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Wide Band Micro strip patch antennas by using inverted U shape for S- Band and C - Band Applications

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Abstract- **In this paper a Wide Band Micro strip antennas for S- C Band is presented. In this work by using inverted U shape slot is used for impedance matching. FR-4 dielectric constant material is used for enhancement in impedance bandwidth. Simulation of antenna was completed in IE3D Simulator, for validation return losses, axial ratio, and gain of antenna considered. The parameter of a proposed antenna is satisfied by required limits. So it is suitable for S-C- Band applications.**

Key words- **Micro strip, S- Band and C – Band.**

I. INTRODUCTION

Up-and-coming relevance in wireless communication demands of Micro strip antenna to have demanding characteristics so that it may be acceptably in the area of modern wireless communication, navigation, 4G/5G mobile services, wireless LAN access, and many small electronics gadget embedded with Bluetooth, DVB etc. Since its commencement, Micro strip patch antennas are of much concern due to their attractive features like low profile, low weight, low cost, and it is very compatible with microwave integrated circuit. Mainly the patch antenna experience from their inherent narrow bandwidth.

For indoor application of wireless communication affect the system performance because of their internal characteristics due to multipath effect that causes signal fading, and effect from adjacent cells that degrades the performance by affecting the bit error rate so, it is demanded to have antenna with challenging characteristics. Lot of techniques are develop to increase impedance bandwidth. The simple solutions are the used of a thick substrate with low dielectric material for a low quality factor [1]. Proposed a Dimensionally Invariance Resonant Frequency (DIResF) method. It comprises features of DI and ResF method to achieved bandwidth is less than 27% because of they optimized the different technique to increase the impedance bandwidth [6].

Introducing the compensating distributed element like capacitance and inductance by using U-Slot on the patch and enhance bandwidth up to 30%.[3-6], by using separate aperture coupling structure introduce bandwidth up to 25% [7],[9].L-Probe and cavity–backed proximity-coupled techniques are able to obtain a bandwidth up to36% and 40% respectively[10] -[11], Stacking patches is another effective technique to enhance bandwidth [15]. From above discussion it is clear that the methodology is used for a low dielectric antenna substrate with height of antenna is approx 0.1λ. Three-dimensional microstrip transition feed [12-13]. For modified radiating patches, it has been shown that, by embedding a U-shaped slot in the radiating patch (U-slotted patch) [16] [18][19], cutting a pair of wide slot just like E shape on a boundary on a patch to increase the bandwidth, By using the different shape of a micro strip patch antenna just like V ,L inverted F edge cutting are used to design a micros trip patch antenna to enhance the bandwidth as we as gain of an antenna. In modern the SRR (split Ring Resonator), met material etc technique is used to enhance compactness, broadness and efficiency and gain of antenna.

II. DESIGN CONSIDERATIONS

The proposed design of an antenna is shown in Figure-1.The antenna is proposed in FR-4, substrate with a dielectric constant of 4.4 and a loss tangent of .019. The thickness of the sub strate is 1.5mm.The proposed antenna is design for transmission line that is antenna is a distributed form. The feeding technique is coaxial probe feeding that is connected in between ground and excited patch.

Whole geometry consist of two patch one is ground and second is a patch which is used to excite the electromagnetic field in to the free space and such field is distributed due to fringing field . Feeding is connected by using mathematical calculation] [2} In this work. The antenna design is highly circular in polarization. The different parameter for proposed antenna is as shown in table 1.

1. Antenna 1 with close meander patch- The Figure 1 shows the front view f proposed design and the inverted U shape for impedance bandwidth is achieved approximately 37.%. The feeding is used as a coaxial feeding. The dimension of an antenna is calculated [2].

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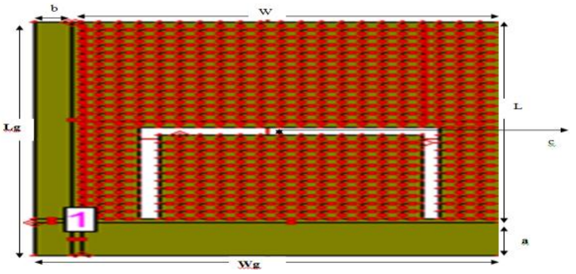

Figure 1 Proposed Antenna.

The Fr4 substrate is used for separating the exciting and ground plane. The height of the substrate is 1.5mm. The measurement of an antenna is as shown in table.

Table1 Design specifications

Parameters	(mm)	Parameters	(mm)
Lg	21.43	a	2
Wg	26.82	B	1
L	11.51	C	0.5
W	15.35		
Xf	-2.94		
Yf	-7.5		

Where Lg and Wg are length and width of ground plan. L and W are the length and width of the exciting patch patch.a,b,c is the dimension as shown in figure1.

III. SIMULATION RESULTS

1. Proposed Antenna

1.1 Return loss vs. Frequency

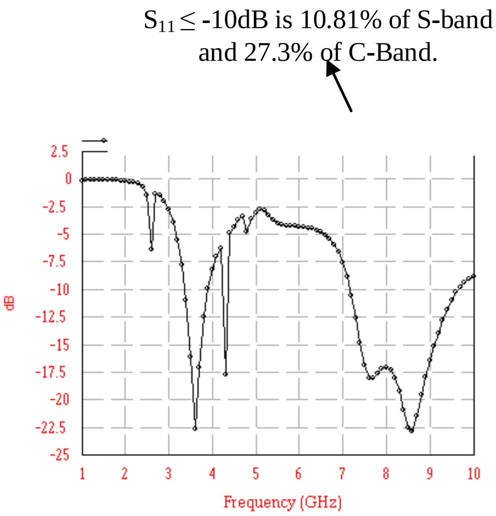

Figure 2 Return loss vs. Frequency.

