Journal of Current Research in Engineering and Science
Bi-Annual Online Journal (ISSN : 2581 - 611X)
Volume 4- Issue 1, Paper 9, January 2021

DESIGN AND ANALYSIS OF U SHAPED MICROSTRIP PATCH ANTENNA USING HFSS

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Abstract— *A novel miniaturized configuration of a U-slotted micro-strip patch is outlined in view of focus recurrence about 25 GHz with dielectric steady (εr) for 2.2 also substrate thicknesses from claiming 3.5mm. The suggested antenna might meet the interest from claiming WiMax and Wideband requisitions. The antenna is positioned orthogonally to achieve excellent polarization diversity. The antenna is mounted on a Roger's 5880 RT/duroid (tm) substrate and also contacting feeding technique is employed. The contacting feeding technique helps the antenna to avoid mutual coupling. The Proposed system also presents the detail steps of designing the U shaped micro strip antenna and the simulated result. U shaped microstrip antenna is used for military, wireless and civil applications. HFSS software is used to compute the gain, power, radiation pattern etc., The proposed antenna is found to have a higher gain of 8.01dB and low VSWR value.*

Keywords — Micro strip antenna, U shaped patch antenna, High frequency structure simulator software, feeding technique, Parameters.

I. INTRODUCTION

The Microstrip patch antenna is key building in the wireless communication systems for different systems and standards with the properties like gain, bandwidth, multiband operations and smart size. Micro strip Patch antenna is a suitable for various applications. Micro strip patch antenna should provide high gain, wide bandwidth, return loss, radiation pattern and improved efficiency. The radiation pattern of an antenna is a diagram of field strength to analysis gain, directivity ect., All the antenna design should to achieve good radiation efficiency there is a need of separation between system ground plane and the antenna. The design of proposed U shaped antenna is used for the high speed mobile communication and also development of microwave systems such as WLANs, WIMAX along with the delivery of high speed data. A number of antenna designs such as H Shaped, E shaped, L Shaped, I Shaped, T Shaped and monopole antennas have been presented for such Wi-Fi and WLAN applications.

The objective of this work is to design and develop a U shaped microstrip based antenna, which can work in resonant frequency of 25GHz for Wi-Fi and WLAN applications. In this paper we have analyzed and designed a U shaped microstrip antenna for many applications in recent wireless communications. In a multiple tuned antenna, the ground loss is reduced. The design of U Shaped patch antenna has been completed using HFSS software. The return loss is good observed followed by the radiation pattern.

II. DESIGN AND ANALYSIS OF U SHAPED MICROSTRIP ANTENNA

Now a day's human beings want smart devices to meet these requirements the slot antenna concept has been used in patch antenna designed to reduce antenna size. In communication systems, a microstrip antennas (also known as a printed antenna) usually means an antenna fabricated using micro strip techniques on a printed circuit board (PCB)as well as compact antenna. Microstrip Patch Antenna with U

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shaped Patch is called U Shaped Microstrip Patch Antenna.The U-slot patch antenna can be designed not only for wideband applications, but also for dual-band and, triple-band applications with small and wide frequency ratios. The u-slot patch antenna uses Frequency reconfigurable. This U shaped patch can be formed by creating a rectangular patch and cutting out the unwanted region or else creating a three rectangular patch and joining them together. Some of the advantages of U shaped micro strip patch antenna are inexpensive, simple to design, it has a support for both linear and circular polarization. There are many techniques to improve the impedance band width, gain, directivity of the micro strip patch antenna. The basic structure of U shaped microstrip patch antenna is given in Figure 1.

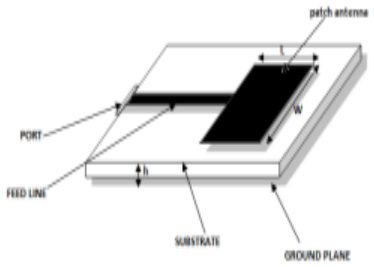

Figure 1. Basic structure of U shaped Microstrip Patch Antenna

W indicates the width of the plane, L is the length of the plane, w is the width of the patch, d is the diameter of patch, l is the length of the patch.

III. DESIGN LAYOUT OF PROPOSED ANTENNA

In this project we have designed a U shaped microstrip antenna for many applications in recent wireless communications. The design of U Shaped patch antenna has been completed using Ansys software. The return loss is observed followed by the radiation pattern.

