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Design and Simulation of O Shape Microstrip Patch Antenna Using ADS Software

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Abstract: The Micro strip patch antenna is extensively worn in numerous wireless communication systems. In this paper a projected structure of O fashioned patch antenna for higher frequency application which is intended and simulated. The antenna is intended for operating frequency 3.3 GHz and 5.6 GHz respectively having dielectric constant 2.20 by using ADS simulation software. Projected antenna is deliberate for wireless communication.

Keywords: ADS, O-shaped patch antenna, Return Loss, Wireless application, VSWR.

I. INTRODUCTION

Due to the great demand of wireless and transportable devices are leads to raise for the wireless application like Wi-Fi, WLAN, WiMAX, Bluetooth etc. It is necessity to intend the high gain antenna and broadband. WLAN defined as a wireless standard which was premeditated to provide the data rate at the 60 Mbps, entice the user to convince their speed demand. Antenna is a device which is used for transmitting or receiving coordination that is premeditated to collect or radiate EM waves". An antenna may be in use of any kind of size or shape. It has plenty of incentive such as compactness, low cost, easy installation, and low profile, easy to fabricate on chips etc. The intentional antenna is deliberate and simulated using ADS. To raise the antenna efficiency and gain the low loss material should be preferable to construct the patch. Microstrip patch antenna give more benefit like low cost, multi-band characteristics, allows linear as well as circular polarization, support both linear and circular polarization. Also patch antenna has some drawback like less gain, narrow bandwidth, Excitation of surface waves, low power handling capacity etc. There is accessibility of special method to boost the bandwidth of an patch antenna like slots, with SMA connector. By means of parasitic patch or using modified shape patch. By escalating quality factor of the patch is lowering the dielectric constant or ever-increasing the substrate height. As a result of using impedance matching networks. Using different layer configuration through vertically stacked resonators structures. By means of many layer resonators situated in one plane. LC parameter variation and Meta material stacking etc. fundamental configuration of micro strip patch antenna is the rectangular patch structure. But the bandwidth of the rectangular patch can be enhanced by above techniques. Also different structures for bandwidth enhancement are investigated in literature survey like- C-shape, E-shape and U shape [4-6].The monopole antenna is over loaded with an electric inductive and capacitive resonator at the bottom of the substrate. This capacitive resonator is reliable for provided that WiMAX (2.5/5.5 GHz) and WLAN (5.2/5.8 GHz) band of applications. On the other hand, 2.5 GHz band was not obtained completely therefore a T-shaped aperture with meandered lines is stamped on above the patch of monopole antenna to get hold of the favored resonance around 2.5 GHz which is for WiMAX band. This resonance merges when the prime band of ELC is accustomed to encircle the complete WiMAX band and current is enclosed in the region of the T- slot. This will provides patronage to opening approach for radiation

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[3]. Handed materials. CRLH contains two RH and LH parts [2,3]. Different model of parasitic element are used in antenna such as U-shaped parasitic elements or split ring resonator (SRR) element [4,5].

II.LITEREATURE SURVEY

The most embrace methods to decrease the micro strip patch antenna size, are inserting slots into the patch to increase the electric length of the antenna [2, 3]. loading the edges of the patch with inductive elements [5], shorting post loading technique [6] etc. In 2007 Jia-Yi Sze et al. proposed an annular-ring slot antenna [7] with more compactness for the 2.4/5-GHz dual-band operations. Antenna is feed by co-axial probe of the 50 ohm characteristic impedance. As discussed many optimization has applied to this antenna, so the IWO optimized antenna [9]. Air with least dielectric constant of 1 shows least return loss of -22.6449 whereas Benzo cyclobutane with dielectric constant of 2.6 return loss is -18.1248[24]. With the use of Duroid 6010 which is counted among the higher dielectric constant substrate used in phased array1×4 at 1.35 GHz . It showed optimized results [26].A nylon fabric is a substrate considered among medium dielectric constant with dielectric constant 3.6. Work has been done to demonstrate the antenna fabricated using nylon fabric .antenna resonates at 989 MHz it result in return loss of -35.42dB, directivity of 6.72dB, Gain of 6.11dB. Fractal shaped microstrip patch antenna is also implemented using the foam substrate. It reduced the size of the antenna up to 84%. RT-Duroid substrate is costlier than LCP (liquid crystal polymer) but RT-Duroid gives better performance in term of gain, directivity and bandwidth [25]. Due to its planar configuration and ease of integration with microstrip technology, the microstrip patch antenna has been heavily studied [27].

