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SIMULATION OF PARASITIC RECTANGULAR PATCH ANTENNA WITH RECESSED GROUND FOR WIDEBAND COMMUNICATION

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Abstract: Patch or microstrip fix receiving wires are turning out to be progressively valuable since they can be printed legitimately on to a printed circuit board (PCB). The effects of finite air field recessed ground along parasitic elements on the reflection and radiation qualities of a microstrip fix reception apparatus at microwave frequencies are to upgrade data transmission and increase of the radio wire. Air material is utilized to structure the recessed ground. The design of the existing parasitic rectangular patch antenna on an FR4-epoxy substrate material with permittivity 4.4. The proposed antenna is recessed ground plane parasitic patch antenna. The measurements for the substrate are 20mm x 20mm x 0.5mm. To improve and compare the properties of antenna such as bandwidth, S-parameters, VSWR, Gain. This structure is designed to be operated in the range of 10.9GHz, with a maximum bandwidth of 8.9GHz, a Return loss of -28dB, VSWR of 0.72dB and Gain of 4.775dB. The proposed radio wire can, along these lines, be utilized for various wideband applications.

***Index Terms* - Microstrip patch, Recessed ground, Parasitic elements, S-Parameters, Gain, Directivity, Bandwidth, Return loss, VSWR, Substrate, Patch, Ground, Radiation pattern, Resonating frequency, Fr4 epoxy.**

I. INTRODUCTION

Wireless communication technology is the most noteworthy disclosure in the cutting edge time correspondence framework. The wireless communication system is the system in which the system can transfer move the data between at least one gadgets without the requirement for any physical correspondence. Patch antenna which is designed operates at a single frequency based on the specifications of the design[1-2]. In the modern era, correspondence frameworks work at numerous frequencies one after another and this outcomes in having various reception apparatus for various working frequencies in a similar chip[3-4]. H. C. Chi, et al., reported that microstrip defective wave radio wire (LWA) cluster structured. It has double shaft radiation example and two-dimensional (2-D) bar examining capacity and has a 4x1 opening coupled arrangement took care of electronically steerable in X-band .K[5]. Gi-Cho, et al., investigated that microstrip exhibit in Ku-band is accomplished by having appropriate impedance coordinating all through the cluster and by appropriately utilizing the corporate and arrangement took care of by microstrip transmission lines[6].B.K. Ang et. al.has been reported that fabricated for fast remote neighborhood and different remote correspondence frameworks covering the 5.15 - 5.825 GHz recurrence band that has E-molded microstrip fix reception apparatus[7]. Microstrip radio wires have been one of the most creative subjects in receiving wire hypothesis and structure as of late, and are progressively discovering applications in a wide scope of current microwave frameworks brought about by D. M. Pozar[8]. Fix receiving wire comprises of three layers: a 'Substrate' at the center layer, on solid land at the base layer and a transmitting 'Fix' at the top layer[9-10]. The Substrate is sandwiched between the ground and fix and it shapes the fix reception apparatus' dielectric medium. The separation between the fix and the 'Ground' frames the substrate tallness for example the dielectric stature which decides the transmission capacity of the radio wire. Microstrip fix radio wires are commonly manufactured by the photograph lithographic strategy[11-12]. Photograph lithographic strategy delivers a profoundly precise carved example for the microstrip fix. Manufacture precision is exceptionally intense as the microstrip fix radio wires are narrowband resounding structures that generally work in the microwave groups[13-14]. HFSS utilizes a scientific technique known as the Limited Component Strategy (FEM). Limited Component Strategy (FEM) is where a shape is part into numerous lesser subdivisions known as limited components.

II.DESIGN

The antenna consists of the furthermore, the normal feed line whose input impedance is 50 Ohms. The substrate materials taken here are FR4 Epoxy. The below fig 5.1 shows the design of the Microstrip Patch Antenna. The position of each patch changes concerning the distance between them. The following are the steps to design an antenna.

Step 1: Initially, the ground plane is taken where the length and width of the ground plane are 20mm and 20mm.

Step 2: Upon that substrate is placed with a material FR4-Epoxy which is the same as the position and dimensions of the ground plane.

Step 3: A single patch is placed about 5mm decreasing at a distance on X-axis considering the is 5mm at a distance from each patch. Then, the patch is placed substrate X-axis dimension and Y-axis on the substrate with a dimension of 10mm x 10mm.

