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# Dual Band RT Duroid Annular Ring Patch Antenna

**Thingbaijam Rajkumari Chanu**
NIT Mizoram
Chaltlang, Dawrkawn
Aizawl 796012

**Ankit Kumar**
NIT Mizoram
Chaltlang, dawrkawn
Aizawl 796012

**Abhishek Kumar**
NIT Mizoram
Chaltlang Dawrkawn
Aizawl 796012

## ABSTRACT

*This paper presents a design of low profile, double Band Circular patch antenna(CPA) using RTDuroid material with coaxial feed.The Dual frequency Band antenna is obtained by inserting circular slot in the circular radiator. The resonating Frequencies are 5.83GHz and 7.088GHz to 7.38GHz which can be used for WLAN and Satellite Communication applications.*

***Keywords***

***Bandwidth, CPA, Return Loss, Coaxial Probe feed, Gain.***

## INTRODUCTION

Demands of microwave and wireless communication in various applications are increasing. This rapid growth in wireless communication is prompting the use of Microstrip patch antenna. Microstrip patch antenna is suitable to apply because of its advantages such as ease of compatibility with microwave circuits, fabrication, low profile and less cost. [2] With these advantages patch antenna have some disadvantages also like narrow band and low gain. In these days the users are increasing so the system should have the wide band.To avoid use of two separate antennas for two frequency bands and to fulfil the demand of leading market there is a need to develop the dual band antennas. In this proposed antenna we are using coaxial feed which has the advantage to change the position of feed to desired location very easily. In the design we inserted the circular slot to enhance the performance of CPA. The change in current distribution in the annular ring leads to two frequency band radiation.

The proposed design radiates at two frequency band with wide bandwidth of 7.6%. The substrate RTDuroid have the loss tangent is very low so the efficiency is high. The designed antenna was simulated using Zeland IE3D 12.0 software.

## ANTENNA DESIGN

The conventional of the conventional CPA using RTDuroid substrate has the dimension of height (h) = 1.588mm, dielectric constant (∈r) = 2.2, loss tangent = 0.0009 radius (r) = 22.65mm.[1] Circular slot with radius α, 8mmis used. The antenna radiates at two frequency 5.82GHz and 7.08GHz to 7.38GHz for WLAN and satellite communication respectively.

Radius of circular patch is given in equation (1)

$$\text{Radius} = \frac{F}{\sqrt{1+\frac{2h}{\pi \in rF}\ln\frac{\pi F}{2h}+1.7726}} \quad \ldots\ldots\ldots\ldots (1)$$

$$\text{Where; } F = \frac{8.791\times10^{9}}{fr\sqrt{\in r}} \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

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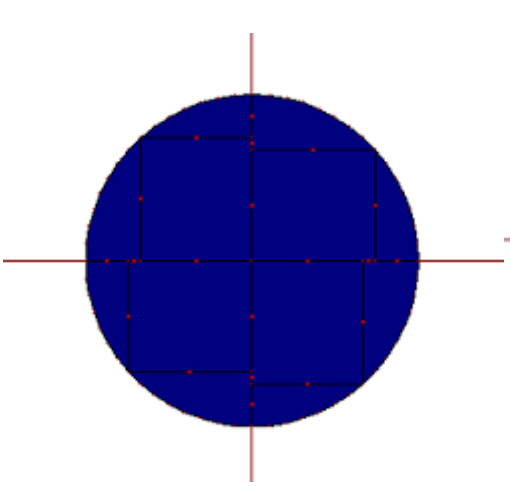