As shown in figure -2 Return loss verses frequency Analyzed usable impedance bandwidth $S_{11} \leq$ -10dB with inverted U shape is 10.81% of S-band and 27.3% of C-Band. The design is valid only for two bands. Return losses at 3.5GHz is -25dB, Return losses at 8.5GHz is -25dB.

1.2 Axial Ratio vs. Frequency

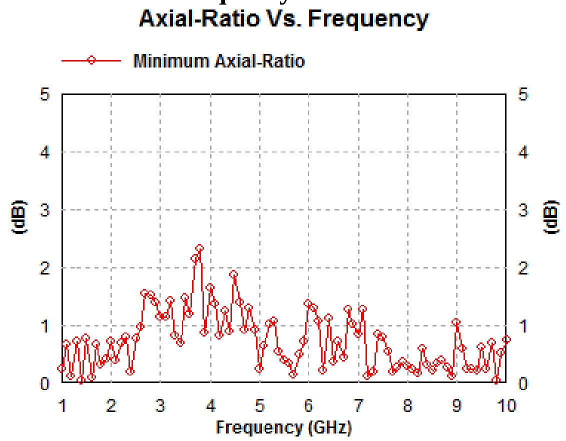

Figure 3. Axial Ratio vs. Frequency.

Achieved axial ratio bandwidth ≤ 3dBi is 3.52GHz shown in figure-3 so that proposed antenna is highly circular polarized, the value of axial ratio at 3 GHz, to 10 GHzis .3dB, .2dB and .1dB respectively.

2. Directivity vs. Frequency

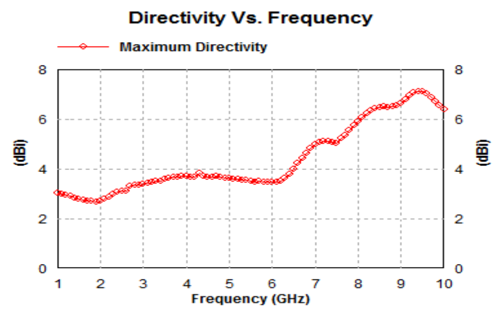

Figure 4. Directivity vs. Frequency

Directivity of antenna varies from 4dBi to 7.5dBi shown in fig 4

3. Antenna and Radiating Efficiency vs. Frequency

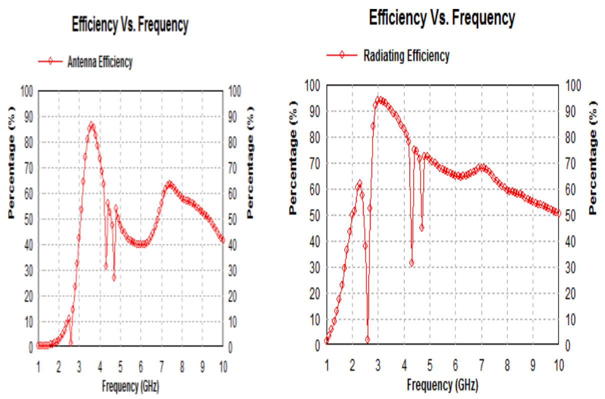

Figure 5. Antenna and Radiating Efficiency vs. Frequency.

Achieved antenna efficiency 30% to 90%and radiating efficiency 30 to92%.

4. Radiation Pattern

We have analyzed elevation and azimuth pattern at 3.5GHzz frequency for different values of θ and φ

4.1. Elevation Pattern and Azimuth Pattern at 3.5GHz

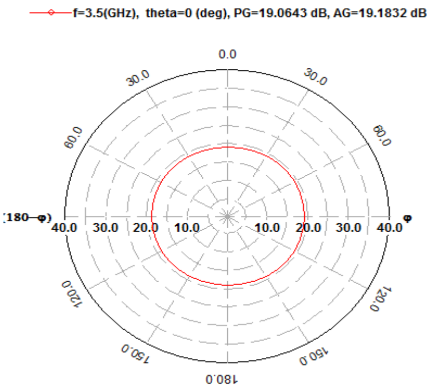

Figure 5 Azimuth Pattern at 3.5 GHz.

Maximum at (0, 20) degrees**,** 3dB Beam Width = -20 degrees**,** The Directivity: 7.5 (dB)**,** Synthesize the azimuth & elevation pattern at 3.5 GHz shown in figure 4 and 5. Obtain Maximum at (0, 30) degrees, 3dB Beam Width = 30 degrees in azimuth pattern and 20) deg.

IV.CONCLUSION

In this Paper analyzed the geometries by using IE3D software and observed improvement in bandwidth. By using U shape-Slot on the Exciting patch for wide band frequency. Whole Geometry is Circular Polarized which is applicable in S and C band application. The proposed design is achived a bandwidth of approximately 37% in (3.5 GHz to 3.9GHz and 7.2GHz to 9.5GHz) by using simple inverted U shape slot at the exciting patch. The proposed antenna is suitable for S and C band application.

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