

Design of Compact U-Shaped Microstrip Slot Antenna for WLAN, Wimax and Radar Applications using ADS Software

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Abstract

In present years Micro strip patch antenna is predominately worn in numerous wireless communication system and Radar applications. In this paper a projected configuration of U shaped micro strip slot antenna for high frequency application is designed and simulated. This projected Antenna with a reduced size of 28.3 x 37 mm is intended with FR4 Substrate by using the micro strip line feeding techniques for Micro strip patch is with a stamped 'U' shaped slot. This Antenna provides a preferential impedance Bandwidth along with an uni directional Radiation Pattern. The antenna is intended for operating frequency 6.33 GHz and dielectric constant 4.4 by using advanced design Systems simulation software. Projected antenna is deliberate for wireless local area network (WLAN).

Keywords: Advanced design Systems, Return Loss, wireless local area network, U shape micro strip slot

I. INTRODUCTION

Micro strip antenna (MSA) realize many applications in the devise of wireless communication systems an antenna is distinct by the IEEE as a "transmitting or receiving system that is intended to emit or collect electromagnetic waves". Now a days there is a insist for wireless and transportable devices are available to increase for the wireless applications like WLAN, Wi-Fi, WiMAX, and etc. An antenna can be several shape or different size. It has numerous advantages such as low profile, firmness, easy to produce on chips, low cost easy and installation etc but it has a few drawback of narrow band width which proved to be a confront for engineers to meet very high data rate for a variety of wide band application. The band width of antenna can be enlarged by a range of techniques such as cutting slot, different shape of antenna and intensifying the depth of substrate with small dielectric constant. By micro strip line feeding moving the different location of feeding point thus we obtained maximized bandwidth.

II. LITERATURE SURVEY

A square opening, a couple of L-strips, and the monopole radiator are used to motivate three different resonances point in [1]. In paper [2], a micro strip line feeding techniques along with, a thick substrate, and a ground plane on which some simple openings are imprinted to accomplish tri band operation. The fork-type ground is using along with non-uniform meandering of line and are anticipated triple band Wireless local area network applications in paper [3]. A twisted M-shaped patch is worn the longer arm of the patch to devise the triple band antenna, for the purpose of compactness in ref [4]. The Inverted L-slot patch with a defect ground plane is used for triple-band operation in paper [5]. An F-shaped micro strip slit antenna with both undefined and small-ended slits linked by a metal by means for getting a micro strip line is oppressed for WLAN and WiMAX multiple input multiple output systems in ref [7]. A monopole antenna with two rectangular corners engraves off and two inverted L slots are imprinted to accomplish three resonant modes for tri band operation is presented in paper [8]. A crooked coplanar stripe fed configuration was instigating in ref paper [9], Meta material transmission lines and MTM inspired reactive loading methods are used in [10] and [11]. In ref paper [14], the antenna can be able to envelop the obligatory bands with a tremendously miniature form factor with the assist of the MTM motivated reactive loading and L cut shaped slot. Even though, every reported antennas reveal triple-band performance. In this communication, a compressed F shaped planar antenna is projected and intended for wireless communication systems with the intention of supporting the triple-band WLAN/WiMAX applications. The anticipated antenna consists of two F shaped openings of the identical size that are etc. on a rectangular patch to accomplish multi band operation.

III. ANTENNA DESIGN

The intended Antenna which has the compressed size of 28.3 x 37 mm which is having thickness of the ground plane is 1.6 mm by means of FR4 Material whose dielectric constant of 4.4 is used. Subsequently the micro strip line feed is used for feeding the

Input power to the patch. A U-Shaped opening facilitates with the purpose of the patch Antenna to radiate at 6.33 GHz and 9.1 GHz frequencies which also provide the benefits better gain and also boost up the efficiency. The general structure of the proposed antenna is given below.

