

## A Stacked Circularized Microstrip Antenna with Semi-Circle Slot for ISM (Industrial, scientific and Medical ) Band

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**Abstract:** A Truncated stacked circular Microstrip patch antenna is proposed for circularly polarized radiation. Proposed circular patch antenna has lower and upper patch and lower patch has radius of 16.8mm and 6.4mm respectively. There are Four Symmetric half circular slots cut from the upper and lower patch from both side of radius 2.1mm and 4.2mm for CP radiation. The performance of the patch antenna has been studied by varying the slots radius . Proposed antenna is optimized to have axial ratios less than 3 dB. The value of axial ratio at frequency 2.5Ghz ( 2.44GHz to 2.53GHz) and 5.8GHz (5.54 GHz to 6.5GHz) are 2.7 dB and 1.7 dB respectively. The Axial BW are 6MHz and 20MHz at the lower and upper band respectively. The Simulated results of return loss are 25.1 dB and 22.6 dB at 2.5GHz and 5.8GHz with respectively impedance BW of 89MHZ and 960MHZ. Proposed antenna is designed to work in ISM (industrial scientific and Medical) band.

**Keywords:** Bandwidth, circularly polarized, Axial ratio, Dual band, ISM band

### 1.Introduction

Since decade, Microstrip antenna has been researcher choice due to its Vital Properties. [1] Since it has light weight and low cost. It has been used for wireless communication application for resolving social cause. Microstrip antenna can be designed for desired application or on demand by the organization. Polarization is a very important factor for secure data communication. [2] Microstrip antenna can be designed for Linear polarization, Circular polarization and cross polarization. [3] It deals with circularly polarized antenna with axial ratio 1.72dB. Antenna parameter like axial ratio less than 3 dB indicates for circularly polarization. To get circular polarization, both modes ( $E_x$  and  $E_y$  fields) are  $90^\circ$  phase out with each other. [4]A wideband Circularized polarized radiation performance is achieved through the combination of two sets of common modes and differential modes with  $90^\circ$  phase delay. Moreover, the shared-aperture configuration of both modes achieves a size reduction.[5] Microstrip antenna can be made fractal by using self-similarity properties. Antenna with fractal geometry, can be made for multiband application. In 1956, B Mandelbrot invented Fractal geometry. [6] A broad bandwidth is achieved under triple-mode frequencies. By rotating in successive order, the triple-mode elements, a circularly polarized Microstrip antenna is designed with a 4-feed network.

#### 1.2 Antenna Geometry approach

A proposed geometry of a stacked microstrip antenna as shown in fig1. It is designed with glass epoxy substrate, FR4 material has dielectric constant 4.4, keeping substrate .A Coaxial feeding technique was used to feed power at optimized feed position. Stacked spacing between both patches is kept 4mm. Four half circle slots was cut at the lower patch and upper patch with radius 16.8mm and 6.4 mm respectively.

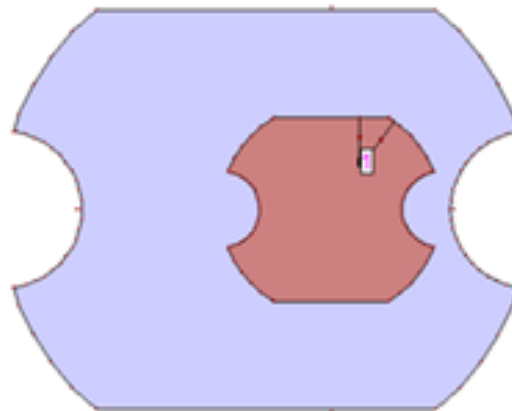
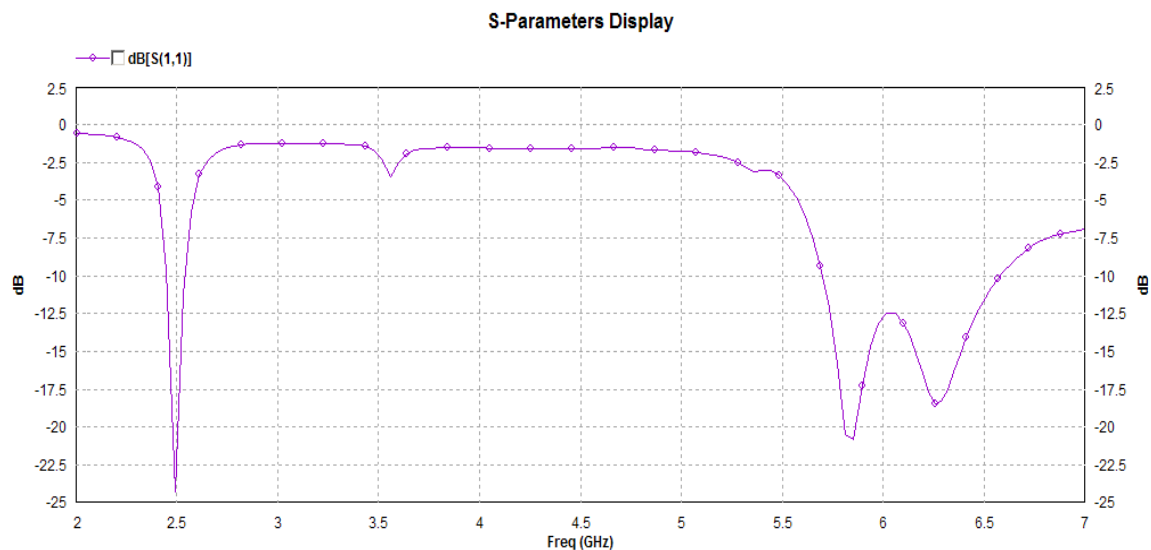


