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# A Crescent Moon like Textile Antenna for C-Band Application

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**ABSTRACT**

In this article a compact crescent moon shape patch antenna for C-band application is presented. The presented antenna is designed on jeans substrate with dielectric constant of 1.7. The overall size of antenna is 53.3 × 59.9 × 1 mm. This antenna has been simulated using CST software. The presented antenna resonates at frequency 7.5 GHz which covers a bandwidth of 3 GHz extending from 5.59 GHz to 8.59 GHz. It has maximum directivity of 4.791 dBi.

***Keywords:*** Wide Band, C-band application, Patch Antenna, CST.

## 1. INTRODUCTION

Microstrip patch antennas are commonly used in wireless application due to its high advantages such as low profile, high broadcast efficiency, light weight, low profile, conformal and planar structure, compactness, low cost and ease of addition with microwave circuit. Now a day's Compact microstrip antennas are getting much more awareness due to the increase in demands of small size antennas used in private and marketable purposes [1]-[6].

There are a variety of methods adopted to increase the bandwidth of microstrip antenna such as enlarge the substrate thickness, use of a low dielectric constant substrate, use of a variety of feeding techniques and impedance matching use of slot antenna geometry and numerous resonators. But the bandwidth and size of the antenna is jointly conflicting property that is enhancement of one deteriorates the characteristics of others [7]-[15].

One more technique is of reducing the size of an antenna and for improving its performance by applying the meandering method to the ground plane of a microstrip antenna. The impedance bandwidth and antenna gain can be improved, which is a great improvement of this kind of ground-meandering method over the patch-meandering method. By stacking a parasitic patch on a microstrip patch antenna, the antenna with high gain or wide bandwidth can be realized [16]-[24]. These characteristics of stacked microstrip antenna depend on the distance between a fed patch and a parasitic patch.

## 2. ANTENNA DESIGN

The presented antenna works for three resonant frequencies which is shown figure 1. If there is more than one resonant part available with each operating at its own resonant frequency then the overlapping of multiple resonance leads to broadband applications. The base of the proposed antenna was a circular patch with outer patch radius 18 mm. The dimension of proposed antenna is shown in table 1.

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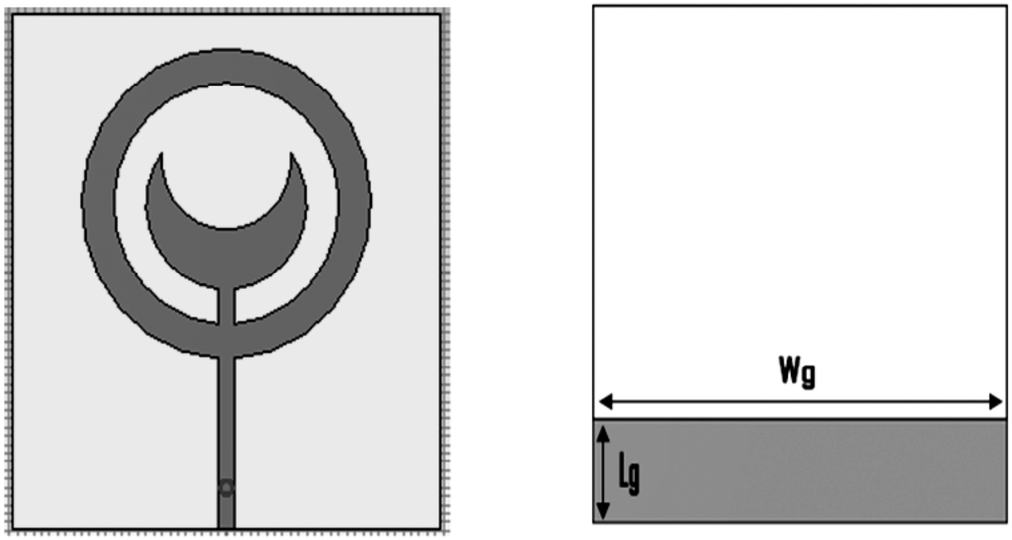