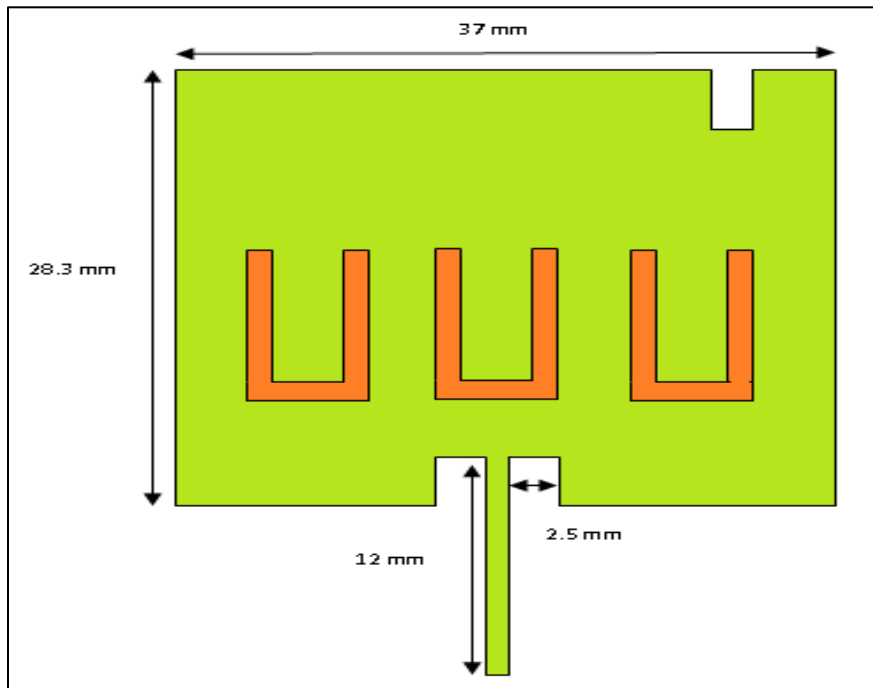


Fig. 1: proposed U shaped slotted micro strip patch antenna

Dielectric constant is distinct as the determining of extent to which an EM wave is slowed down at the same time as it travels throughout the material. consequently, a small value of dielectric constant material is selected to keep away from the storage of charge in the dielectric substrate, Electro Magnetic wave should be contemplate through the substrate and it is not engrossed. The very thin substrates with higher dielectric constant which causes the reduction of efficiency, lesser band widths and slighter element sizes, the excitation of surface waves that decline the radiation pattern. To raise the narrow bandwidth and radiation efficiency of patch antenna, slotted patch antennas or stacked can be used. If the quality factor of the antenna is small so we are used the small value of dielectric constant.

IV. DIMENSION OF ANTENNA

The devise parameters are specified below which conveys the dimensions between patch u shaped slot, and the feed line. The feed width and gap are designed to get 50 ohm input impedance. The projected U-Shaped patch Antenna geometry are given below.

Width of the patch $w = 37$ mm

Length of the patch $L = 28.3$ mm

Height of the substrate $h = 1.6$ mm

Dielectric constant = 4.4

Length between patch and feed line = 4.2 mm

Width between patch and feed line = 2.5 mm

Width of the ground plane = 30 mm

Length of the ground plane = 30 mm

Width of the slot = 1 mm Length of the slot = 7.9 mm

Thickness of the u slot = 0.9 mm Length of the upper u slot = 3.5 mm.

Micro strip patch antennas can be feed by a different of methods. These methods be able to be secret into two types: one is contacting and another one is non-contacting.

- 1) In contacting Technique, the RF input power is contacting directly between fed to the radiating patch using a connecting element such as a microstrip line.
- 2) In non-contacting technique, EM field coupling is made to transfer input power between the micro strip line and the radiating patch

V. SIMULATION RESULTS

Our main objective of this work is to intend and extend a U shaped micro strip based antenna, which can operates for wireless applications. The ADS software is used to figure the power, gain, radiation pattern, and return loss of the antenna. Reflection coefficient s_{11} is greatly depends on the source and load impedance. It shows with the intention of how much the transmission line is well matched. But the load impedance and source impedance are having the same value. For greatest power transfer of the Return Loss should be present less as much as achievable. This conveys that the that the ratio P_R/P_T should be as miniature as possible otherwise or articulated in dB, the return loss should be as huge in negative number as achievable