Step 4: A parasitic element-1 is placed on the substrate with a dimension of 9.5mm x 2.5mm and another parasitic element-2 is placed with a dimension of 16mm x 0.5mm.

Step 5: A ground plane whose dimension is 20mm x 4mm.

Step 6: A recessed ground whose dimension of 20mm x 12mm x 2.5mm.

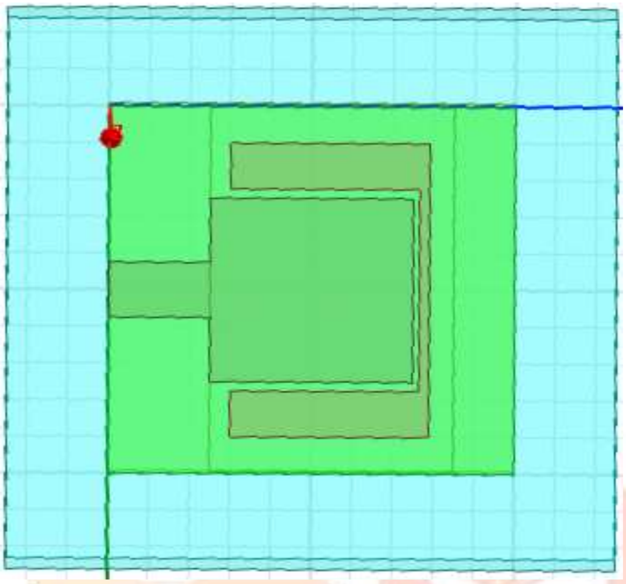

Fig 1: Design

Table 1: Specifications

Parameters	Description	Optimal Values
L_s	Substrate Length	20mm
W_s	Substrate Width	20mm
H	Substrate Height	0.5mm
L_g	Ground Length	20mm
W_g	Ground Width	20mm
H_g	Ground Height	4mm
L_p	Patch Length	10mm
W_p	Patch Width	10mm
L_f	Feed Length	4.5mm
W_f	Feed Width	3mm
L_{p1}	Parasitic 1Length	9.5mm
W_{p1}	Parasitic 1 Width	2.5mm
L_{p2}	Parasitic 2 Length	16mm
W_{p2}	Parasitic 2 Width	0.5mm
L_{rg}	Recessed Ground Length	20mm

W_{rg}	Recessed Ground Width	12mm
H_{rg}	Recessed Ground Height	2.5mm

Design Parameter

Substrate Dimension = 20mm x20mm x0.5mm

Ground Dimension = 20mm x 20mm x 4mm

Substrate Material = FR-4 epoxy , €r = 4.4

Radiation Box Material =Air

Length of the parasitic elements are 9.5and 16mm

Width of the parasitic elements are 2.5 and 0.5mm

III. RESULTS

The recurrence ranges from 1GHz to 20GHz with FR-4 Epoxy as substrate material with return misfortune not exactly - 28dB at three distinctive thunderous frequencies i.e., 5.80GHz, 6.9GHz, and 10.5GHz, spread over C and X Groups individually.

S-Parameters:

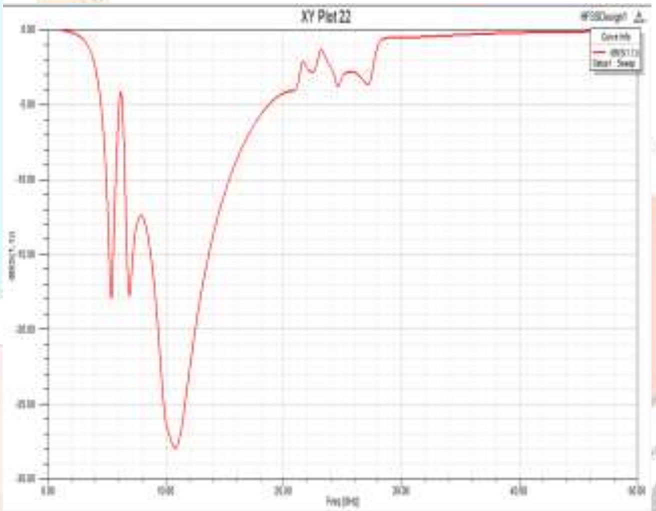

Fig 2: S-parameters

Fig 2 showed that x-axis frequency is in terms of GHz and on y- axis return loss is in terms of dB. The return loss of a rectangular microstrip patch antenna is-28dB at a resonant frequency f_r=10.5GHz where it can operate at X-band.

