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Diffrernt Shaped Centered Circular Slots Patch Antenaa At 1.959 GHz

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***Abstract*— In this paper, a novel meta-material based circular slotted antenna at 1.959 GHz frequency, is proposed. The given antenna is composed of a rectangular patch antenna loaded with center modified circular slotted structures. The antenna is designed for resonating at 1.959 GHz frequency. In addition to this, the antenna is also resonating at different resonating frequency which makes it dual band antenna. The proposed antenna is simulated on CST version 10 and the results are in good agreement. The 50 ohm port is used to fed the proposed antenna.**

***Keywords*—Micro-strip patch antenna, Dual-band, Meta-material, symmetry.**

I. INTRODUCTION

Concept of antenna has been around for a long time, millions of years, as the organ of touch or feeling of animal, birds and insects. But in the last 100 years they have acquired a new significance as the connection link between a radio system and the outside World. The first radio Antenna was built by Heinrich Hertz, a professor at the Technical Institute in Karlsruhe, Germany. The IEEE standard defines an antenna as a part of a transmitting or receiving system that is designed to radiate or to receive electromagnetic waves [1]. A patch antenna [2–3] is a low-profile antenna consisting of a metal layer over a dielectric substrate and ground plane. Typically, a patch antenna is fed by a micro-strip transmission line, but other feed lines such as coaxial can be used. The advantages of patch antennas are that they radiate with moderately high gain in a direction perpendicular to the substrate and can be fabricated in a low cost FR-4 substrate. Micro-strip antennas have unique features and attractive properties such as low profile, light weight, compactness and Conformability in structure [4]. With those advantages, the antennas can be easily fabricated and integrated in solid-state devices. Micro-strip antennas are widely applied in radio frequency devices with single-ended signal operation. In modern wireless communication systems, the micro-strip patch antennas are commonly used in the wireless devices. Therefore, the miniaturization of the antenna has become an important issue in reducing the volume of entire communication system [6]. Further the tremendous increase in wireless communication in the last few decades has led to the need of larger bandwidth and low profile antennas for both commercial and military applications. One technique to construct a multiband antenna with best return loss is meta-material design.

II. ANTENNA DESIGN THEORY

The designing parameters [10, 11] of rectangular micro-strip patch antenna are L=28.50mm, W=36.00 mm, length of transmission line feed=35.82175 mm, with width of the feed=3.009 mm. The rectangular micro-strip patch antenna is designed on FR-4 (Loss free) substrate with permittivity of 4.3 and height from the ground plane is 1.6 mm. A novel printed antenna is composed of a rectangular patch printed antenna over the FR4 substrate loaded with a another FR-4 plate loaded with circular slots which is proven as a good resultant in terms of performance as a return loss..

The RMPA parameters are calculated from the following formulas [11-12].

Calculation of Width (W):

$$W = \frac{1}{2f_r\sqrt{\mu_0\varepsilon_0}}\sqrt{\frac{2}{\varepsilon_r+1}} = \frac{C}{2f_r}\sqrt{\frac{2}{\varepsilon_r+1}}$$

Where C = free space velocity of light,

Ɛr =Dielectric constant of substrate.

The effective dielectric constant of the rectangular micro-strip patch antenna:

$$\varepsilon_{eff} = \frac{\varepsilon_r+1}{2} + \frac{\varepsilon_r-1}{2}\left(\frac{1}{\sqrt{1+\frac{12h}{w}}}\right)$$

Actual length of the patch (L):

L = Leff - 2ΔL

Where, $\mathrm{Leff} = \frac{c}{2 f_r \sqrt{\varepsilon_{eff}}}$

Calculation of length extension:

$$\frac{\Delta L}{h} = 0.412 \frac{(\varepsilon_{eff}+0.3)\left(\frac{W}{h}+0.264\right)}{(\varepsilon_{eff}-0.258)\left(\frac{W}{h}+0.8\right)}$$

Fig.1, 2, 3 shows the structure of the simple patch, return loss of the simple patch which is -10.98dB and radiation pattern of simple patch. The antenna is modeled and simulated using method of moment based electromagnetic simulation software CST, version 10, for 1.959 GHZ.