III.ANTENNA DESIGN PROCEDURE

The designed 'O-slot' Micro-strip Patch antenna is illustrate in the figure. The micro strip patch has been intended for the S-band frequency ranges.

Step 1: The width can be calculated by using formula

$$W = \frac{c}{2f_0\sqrt{\frac{\varepsilon_r + 1}{2}}} \quad (1)$$

Step 2: The effective dielectric constant can be calculated by using formula.

$$\varepsilon_{reff} = \frac{(\varepsilon_r + 1)}{2} + \frac{(\varepsilon_r - 1)}{2}\left[1 + \frac{12h}{W}\right]^{-\frac{1}{2}} \quad (2)$$

Step 3: The effective length can be calculated by using formula.

$$L_{eff} = \frac{c}{2f_0\sqrt{\varepsilon_{reff}}} \quad (3)$$

Step 4:The length extension can be calculated by using formula.

$$\Delta L = \frac{0.412h(\varepsilon_{reff} + 0.3)\left(\frac{W}{h + 0.264}\right)}{(\varepsilon_{reff} - 0.258)\left(\frac{W}{h + 0.8}\right)} \quad (4)$$

The patch which is having the condensed dimensions 28.4X 37 mm. The patch antenna having a relative permittivity (εr) = 2.20, substrate of thickness which (h) = 1.6 mm and the micro strip feed line is accomplish on the same substrate layer. Micro strip and coaxially feeding for patch antennas are generally used in different types of smart antenna systems. In order for any agreed antenna to trigger efficiently, the maximum transfer of power have to take place between the feeding system and the antenna. Dielectric constant is defined as the compute of degree to which an EM wave is slowed down as it movements through the material. So, a small value of dielectric constant material is designated to avoid the storage of charge in the substrate, EM wave should be reflected by the substrate and not absorbed. The purpose of the optimization is to resonate the antenna at 3.3 GHz and 5.3 GHz and length of the central division is the conflicting parameter to control the resonate

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frequency. The dimensions of the proposed antenna are given below.

Table1
Dimensions of the antenna

S.No	Parameters	Dimensions in mm
Lp	28.3	mm
Wp	37	mm
S1	1.9	mm
Fw	1.6	mm
S2	3.4	mm
Ws	1	mm
Ls	7.8	mm

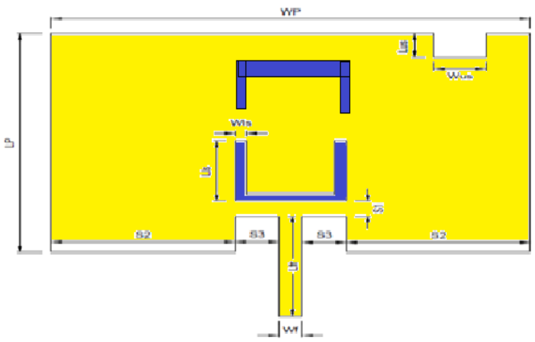

Fig.1. Structure of O shaped patch antenna

IV. SIMULATION

Simulation of projected antenna is carried out on Advanced Design System (ADS). The value of the reflection coefficient S11 vs. frequency curve which is given below. The maximum value of S11 shown by the curve is -21.1 dbi and 14.9 dbi.

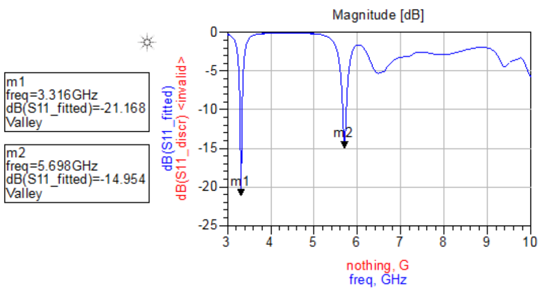

Fig 2. Return loss for the O shaped patch antenna

Return Loss is a parameter related to the *VSWR* which designate the quantity of power that is missing to the load and should not return as a reflection. The value of return loss should be least in order to diminish the reflection wave and able to exploit the transmitting power thus working the antenna with the improved performance. The radiation pattern of an antenna is a plan of the far-field radiation properties of an antenna as a purpose of the spatial co-ordinates which are particular by the azimuth angle (φ) and elevation angle (θ).