VSWR:

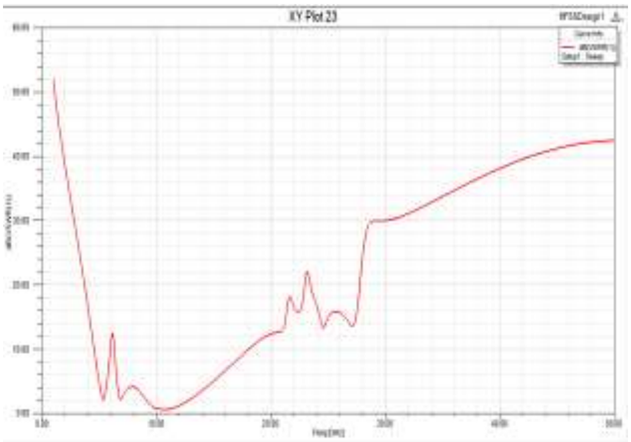

Fig 3: VSWR

Fig 3. Illustrates that VSWR is minimum at a resonant frequency 10.5GHz. VSWR value for microstrip patch antenna is 0.72dB.

Gain:

The gain of the microstrip patch antenna is 1.187dB occurs at the resonating frequency of 5.80GHz

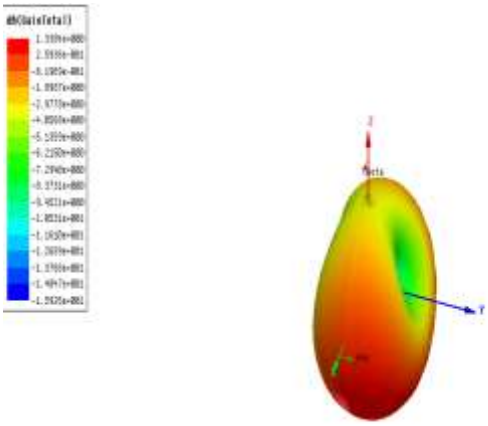

Fig 4: Gain plot for fr= 5.80GHz

The radiation pattern of microstrip patch antenna is -3.8dB occurs at the resonating frequency of5.80GHz in Fig. 5.

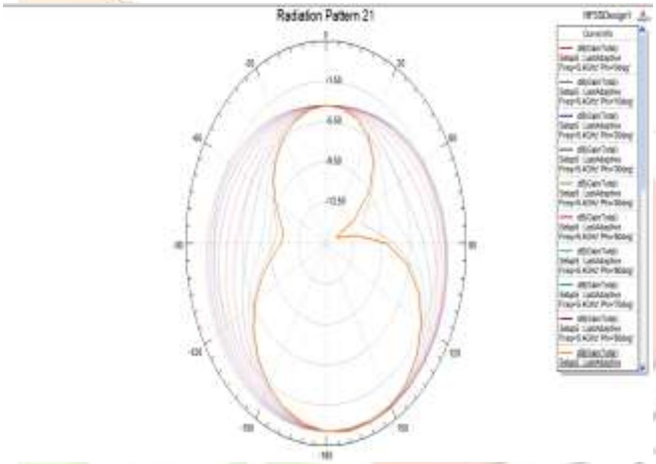

Fig. 5:Radiation pattern for fr= 5.80GHz

6.9GHz: The microstrip patch antenna gain is 4.774dB occurs at the resonating frequency of 6.9GHz

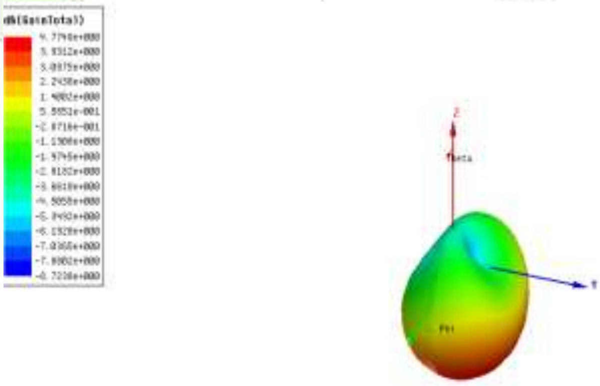

Fig 6: Gain plot for fr= 6.9GHz

The radiation pattern of microstrip patch antenna is -12.4dBoccurs at the resonating frequency of10.5GHz. in fig.7.