Figure 1(a): Conventional CPA

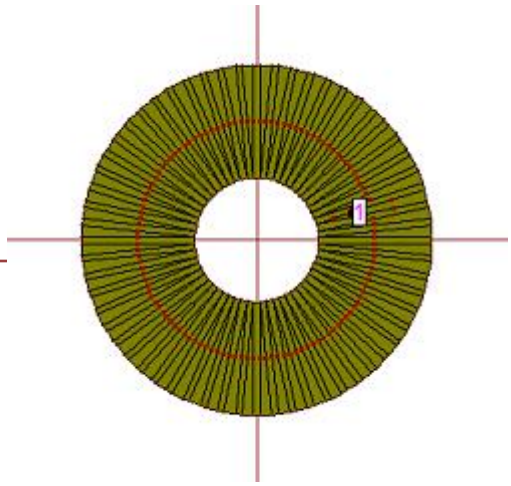
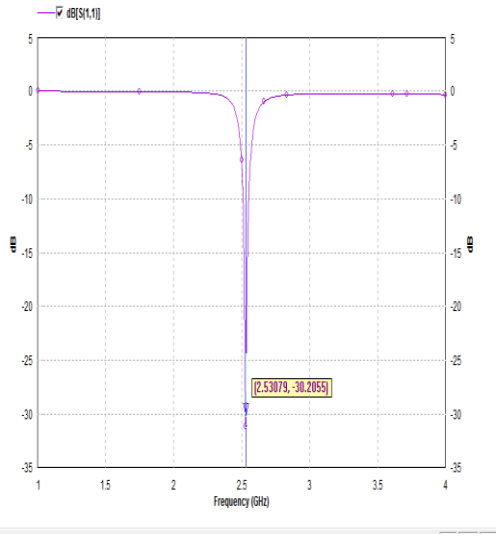



Figure 1(b): Proposed Annular Ring Patch Antenna

## SIMULATED RESULTS

**1. RETURN LOSS ($S_{11}$) & BANDWIDTH:** For conventional CPA the resonation frequency is 2.5GHz and its $S_{11}$ value is -30.2055dB and the bandwidth obtained is 1.5836% which is shown in Figure 2(a). The Return Loss ($S_{11}$) graph in Figure 2(b) is of the Annular Ring Patch Antenna is-19.2785 dB at resonating frequency at 5.82GHz and -30.3063 dB at resonating frequency 7.088GHz. The bandwidths obtained are 1.54% and 7.6% respectively.



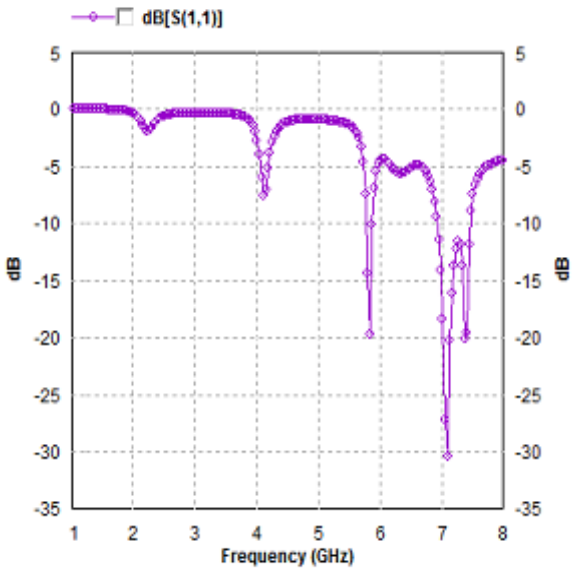




Figure 2(a): $S_{11}$ graph for Conventional CPA

Figure 2(b): $S_{11}$ graph for Annular Ring Patch Antenna

**2. RADIATION PATTERN:** The microstrip antenna radiates normal to its patch surface. So, the elevationpatternfor$\phi$ = 0 and $\phi$ = 90degrees are important for the measurement. The simulated E-plane and H-plane pattern, 2D pattern view of the RTDuroid CPA is shown in Figure 3(a) and 3(b).

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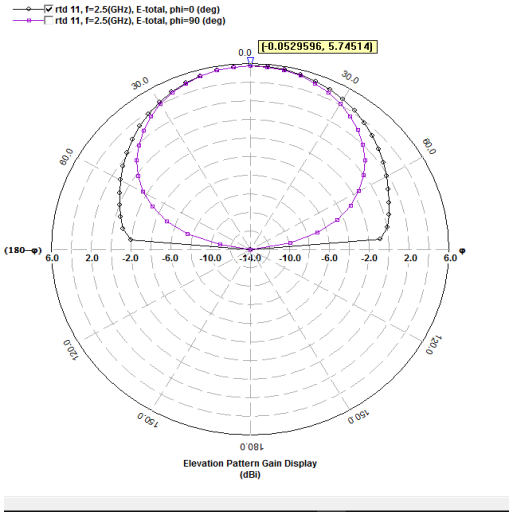


