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APPLICATION ON DESIGN OF MULTIBAND TRIANGULAR SLOT RECTANGULAR PATCH ANTENNA

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ABSTRACT

This paper presents the three-sided space rectangular fix recieving wire for working on the increase and it is worked for multiband applications. Proposed radio wire is worked at various resounding frequencies and accomplishing acquire more noteworthy than 7db with VSWR under 2, return misfortune is likewise extensively decreased by altering a little primary changes in the recieving wire. The radio wire can be planned by utilizing cst programming.

.***KEYWORDS***

Rectangular patch antenna, triangular slot, multi bands.

I.INTRODUCTION

In the current years the improvement in communication system requires the advancement of ease, insignificant weight, low profile antennas that are equipped for keeping up good performance over a wide range of frequencies. The basic Microstrip patch Antenna comprises of a dielectric substrate having a fixed dielectric constant. Patch is present on one side of a dielectric substrate and a ground plane is available on opposite side of a substrate. The metallic patch may have any geometrical structures like rectangular, triangular, helical, ring, curved. The measurement of the patch resembles to the resonant frequency of antenna. But patch antennas have narrow bandwidth and the improvement of bandwidth is essential for most applications. So to increase the bandwidth diverse methodologies have been used. The design represented in this project has triangular slot cut on rectangular patch. In contrast with the previous design this design provides multi bands with more directivity and other parameters. This design gives the flexibility to upgrade the parameters by changing the width and relative position of slot[8].

II. DESIGN PROCEDURE

Slot antenna is a method for expanding the number of bands with relative high gain. At that point when a slot antenna is fed with a line feed the electric field produced by that piece of microstrip line over the slot, crosses out the slot electric field created by the return current of microstrip line in ground plane at a specific location near the feed. This creates a short circuit across the slot at the microstrip feed. Therefore it produces a resonance with a frequency greater than the main resonance. So, inorder to check this idea we modified the rectangular patch antenna to be utilized for multiband operation by making a slot[8]. The First antenna was designed to operate at a resonant frequency of 2.45GHz. The dielectric substrate used for the design is RogersRT5870 with a relative permittivity of $\varepsilon_{r=}$ 2.33 and the height of substrate is 0.787. The proposed antenna is designed and simulated using Computer Simulation Technology (CST).

III. DESIGN OF ANTENNA

Figure 1,2 represents the geometrical view of antenna designed in CST Microwave Studio. The measurements and location of feed point are improved to get the ideal impedance matching to the antenna.

[1]The design equations of antenna are given as:-

1. Calculation of the Width **(*W*):**

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

2. Calculation of Effective dielectric constant **(*εreff*):**

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

3. Calculation of the Effective length **(*Leff*):**

$$L_{eff} = \frac{c}{2 f_o \sqrt{\varepsilon_{reff}}}$$

4. Calculation of the length extension **(Δ*L*):**

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

[9]The three important parameters for the design of patch antenna are:-

1) Operating frequency (f_0):-

The designed antenna must operate in the frequency range so the resonant frequency must be selected carefully in order to calculate antenna parameters.

2) Dielectric constant:-

Here Rogers RT5870 material is used for substrate. The dielectric constant of this material is low. The low dielectric loss makes it worth for high frequency and broadband applications where dispersion losses are minimum. These materials are hydrophobic and highly isotropic.

3) Height of dielectric substrate:-

In order to utilize the antenna for wireless devices the antenna should not be massive. So, the height of substrate is also an essential parameter.

The following table1 gives the design parameters for the antenna:-

Resonant frequency= 2.45ghz

Dielectric constant=2.33

Speed of light=$3*10^8$mm/s

Parameters	Dimensions (mm)
Length of patch	39
Width of patch	47
Thickness of patch	0.07
Height of substrate	0.787
Length of microstrip feed	32
Width of microstrip feed	2.3
Gap between microstrip and patch	1
Distance of inset feed	12.7

