profile, and simplicity of integration into monolithic

microwave integrated circuits, square-slot and ring-slot CP antennas have received a lot of attention recently. Because of its lower dispersion, lower radiation losses, and simpler integration with solid-state devices, CPW feeding is typically favored over microstrip feeding. Axial ratio bandwidth (ARBW) and impedance bandwidth (IBW).



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LITERATURE REVIEW

Sr. No.	Author Name (Year)	Title	Source
1	Mr. Amit Kumar, Mr. Abdul Quaiyum Ansari, Mr. Binod Kumar Kanaujia & Mr. Jugul Kishor (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 & Dr. Amit Kumar (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 (2008)	A novel design of dual circularly polarized antenna fed by L-strip	Publication on Research Gate

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.

SOFTWARE & HARDWARE UTILIZED:

- CST (Computer Simulation Technology) STUDIO SUITE 2016

  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

ADVANTAGES & APPLICATIONS:

- 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.

DATA COLLECTION

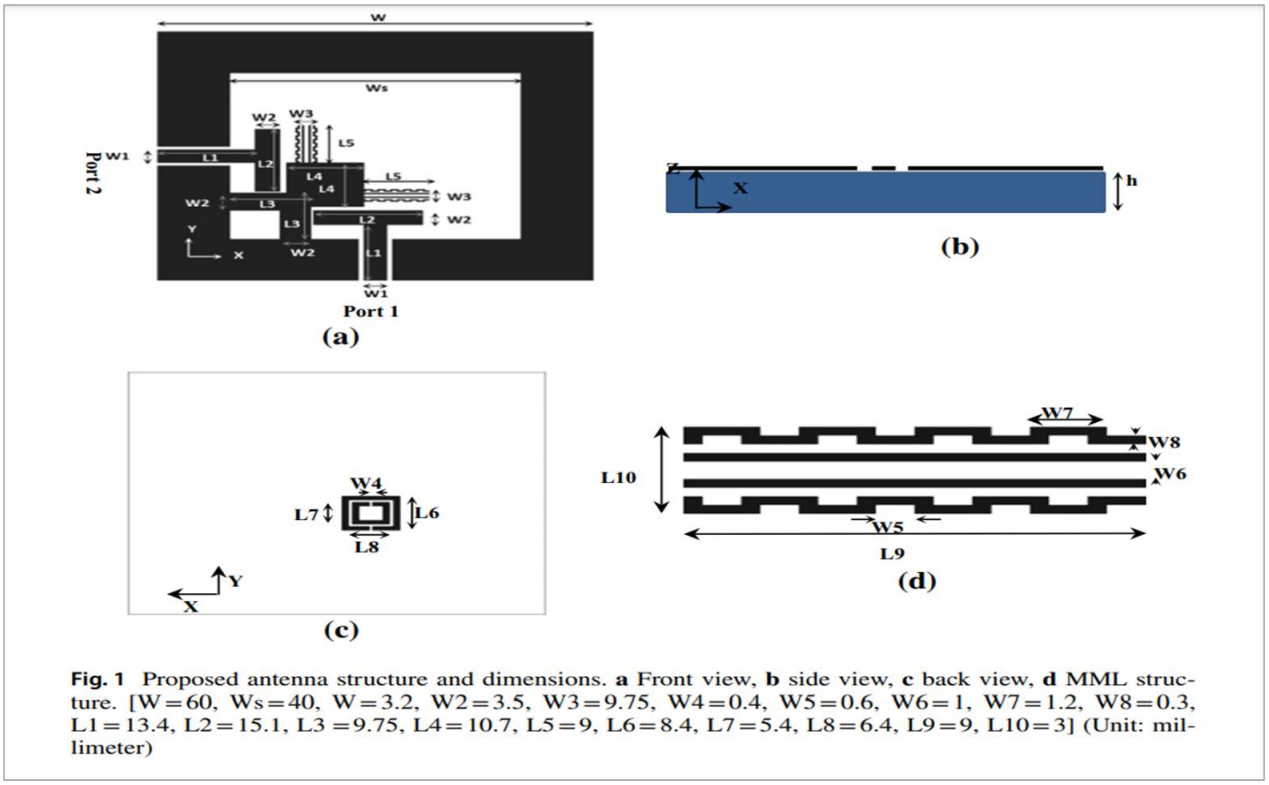


Fig. 1 Proposed antenna structure and dimensions. **a** Front view, **b** side view, **c** back view, **d** MML structure. [W = 60, Ws = 40, W = 3.2, W2 = 3.5, W3 = 9.75, W4 = 0.4, W5 = 0.6, W6 = 1, W7 = 1.2, W8 = 0.3, L1 = 13.4, L2 = 15.1, L3 = 9.75, L4 = 10.7, L5 = 9, L6 = 8.4, L7 = 5.4, L8 = 6.4,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