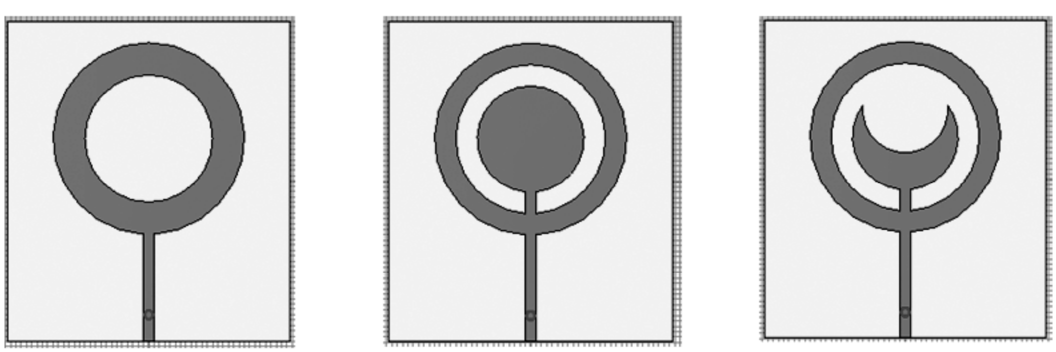

**Figure 1: Configuration of the proposed pentagonal microstrip antenna**

**Table 1**
**Design Parameters and Dimensions of Proposed Antenna**

| *Parameters* | *Dimension (mm)* |
|---|---|
| Relative permittivity ($\varepsilon_r$) | 1.70 |
| Loss tangent (tanδ) | 0.025 |
| Substrate thickness (h) | 1.0 |
| Outer Circle Patch radius (R1) | 18 |
| Inner Circle Patch radius (R2) | 14 |
| Moon Circle Slot radius (R3) | 8 |
| Microstrip feed line (L × W) | 2 × 30.9 |
| Substrate dimension (Ls × Ws) | 47.3 × 53.8 |
| Partial ground plane (Lg × Wg) | 53.3 × 14.9 |

## 3. ESTIMATION OF PROPOSED MICROSTRIP ANTENNA

The CST software has been used to design and optimize the results created by the antenna. Initially circular patch was used to achieve the desired bandwidth, then the circular patch was modified to pentagonal shaped patch and finally the proposed shaped patch was achieved to optimize the results. Figure 2 shows the geometry of antenna1, antenna 2 and antenna 3. The return loss for antenna 1, antenna 2 and antenna 3 has been denoted by blue, orange and gray colored curves respectively in the given figure 3.



**(a)** **(b)** **(c)**

**Figure 2: Geometry of the proposed Antennas (a) Antenna1 (b) Antenna2 (c) Proposed Antenna3**

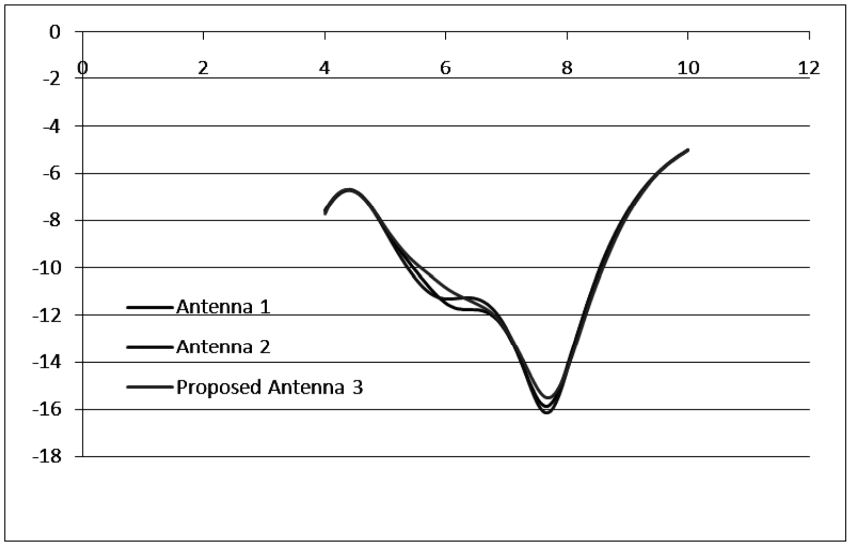



**Figure 3: Simulated return loss against frequency for the proposed microstrip Antenna1, Antenna2 & Antenna3**

## 4. RADIATION PATTERN AT RESONANT FREQUENCY

Figure 4 depicts simulated 2D radiation pattern of proposed microstrip antenna at 7.5 GHz which describes the main lobe direction = 135.0 deg and angular width (3dB) = 41.1 deg at Phi = $90^0$, and it gives a main

