ASYMMETRIC MICROSTRIP ANTENNA FOR S-BAND

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ABSTRACT

In this,a circularly polarized asymmetric slits, high gain, a small patch antenna dedicated for wireless applications is showed.Four v-shaped slits in the diagonal directions on the square patch and a two parasitic elements of same dimensions are used to create circularly polarized (CP) radiation with a large axial ratio beamwidth. A proposed of the antenna has been design with a 1.6 mm thick single layer FR4 substrate having relative permittivity of 4.4.The simulated 3-dB axial ratio (AR) bandwidth of the proposed antenna is 118 MHz (2.44–2.53 GHz) and a 10-dB return loss bandwidth is 65.0 MHz (2.41–2.45 GHz) with a gain of more than 6.8dB.The overall size of the antenna is 56mmx56mmx1.6mm.Also,effects of with parasitic element to improve more gain are examined and discussed here . All the simulations results are performed using HFSS software package and Simulation results are performed,showing that this antenna realizes the required parameters in terms of frequency bandwidth, gain, circular polarization bandwidth, and axial ratio (AR) beamwidth.

Keywords— *Circular polarization, axial ratio, patch antennas, wireless application*

I. INTRODUCTION

In rapidly growing market for wireless communication and applications, Micro strip antenna has become famously used because of its various properties such as it is low profile,comfortable to the hosting surfaces, compact size and can be easily togethered with the electronic circuits.Patch antenna is widely used in military, mobile applications, global positioning system (GPS), remote sensing etc.Taking advantages of today's computers,HFSS(High Frequency Structure Simulator) simulator are used to perform planer and 3D analysis of high frequency structure.HFSS simulator tool has been an essential modeling tool for RF/Microwave design. The Proposed antenna is designed and simulated on HFSS simulator software.Microstrip patch antenna generally consists of a radiating patch on upper side,ground plane on other side and dielectric substrate in between them.The patch is a very thin copper metal disk. To overcome its disadvantage of small bandwidth by generating more than one resonant frequencies, many research work has done in the past e.g.different shaped slots[2-4],stack, multilayer[6],two folded parts to the main radiated patch and use of air substrate have been proposed and investigated.Because of its advantages,microstrip antenna have made them a perfect to use in the wireless local area network (WLAN) applications though it has certain disadvantages microstrip patch antenna can be used in the new high data rate broadband Wireless LAN system and the router device.This paper presents manufacture of broadband micro strip patch antennas for 2.4GHz ISM –band. It is now both possible and easy to surf the web from your laptop without any wire connectivity and we can enjoy live games on our television sets.A WLAN is high speed communication network used as an extension to or an alternative for a wired LAN in a building.Because of this the demand has been increased for broad band WLAN antenna that meets all the desired features.The broadband antenna are compact, low profile directive for high transmission efficiency and designed to be discrete.Due to these all requirements,the micro strip patch antenna is well suited for broadband wireless applications.

In this,we construct a high gain micro-strip slit patch antenna in which v-shaped slits are cut in micro-strip patch to enhance its axial ratio bandwidth and frequency response.The two parasitic elements are introduced for circular polarization and enhancing the axial ratio bandwidth.

II .MICROSTRIP ANTENNA DESIGN

The first design was chosen based on the literature that provided circularly polarized radiation in the broadside direction.A square shape patch antenna design are one of the earliest example of microstrip patch antenna..To produce circular polarization from square or rectangular patch antennas ,techniques, like offset feeds, truncated corners and diagonal slits were used.Fig.1shows the proposed asymmetric V shape microstrip antenna with parasitic elements. Two parasitic strips has been added to the downward and upward direction of the radiating patch. The parasitic strips are to be longer than the radiating element so that they may act as reflectors of a Yagi antenna. The maximum size of the antenna is limited to 56 mm × 56 mm. Thus the initial design was chosen of dimensions 56 mm × 56 mm. A probe feed from the bottom is connected to the patch through a hole drilled into the substrate. The coaxial feed location is along the orthogonal X-axis from the center of a patch. Fig 1 introduces the asymmetric V-shaped slits square patch for CP radiation and rectangular strips for wide axial ratio beamwidth.

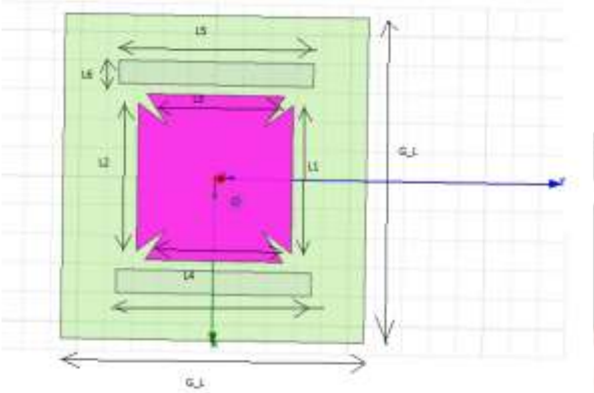

Figure 1: Proposed antenna geometry

The dimensions of the strips and the corner of the V-shaped asymmetric slits are used to create the resonance and circular polarization at 2.45 GHz.The optimized dimension is as follows:
G_L=56 mm, *L1=25.47* mm, *L2*=26.06mm, *L3*=25.76mm, *L4*=27.06 mm, *L5*=36 mm and *L6*=4mm.