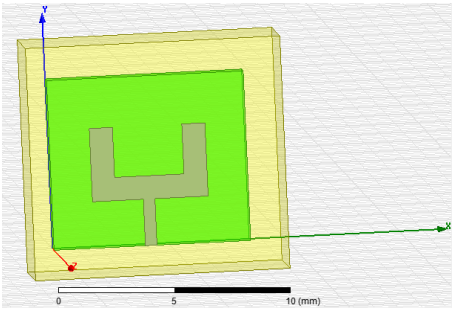

Figure 2. Design Layout of U shaped Microstrip Patch Antenna

IV. DESIGN PARAMETERS OF PROPOSED ANTENNA

In this work, U shaped antenna is developed from a rectangular patch of the width (W) = 7.3mm and length (L) = 5mm.The substrate material used for the proposed antennas is Rogers RT, with the dielectric constant of 2.2 and loss tangent of 0.0009. The proposed antenna design involves calculation of

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dimensions at the required frequency.The Operating frequency depends on its dielectric constant and loss tangent using for the choice of the substrate. The frequency of the proposed antenna is need to be analysed. The substrate is used having the dielectric constant value of Ɛr=2.2.

Table. I Optimized design parameters of antenna calculated from (3a),(3b)

PARAMETERS	**VALUE**
Length of the Patch	7.3mm
Width of the Patch	5mm
Length of the Ground Plane	7.3mm
Width of the Ground Plane	3.5mm
PORT Length and Width	W - 0.5mm & H - 1mm
Feeding Technique	MicroLine
Feed Length and width	L – 2mm & W - 0.5mm
Substrate & Dielectric Constant	Rogers RT & ε_r=2.2

V. SIMULATION RESULTS AND EXPERIMENTAL VERFICATION

This segment presents design, simulation, evaluation and experimental verification of proposed micro strip patch antenna. The proposed designed of the presented antenna have been simulated in ANSYS HFSS software. These dimensions have been calculated based on the proposed sets of design equations.

$$\text{Reflection Coefficient } (\Gamma) = \frac{VSWR-1}{VSWR+1} \quad (5a)$$

$$\text{Return loss} = -20\text{Log10}(\Gamma) \quad (5b)$$

$$VSWR = \frac{Vmax}{Vmin} \quad (5c)$$

$$VSWR = \frac{1+|\Gamma|}{1-|\Gamma|} \quad (5d)$$

Whereas, Γ is the Reflection Coefficient

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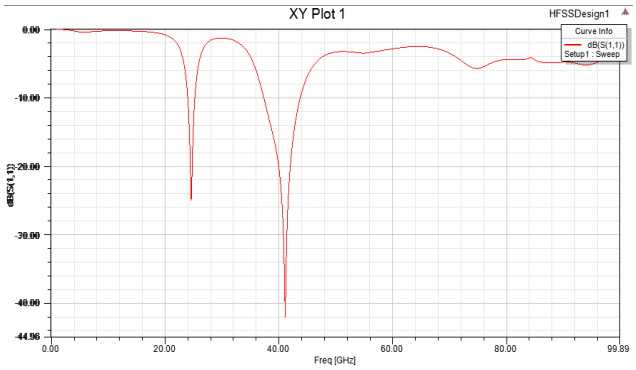

Figure.3.Return Loss vs Frequency plot

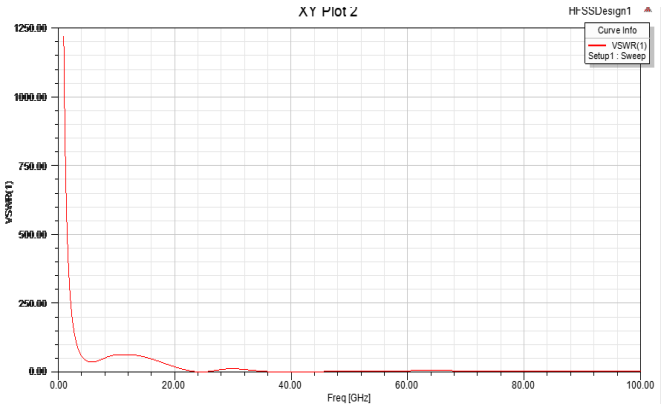

Figure.4. VSWR vs Frequency plot

The U Shaped patch antenna designed above and all its parameters are remain same, only the ground of the antenna and resonance frequencies is modified. Results of simulation are presented in Table II. The first design represents the slight larger gain the second design. The second design represents is quite smaller than in size. The radiation pattern of the proposed micro strip patch antenna Φ =90. It is an Omni-directional pattern is achieved over the entire frequency over the two proposed antenna The Proposed antenna achieved low VSWR, and also the maximum Gain.