Figure 3(a): Radiation pattern for CPA

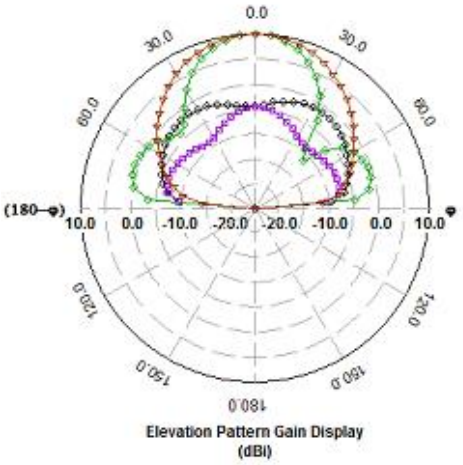


Figure3(b): Radiation pattern for Annular Ring Patch Antenna

**3. ANTENNA EFFICIENCY:**The proposed Annular Ring patch antenna has the efficiency of 67.3% at the resonating frequency 5.82GHz and 69.42% at the frequency 7.0887GHz to 7.38GHz.It has the high efficiency because the substrate has the loss tangent very low. But it is lower than the conventional CPA's efficiency. The efficiency of conventional patch antenna is 87.0212%.

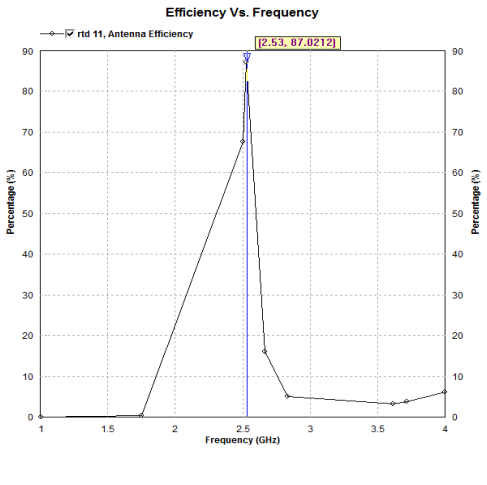


Figure 4(a): Efficiency of conventional CPA antenna

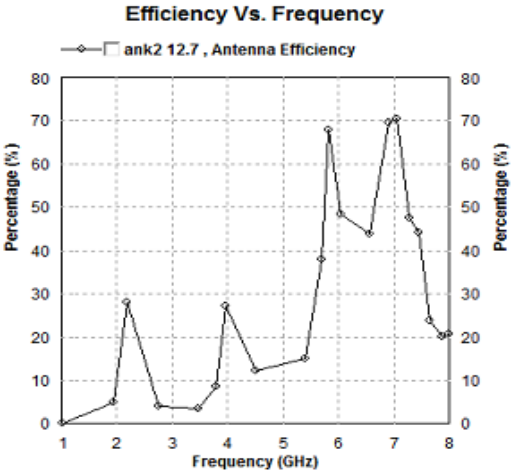


Figure 4(b): Efficiency of Annular Ring patch antenna

**4. OBSERVATION TABLE : PROPOSED ANNULAR RING DUAL BAND ANTENNA:**

| S.NO. | PARAMETERS | RESONATING FREQUENCY | |
|---|---|---|---|
| | | fr1 | fr2 |
| 1 | FREQUENCY | 5.82GHz | 7.08GHz to7.38GHz |
| 2. | GAIN (dBi) | 6.19178 dBi | 9.48212dBi |
| 3. | ANTENNA EFFICIENCY | 67.3 % | 69.42 % |
| 4. | RETURN LOSS ($S_{11}$) | -19.2785 dB | -30.3063 dB |
| 5. | FRACTIONAL BANDWIDTH | 1.54% | 7.6% |

## CONCLUSION:

In this paper, the new geometry proposed radiates at two frequencies and it can be use as dual band antenna.Analysis and results show thatthe radiation pattern is stable over the entire bandwidth and have the very good efficiency at the both resonating frequencies. Gains on both the resonating frequencies are quite high and it is achieved for the entire bandwidth frequency range. It can be used for WLAN and SATELLITE COMMUNICATION applications.

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