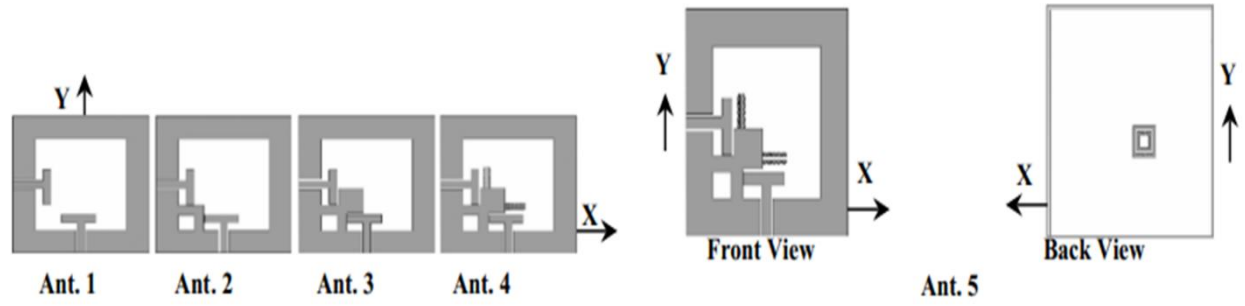
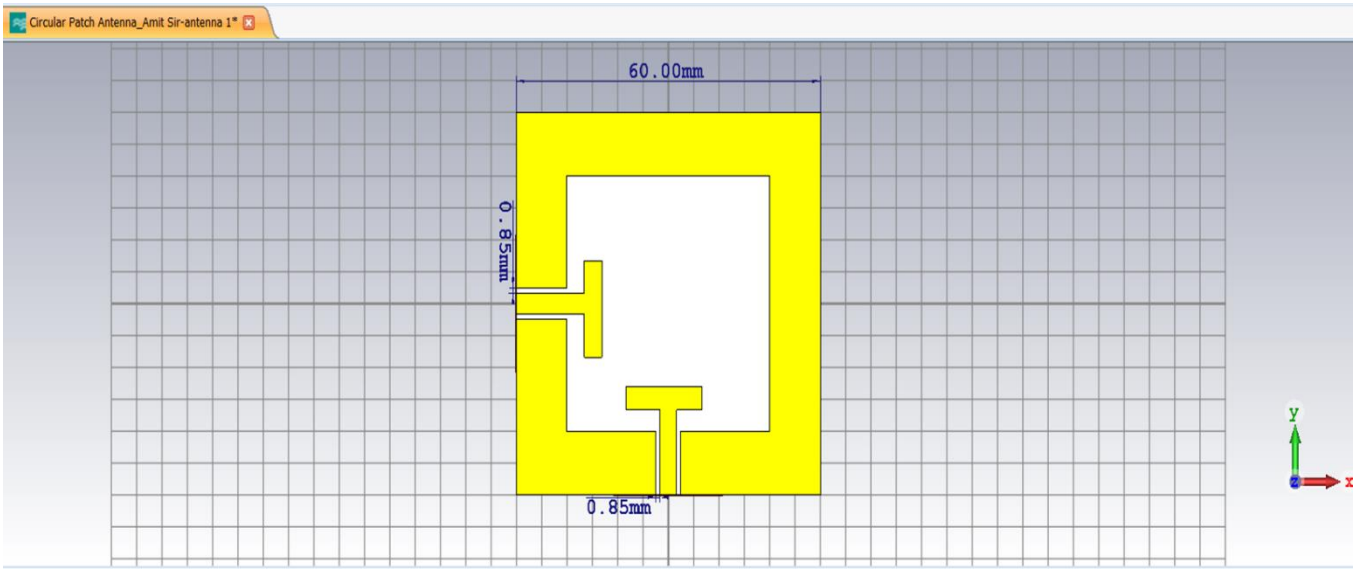