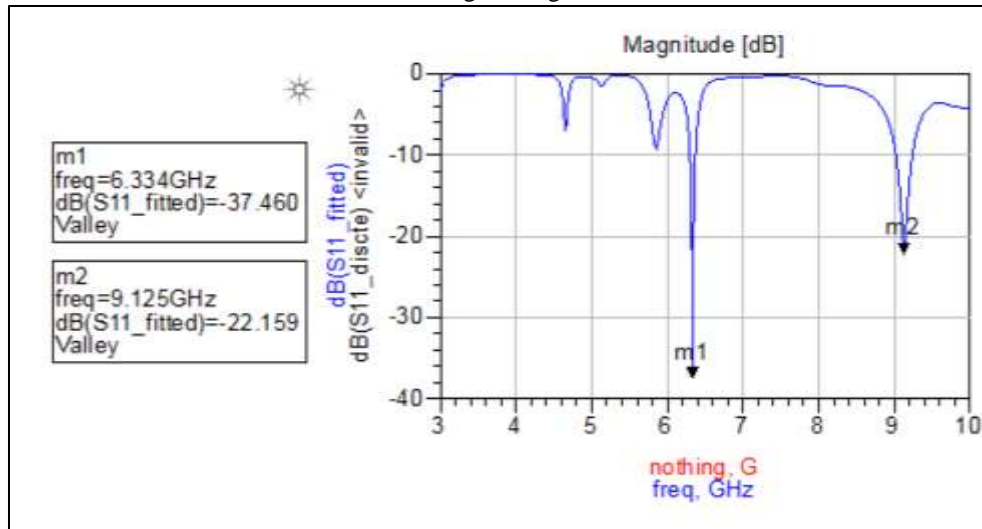


Fig. 2: Return loss at 6.63 GHz and 9.12 GHz Frequencies

The below image Figure out the return loss which conveys the information that the loss throughout the radiation of antenna is very a smaller amount thus the efficiency is increased. The antenna resonates at frequency of 6.63 GHz and 9.125 GHz with low return loss of -39 dBi and -22 dBi respectively.

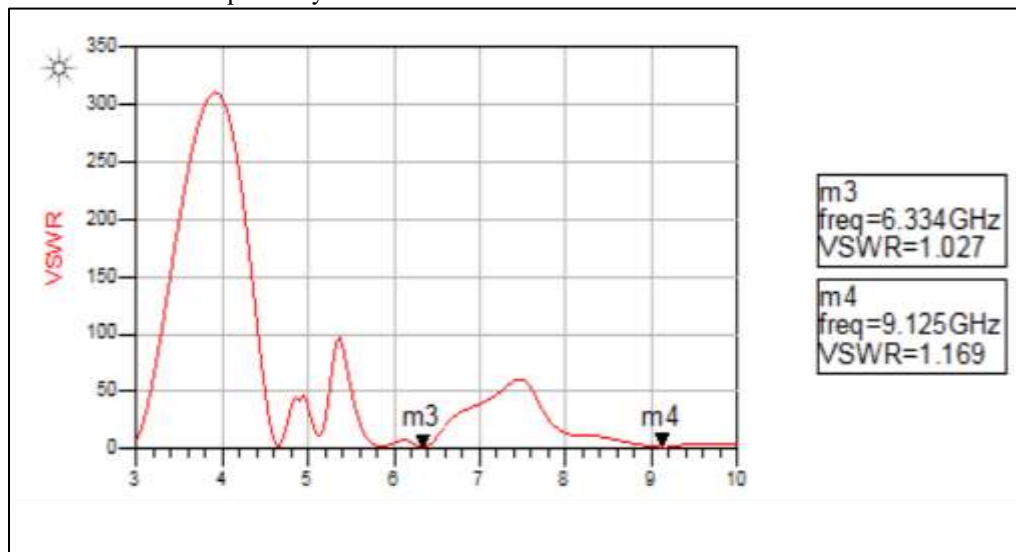


Fig. 3: VSWR at 6.63 GHz and 9.12 GHz Frequencies

The achieved return loss value of return loss is good for the specified frequency band. In this projected antenna, the gain is also improved, the performance is better and thus miniaturized is also achieved. The return loss is increases that corresponds to decreases in VSWR. The perfect value of the VSWR is 1. A match is good if the return loss is high. Thus Performance of micro strip patch U shaped patch antenna is realized in terms of directivity, gain, efficiency and it is illustrated below. These proposed U slotted micro strip patch antenna provides that gain of 6.62 dBi and 5.40 dBi for the Resonating frequencies at 6.63 GHz and 9.12 GHz Respectively. The projected antenna is worn to realize the voltage and current distinction along the patch. The average current intensity of the u slotted patch antenna is shown below.

Frequency (GHz)	6.33796
Input power (Watts)	0.00249516
Radiated power (Watts)	0.00172311
Directivity(dBi)	8.23052
Gain (dBi)	6.62265
Radiation efficiency (%)	69.0579
Maximum intensity (Watts/Steradian)	0.000912335
Effective angle (Steradians)	1.88868
Angle of U Max (theta, phi)	56 143
E(theta) max (mag,phase)	0.757961 -18.3508
E(phi) max (mag,phase)	0.33601 -63.3699
E(x) max (mag,phase)	0.502239 145.102
E(y) max (mag,phase)	0.200762 52.6411
E(z) max (mag,phase)	0.628379 161.649

Fig. 4: Gain and Directivity for 6.33 GHz

Frequency (GHz)	9.02778
Input power (Watts)	0.0022797
Radiated power (Watts)	0.00128644
Directivity(dBi)	7.88728
Gain (dBi)	5.40242
Radiation efficiency (%)	56.4304
Maximum intensity (Watts/Steradian)	0.000629375
Effective angle (Steradians)	2.044
Angle of U Max (theta, phi)	62 89
E(theta) max (mag,phase)	0.685954 -83.432
E(phi) max (mag,phase)	0.0606268 12.4241
E(x) max (mag,phase)	0.0614459 -162.355
E(y) max (mag,phase)	0.321881 -83.2446
E(z) max (mag,phase)	0.605662 96.568