Table 1:- Design parameters

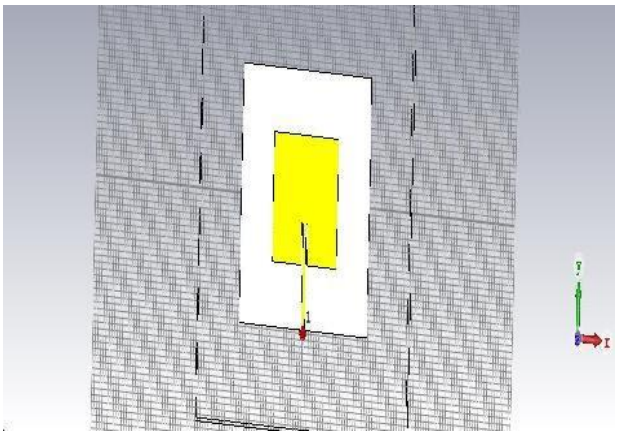

Figure 1:- Geometrical view of rectangular patch antenna

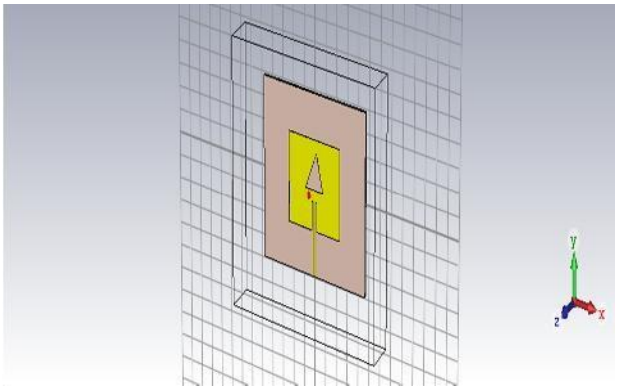

Figure 2:- Geometrical view of triangular slot rectangular patch antenna.

IV. SIMULATION RESULTS

Fig 3 represents the s-parameters of rectangular patch antenna. It has a return loss of -26db at 2.45 and 4.17db respectively. Fig 4 is the simulation result that represents the multiband behavior of antenna when a triangular slot is cut. The scattering

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parameter of antenna is shown in fig 4. The s-parameter clearly represents the multi bands with -13db and -29db at 2.47ghz and 4.78ghz respectively. It also has a return loss of -13 db ,-23db and -33db for 4.17ghz,5.1ghz and 5.4ghz respectively.

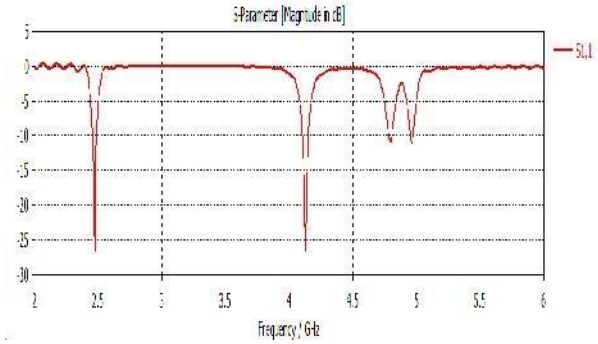

Figure 3:- S-parameters

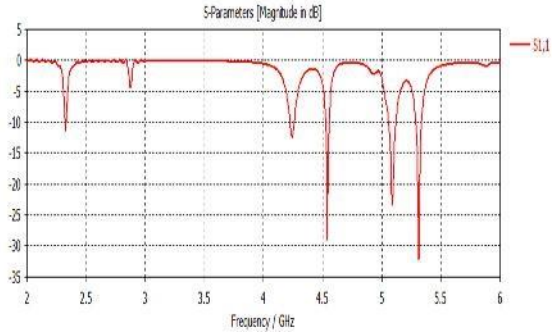

Figure 4:- S-parameter

Fig 5 represents the VSWR of rectangular patch antenna which iss less than 2. Fig 6 represents the VSWR (voltage standing wave ratio) of triangular slot antenna whose value should be between 1 and 2. It is used to measure the efficiency of transmission lines. The value of VSWR for the antenna is less than 2 for both 2.47ghz and 4.78ghz

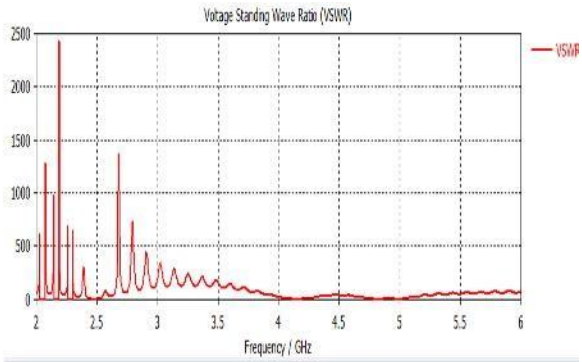

Figure 5:-VSWR plot

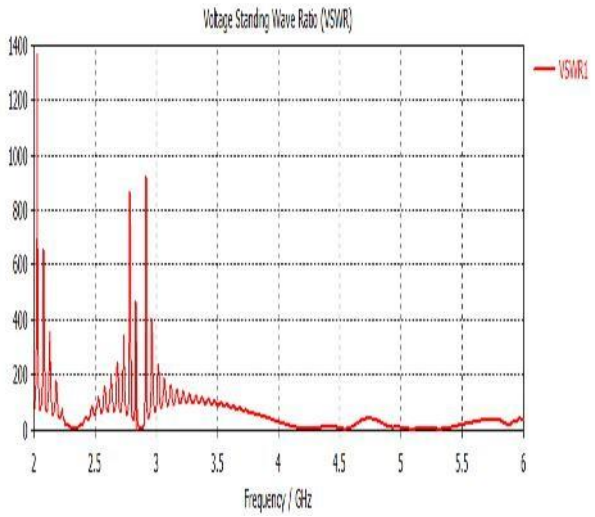

Figure 6:- VSWR plot

Radiation pattern is the graphical representation of relative field strength of antenna. Generally, the antenna should not have any side lobes. Even if they are present we cannot eliminate them instead we should minimize them. Fig 7,8 represents the pattern of rectangular patch antenna which is 7.32dband 7.55db for 2.45ghz and 4.15ghz respectively. Fig 9,10 shows the radiation pattern of triangular slot patch antenna at 2.47ghz and 4.78ghz.