The Directivity obtained from the simulation of antenna can be given as,

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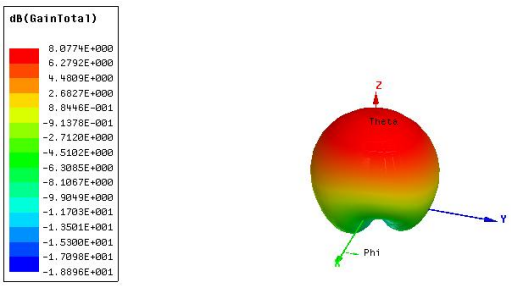

Figure.5. 3D Polar Plot of Directivity

The Directivity achieved by the antenna is 8.08 dB. Gain plays a major role in finding the efficiency of the antenna. The Gain obtained from simulation is given as,

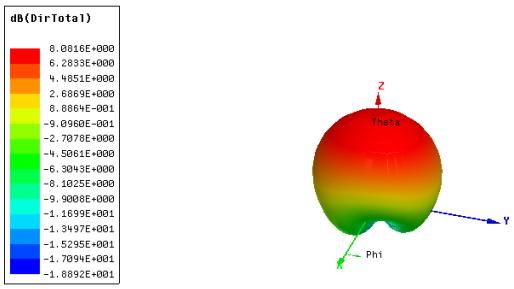

Figure.6. 3D Polar Plot of Gain Total

The gain is achieved by the antenna is 8.07 dB.

Table. II Obtained Result of Antenna from formula (5a),(5b),(5d)

Parameters	**Values**
Reflection Coefficient	0.065
Return Loss	-23 dB
Directivity	8.08 dB
VSWR	1.139 dB
Gain	8.07 dB

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The radiation property of most concern is the two- or three-dimensional spatial distribution of radiated energy as a function of the observer's position along a path or surface of constant radius.

The Radiation Pattern for the gain total and directivity obtained from the simulation results can be given as,

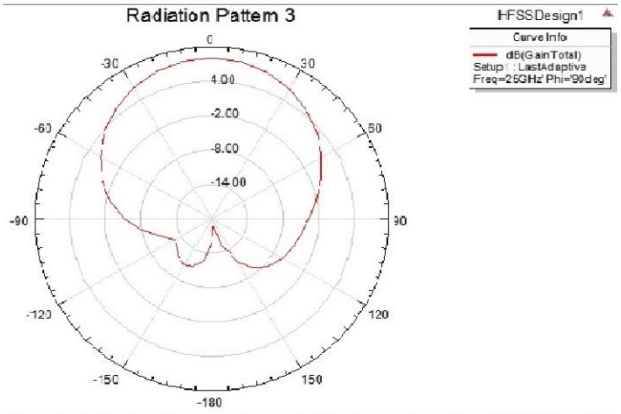

Figure.7. Radiation Pattern Of Total Directivity

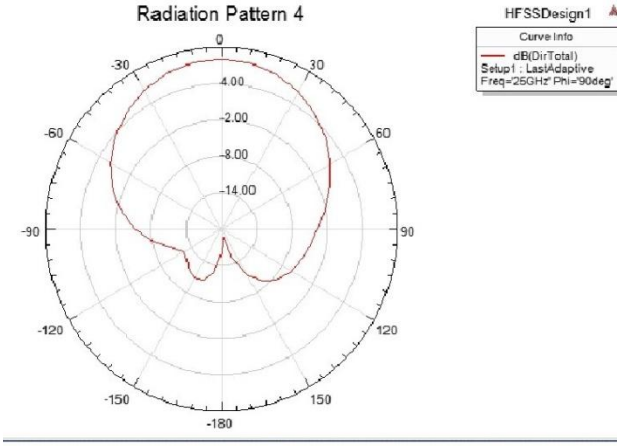

Figure.8. Radiation Pattern Of Gain Total

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VI. CONCLUSION

Designing and analysis of U shaped microstrip patch antenna is done using ANSYS software. Excellent omni-directive pattern, low VSWR, maximum gain, direction pattern and broad bandwidth have been achieved. The presented micro strip patch antennas are compact in size, and they can be used for Wi-Fi, LTE and WiMax devices. The designed seem to provide Gain of 8.07dB, Directivity of 8dB, VSWR of -23. Antenna has been designed for the application of WiFi and WiMax for faster wireless communication. Thus, we have completed the designing and analyzing the antenna performance. and planned for fabrication of antenna for further testing.

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