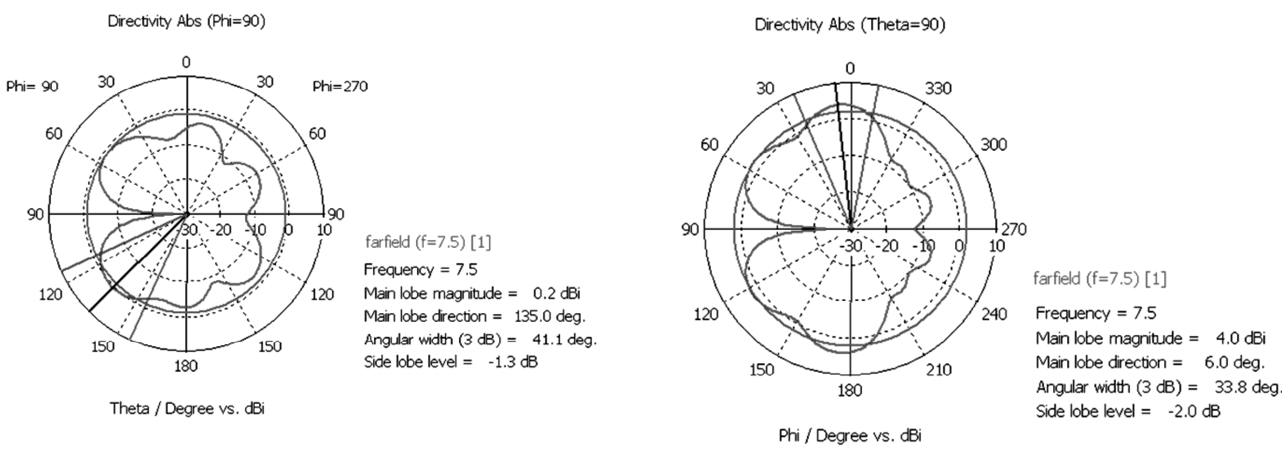



**Figure 4: Simulated 2 D radiation pattern of proposed microstrip antenna at 7.5 GHz**

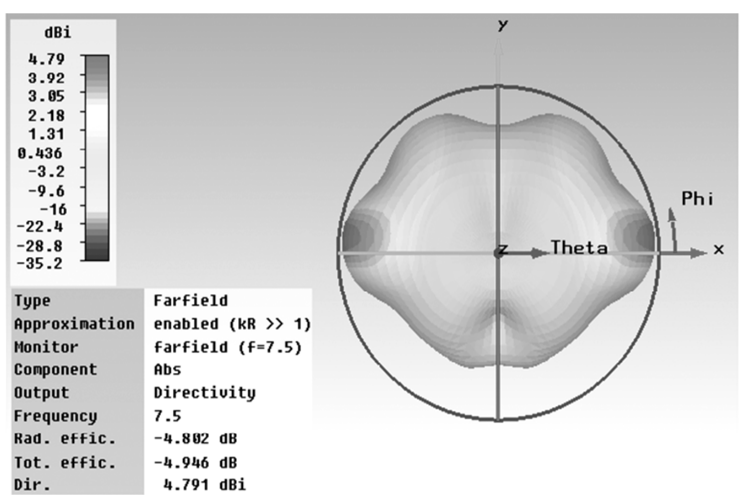



**Figure 5: Simulated 3 D radiation pattern of proposed microstrip antenna at 7.5 GHz**

lobe magnitude = 4.0 dBi and main lobe direction = 6.0 deg at theta = 90 degree. Figure 5 shows simulated 3D radiation pattern of proposed microstrip antenna at 7.5 GHz, The proposed antenna gives good total efficiency of about -4.946 dB and directivity of 4.791 dBi.

## 5. CONCLUSIONS

A crescent moon shape microstrip antenna is estimated for C-band application. The overall dimension (53.3 × 59.9 × 1.0 mm) of presented antenna is very compact, thus suitable for C-band application. The results are obtained by using CST microwave studio software. The antenna has maximum gain of about 4.791 dB. The presented antenna resonates at 7.5 GHz which covers a bandwidth of 3 GHz extending from 5.59 GHz to 8.59 GHz.

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