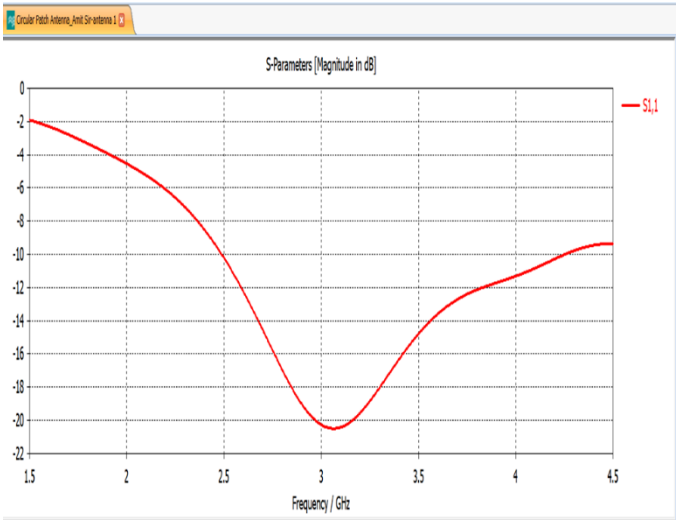
Fig. 2 Steps of improvement in proposed antenna

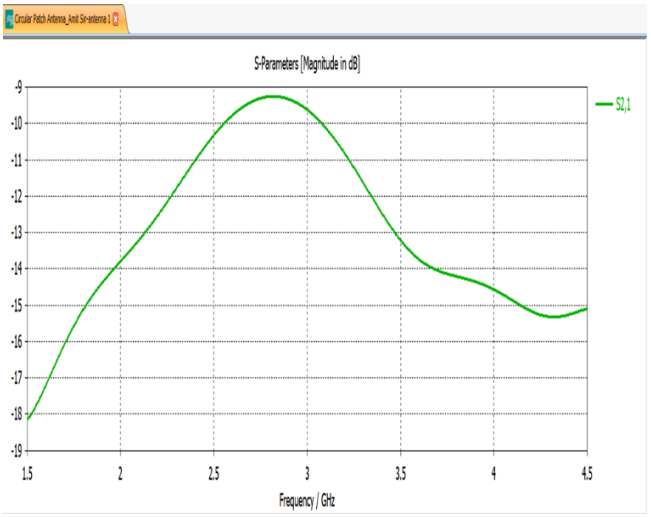
Reference-1

DATA ANALYSIS

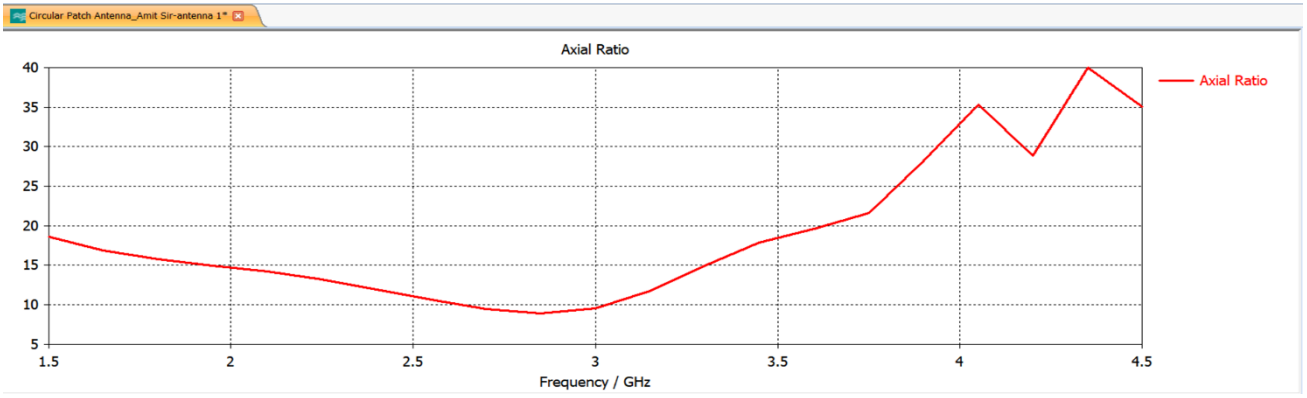


ANTENNA 1: FRONT VIEW

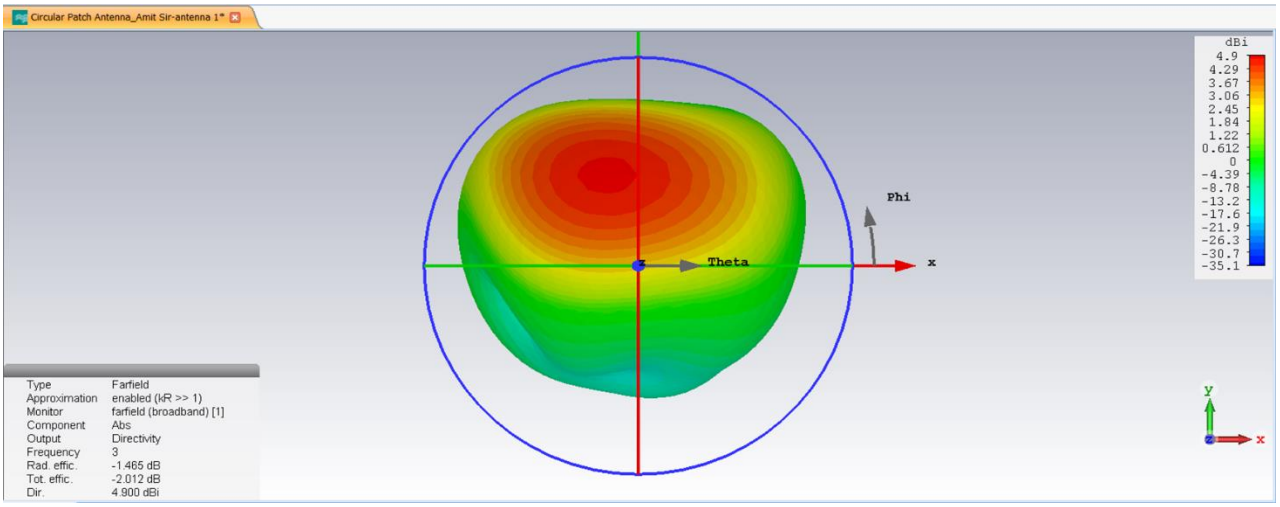




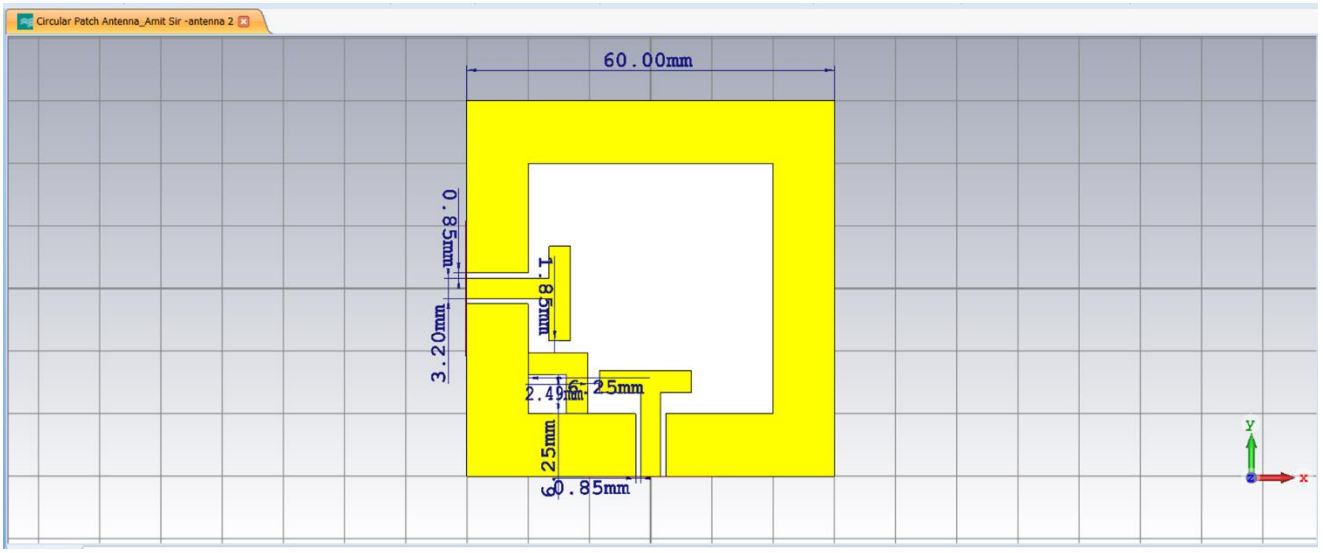
S11(in dB) & S21(in dB) for Antenna 1



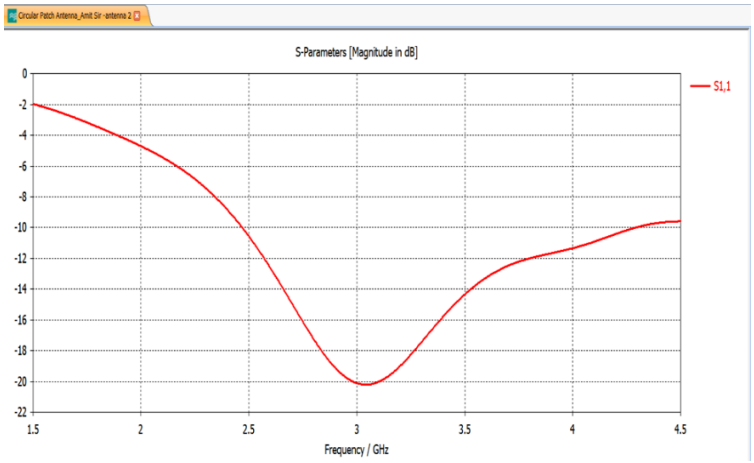
AXIAL RATIO for ANTENNA 1

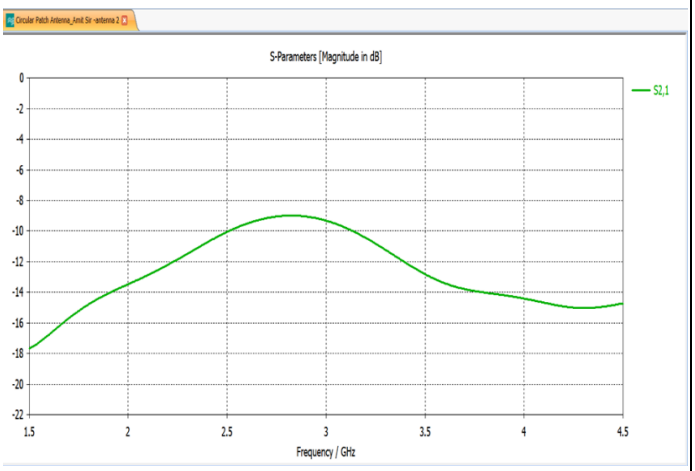


RADIATION PATTERN for ANTENNA 1



ANTENNA 2: FRONT VIEW





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

CONCLUSION