III.METHODOLOGY

The formulas for calculating the length, width and value of air gap are given.The value of resonant frequency (Fr) is taken as 2.44 GHz and dielectric constant of the substrate (εr) is 4.4 .The height of dielectric substrate (h) is 1.6mm.

Then to calculate the other parameters like length and width of micro strip patch is given as:

Step 1:

The width of micro strip patch is given below,

$$w = \frac{c}{2f_0\sqrt{\frac{\varepsilon_r+1}{2}}} \qquad (1)$$

Step 2:

The length of micro strip patch is given below:

$$\Delta L = (0.412 * h)\frac{(\varepsilon_{reff}+0.3)\left(\frac{w}{h}+0.264\right)}{(\varepsilon_{reff}-0.258)\left(\frac{w}{h}+0.813\right)} \qquad (2)$$

Step 3:

The resonant frequency for any mode is given by:

$$f_0 = \frac{c}{2\sqrt{\varepsilon_{reff}}}\left[\left(\frac{m}{l}\right)^2+\left(\frac{n}{m}\right)^2\right]^{1/2} \qquad (3)$$

IV. RESULTS AND DISCUSSION

The designed four V-shape slits square patch with two parasitic elements was simulated for validate the design. The simulated reflection coefficient of The proposed antenna design is simulated in Ansoft hfss software. Simulated and 10-dB return loss bandwidth are 65 (2.45-2.52GHz)

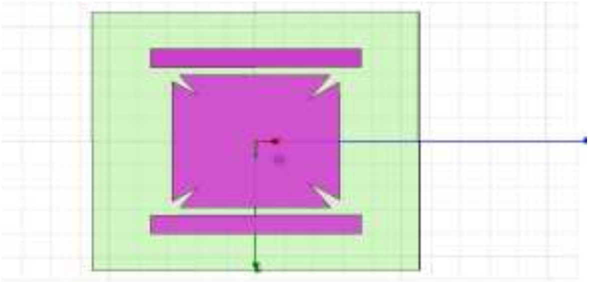

Fig.2 Proposed antenna geometry

Fig.3 shows the return loss of the antenna.it shows that return loss is -21.61 at resonant frequency 2.43 Ghz.And bandwidth is 65Mhz.

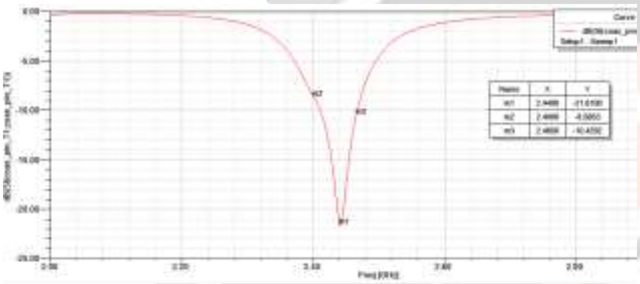

Fig.3 return loss

The 3-D plot of radiation pattern and polar plot of radiation pattern are shown in fig.4 a and b.It shows the maximum gain of 6.8db.