Fig 1: Proposed Antenna Geometry

### 1.3 Result and Analysis

The proposed antenna was simulated using IE3D software and results of  $S_{11}$  and Axial ratio was shown in fig 2 and fig3. This configuration of antenna results in dual band -10dB impedance response ranges from 2.44GHz to 2.53GHz ( 3.56 % ) at 2.5GHz and 5.54 GHz to 6.5GHz (15%) at 5.8GHz in respective  $S_{11}$ -parameters response. Axial ratio plot in fig 3 shows axial band width of 89MHz and 870MHz at the above frequencies. In the table 1 ,simulated results are summarized and shown in tabular form. From the table ,axial ratio 2.7dB and 1.77 dB are achieved at the same frequencies. To achieve the circularized polarized antenna axial ratio value should be less than 3dB.



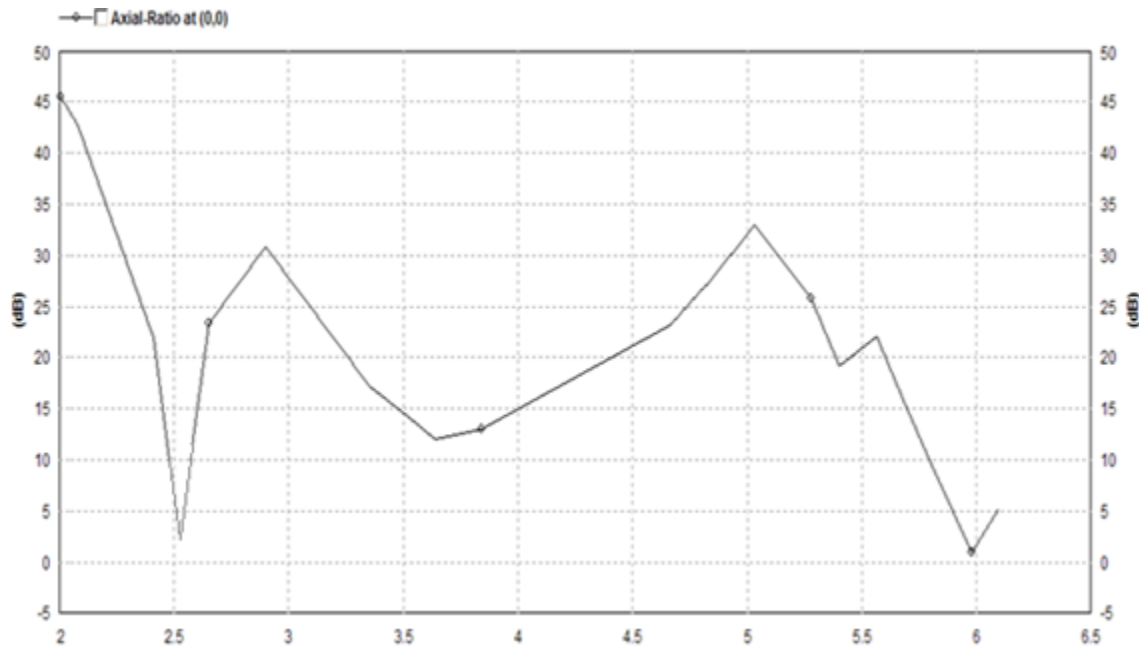


Fig 3: Axial Ratio vs Frequency plot

Table 1: simulated result

S.No.	Frequency (GHz)	$S_{11}$ (dB)	axial ratio(dB)	Bandwidth(MHz)
1.	2.51	-25.1	2.7	89
2.	5.8	-22.6	1.77	870

**Conclusion:**

A stacked Microstrip antenna with four half circle slots was presented to have circularly polarized antenna. This geometry results a dual band antenna at 2.5GHz and 5.8GHz .The proposed antenna have axial ratio of 2.7dB and 1.77dB with axial Bandwidth of 89MHz and 870Mhz at the same frequency respectively. The proposed antenna has better impedance matching with return loss 25.1 dB and 22 dB.This antenna with optimized parameters can be utilized for industrial, scientific and medical applications.

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