Discussed the benefits of circularly polarized antennas and microstrip antennas and the mechanism of circular polarization. Calculating the axial ratio bandwidth provided insight into computer simulation technology (CST) and operation. The two E-fields produced by the two antennas are further redirected along the horizontal and vertical components with the help of inverted-L grounded strips at the left corner, as shown in Antenna-2 design, resulting in a 3-dB ARBW of 36.30% and an improved S parameter, according to analysis of the S11 and S21 parameters, Axial ratio, and Radiation pattern of the final antenna design.

REFERENCES

1. Mr. Amit Kumar, Mr. Abdul Quaiyum Ansari, Mr. Binod Kumar Kanaujia & Mr. Jugul Kishor (April 1st 2019), *Dual Circular Polarization with Reduced Mutual Coupling Among Two Orthogonally Placed CPW-Fed Microstrip Antennas for Broadband Applications*, ***Wireless Personal Communications, An International Journal*** ISSN 0929-6212.
2. Mr. Prashant Ranjan & Dr. Amit Kumar (March 28th 2021), *Circularly polarized ultra–wide band filtering antenna with controllable band-notch for wireless communication system*, ***International Journal of Electronics and Communications, (***AEU) 135 (2021) 153738
3. Glenn Robb, Principal Engineer Antenna Test Lab Co. (2017), *Circularly Polarized Antennas Explained, Without the Math*, ***An AntennaTestLab.com Publication,*** Version 5