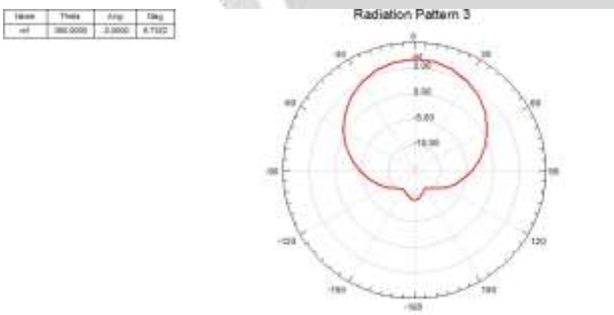

Fig.4 a) Radiation pattern of antenna

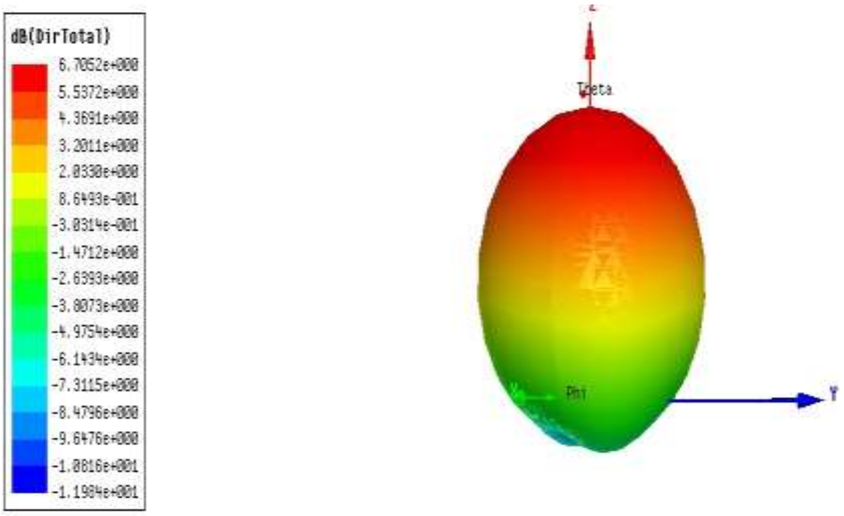

Fig.4 b)3-D plot of radiation pattern

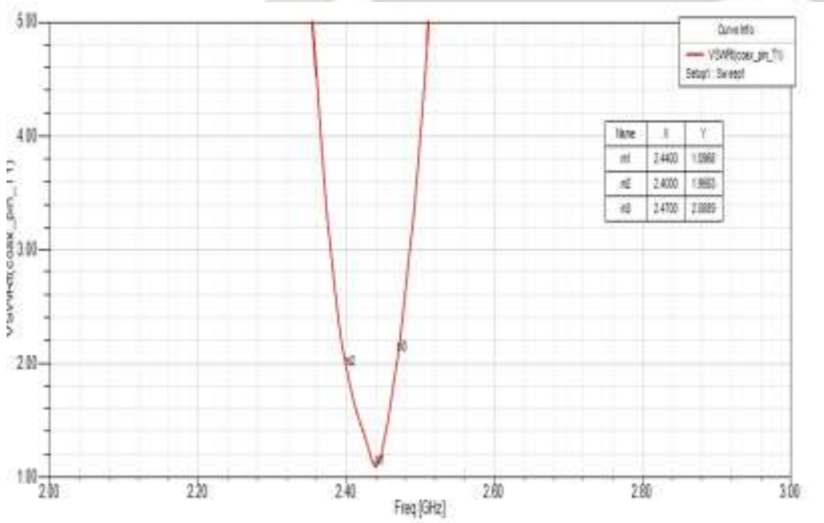

Fig.5.VSWR

Fig.5 shows the VSWR of the antenna which is less than <2 at 2.46ghz frequency and the fig.6 shows the axial ratio of 0.89db at 2.45Ghz frequency.

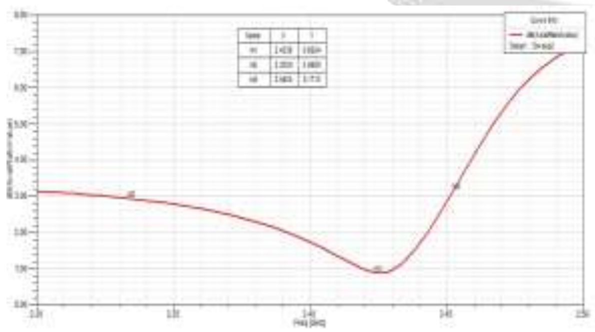

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Fig.6 Axial ratio

Figure 6 depicts the simulated AR value is 0.89db at resonant freq of the antenna. The simulated 3-dB AR bandwidth is also near about 46 MHz.

Sr.No.	Shape of MSA	Freq (GHZ)	Return Loss(dB)	VSWR	Bandwidth (MHZ)	Axial ratio (BW)	Axial Ratio (dB)	Directivity (dB)
1.	V-shaped asymmetric slit square patch with parasitic1	2.46	-20.47	1.20	55	41	1.46	6.1
2.	V-shaped asymmetric slit square patch with parasitic2	2.47	-21.61	1.18	65	118	0.89	6.7

Table 1: Comparison table

In addition, effects of with one parasitic element and two parasitic elements to improve gain are examined and discussed in detail .Table 1 shows with two parasitic elements the gain is increased upto 6.7dB instead of 5db.

V. CONCLUSION

A compact high gain Circular polarized V-shaped symmetric slits MSP antenna was proposed. Slits are inserted on four corners of the patch. the antenna exhibits an effective bandwidth of 65MHz from 2.43-2.49 GHz for 10-dB return loss and AR<3 dB at 125MHz. The simulated gain of the antenna is around 6.9 dBi and the 3-dB axial ratio beamwidth is about 180deg. The overall dimension of the antenna is 56mm×56mm×1.6mm at 2.45GHz and thus can be considered as a suitable for various like WLAN applications, ISM-band(2.43-2.49Ghz) and S-band satellite applications.

VI. REFERENCES

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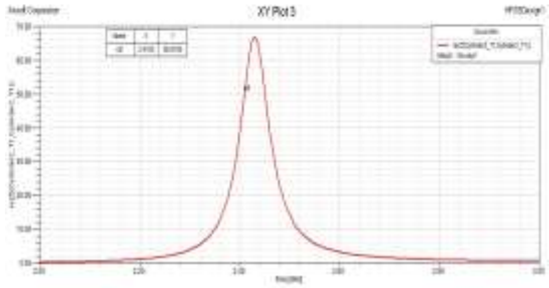
XY Plot 5