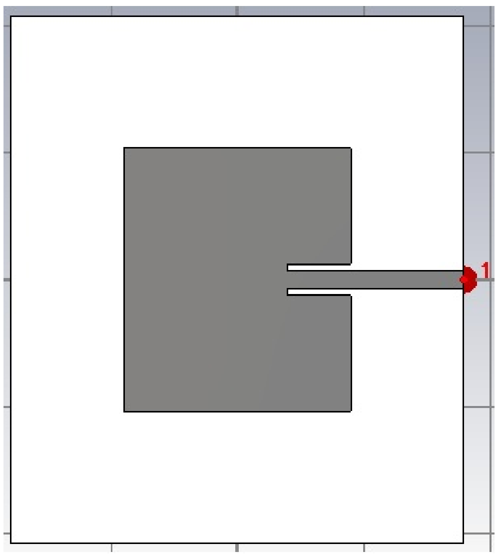

Figure 1: Structure of simple RMPA antenna.

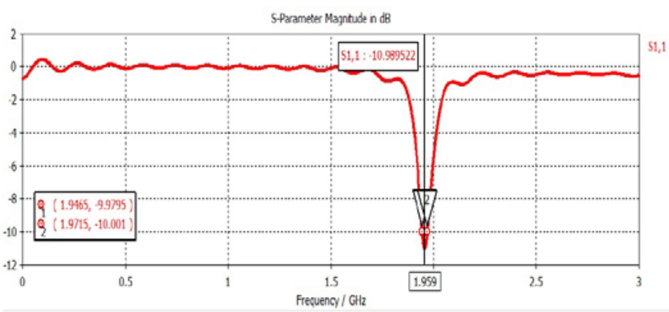

Figure 2: Return loss of simple RMPA

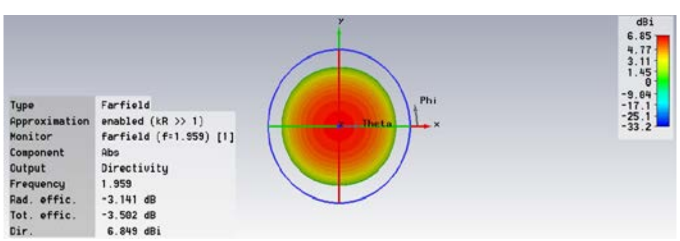

Figure 3: Radiation Pattern of simple RMPA

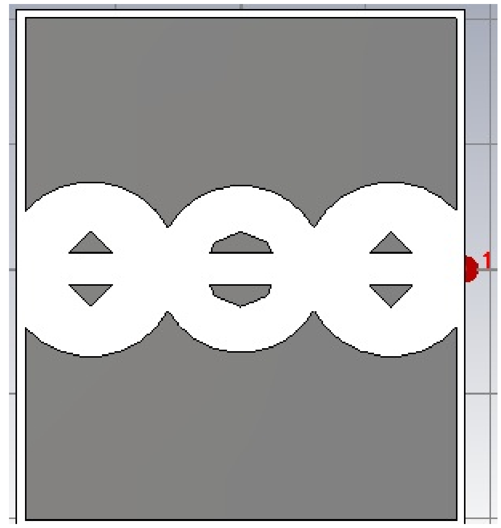

Figure 4: Structure of improved design

III. SIMULATION RESULTS

Fig. 4 and 5 shows the structure of improved design and the graph of return loss V/s frequency. The graph of return loss shows that antenna is resonating as a dual-band .

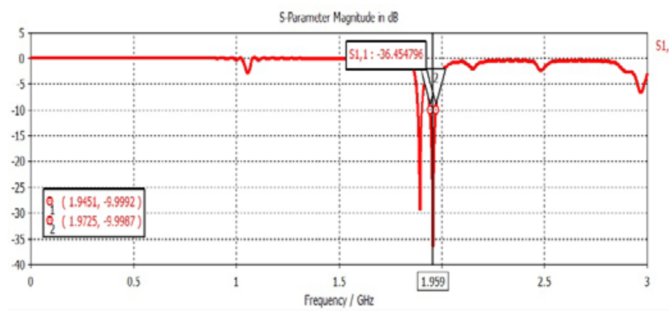

Figure 4: Return Loss V/s Frequency of improved version

IV. CONCLUSION

A Novel modified centered circularly slotted antenna is designed that shows better return loss as compared to the simple patch that is exactly -36.45 dB at 1.959 GHz frequency. Also due to this effect, antenna is also converted into dual band as shown in the figure 4.The antenna is modeled on low cost and easily available FR4 substrate. Bandwidth of the modified patch along with return loss can also be improved by using some different structures or techniques.

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