The directivities are 7.28dbi and 9.3dbi respectively.

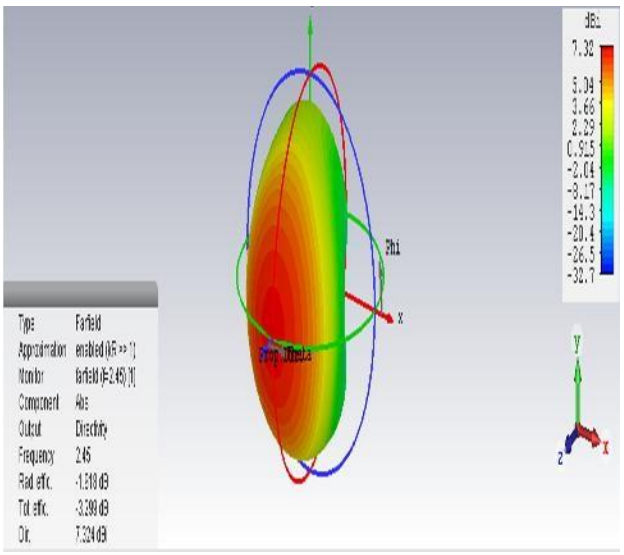

Figure 7:- radiation pattern at 2.45ghz

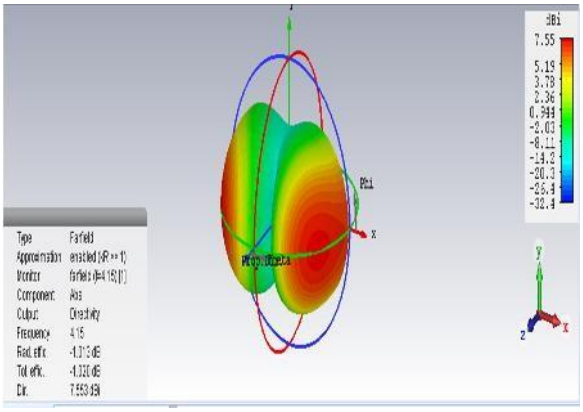

Figure 8:- radiation pattern at 4.15ghz

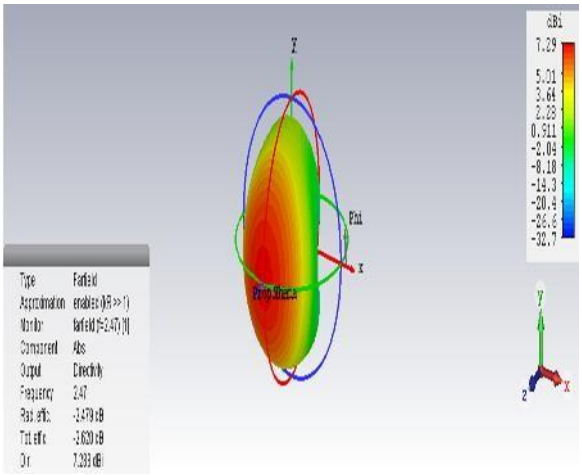

Figure 9:- Radiation pattern at 2.47ghz

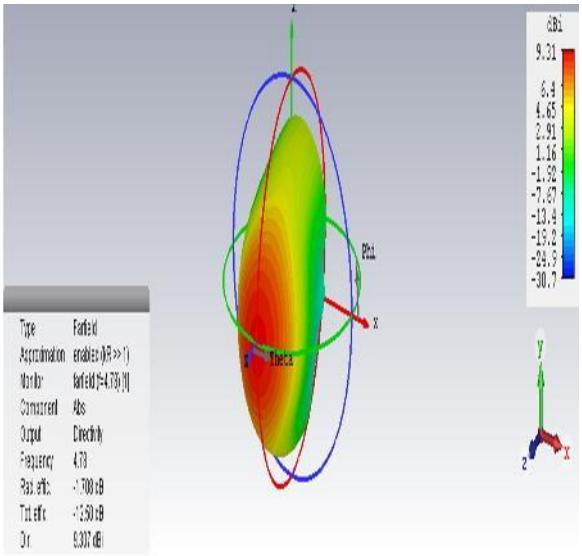

Figure 10:- Radiation pattern at 4.78ghz

V. CONCLUSION

The proposed antenna has successfully increased gain to greater than 7db at different operating frequencies. The return loss is also considerably reduced and this makes antenna more reliable for bluetooth, wifi and satellite downlinks applications.

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