Fig. 5: Gain and Directivity for 9.12 GHz

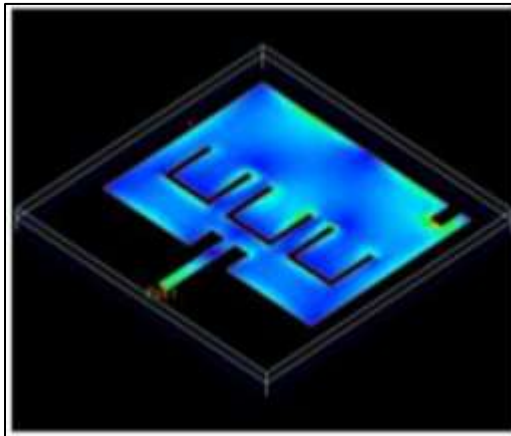


Fig. 6: Average current density at 6.33 GHz

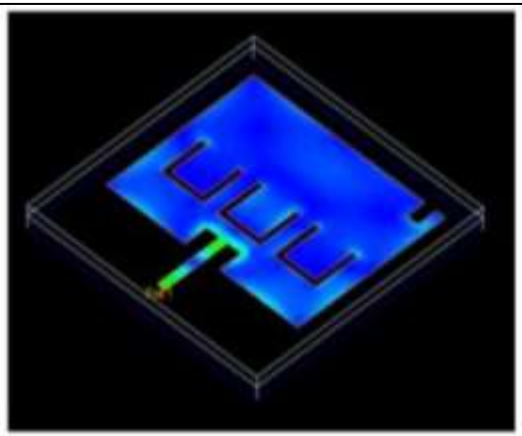


Fig. 7: Average current density at 9.12 GHz

the radiation characteristics of the micro strip patch antenna is given below which radiates at the desired frequencies at 6.63 GHz and respectively. The radiation pattern of an antenna is defined as a contrive of the far-field radiation properties of an antenna which is a function of the spatial co-ordinates and these are precise by an the azimuth angle (ϕ) and elevation angle (θ).

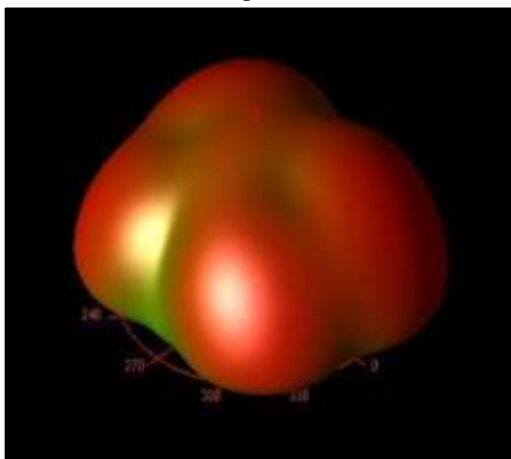


Fig. 8: Radiation characteristics at 6.33 GHz

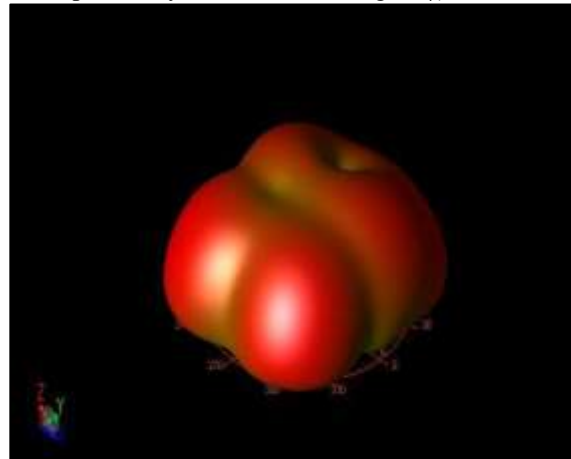


Fig. 9: Radiation characteristics at 9.12 GHz

More specifically it is a plot of the power radiated from an antenna per unit solid angle which is nothing but the radiation intensity.

VI. CONCLUSION

In this paper a microstrip U shaped antenna is successfully designed at a resonant frequency of 6.63 GHz. Micro strip antennas has become a rapidly growing area of research such as light weight, compact size and various applications. A compact triple U shaped microstrip patch antenna is designed for Wireless communication application. Antenna gain is 6.62 dB , Directivity is 8.23 and the Radiation Efficiency is also increased.

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