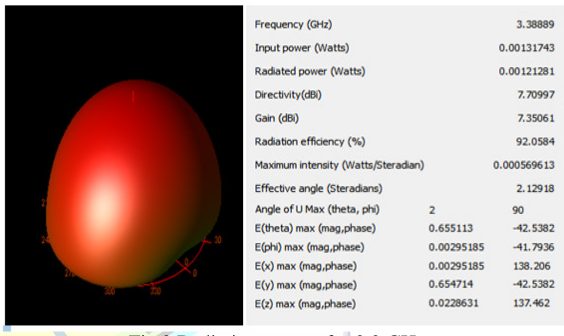

Fig 3 Radiation pattern for 3.3 GHz

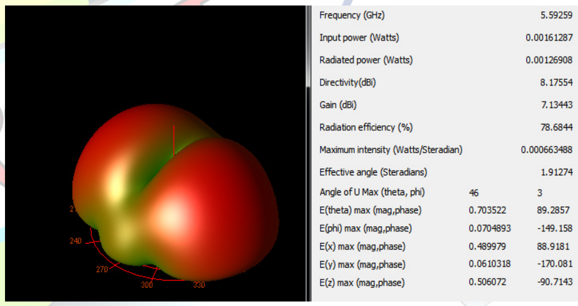

Fig.4. Radiation pattern for 5.5GHz

A. Average Current Density Distribution of a Rectangular Patch

It intimates that the average strength of the time-harmonic current density distribution at a specific frequency. The colour indicates the average strength of the current density at a explicit point. For the evasion continuous tone display, the red colour earnings strong current density.

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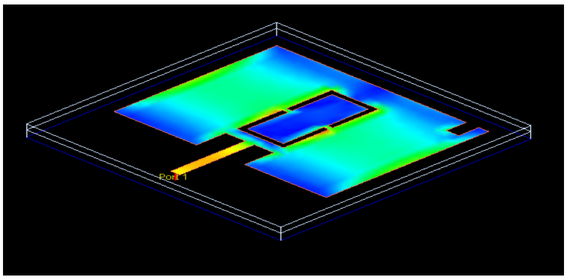

Figure 5 Average current density for 3.3GHz

The blue colour indicates weak current density. The average current density of the dual band antenna is shown below. More intentionally it is a plot of the power radiated from an antenna per unit solid angle which is nothing but the radiation intensity. The proposed antenna provides the best performance in terms of the gain ,return loss, and bandwidth.

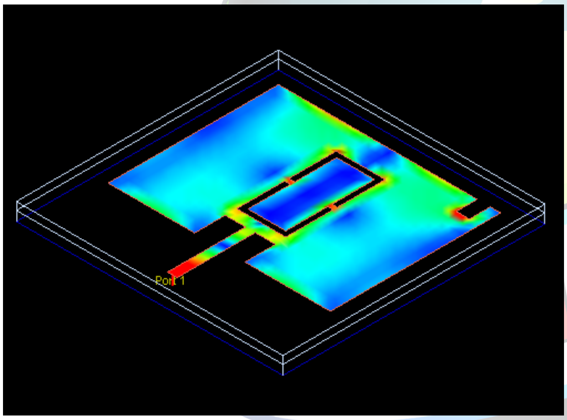

Figure 6 Average current density for 5.5GHz

V. CONCLUSION

The 'O-slot' is etched on the patch antenna which provides enhanced radiation. The most important aim of the paper is to give the performance analysis of 'O' shape slotted antenna to increase gain. And also it delivers the maximum gain value of 7.35 dbi and 7.13 dbi with the reflection coefficient S11 of -21.1dbi and -14.9 dbi for the corresponding frequencies respectively. In this proposed antenna bandwidth is improved and the efficiency of antenna is also very good. It minimize the return losses and increases the main lobe radiation. This antenna shows the fine agreement with the desired return loss bandwidth and gain.

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