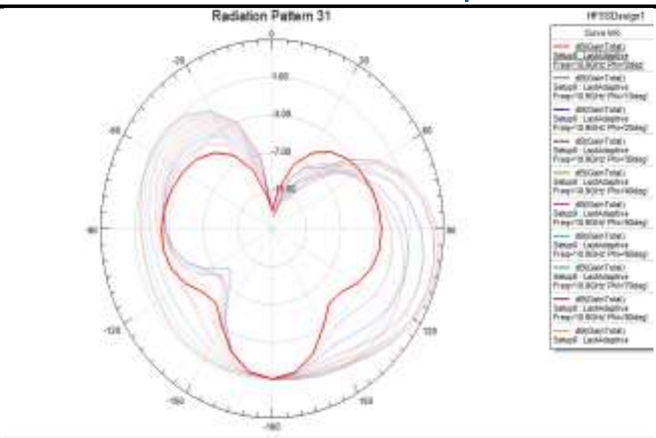

Fig. 7:Radiation pattern for fr= 5.80GHz

10.5GHz:

Gain of microstrip patch antenna is 4.775dB.

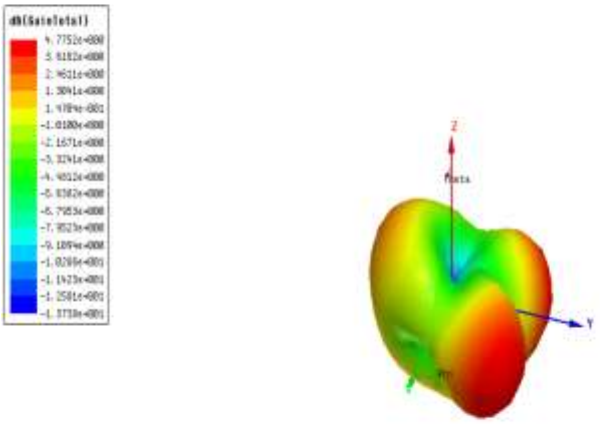

Fig 8: Gain plot for fr= 10.5GHz

The radiation pattern of microstrip patch antenna is -12.4dB occurs at the resonating frequency of10.5GHz

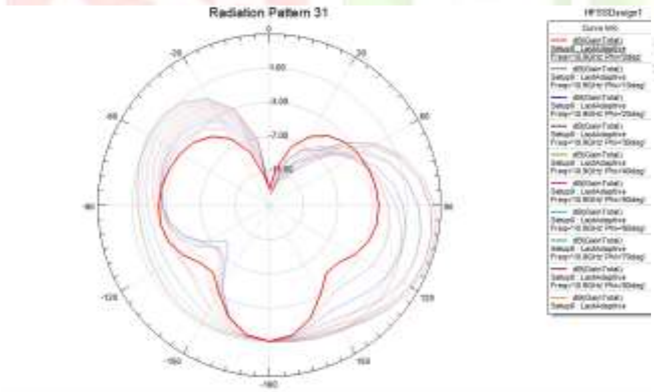

Fig. 9: Radiation pattern for fr= 5.80GHz

IV:CONCLUSION

Microstrip fix receiving wire with FR-4 Epoxy as substrate material with relativity permittivity of 4.4 is appropriate for recurrence scope of activity from 1GHz to 75GHz with Double band in C and X bands. The substrate material FR-4 Epoxy of relative permittivity of 4.4 were talked about, and different parameters of microstrip fix radio wire for FR-4 Epoxy substrate material.

Table 2: Design parameters

Parameters			
Material	FR4 EPOXY		
Relative Permittivity	4.4		
Return loss(dB)	-18	-17.9	-28
Resonant Frequency(GHz)	5.80	6.9	10.5
Gain(dB)	1.187	4.774	4.775
Directivity (dB)	1.511	4.919	4.936
Efficiency	Low	Low	Moderate
Lower cut-off frequency(GHz)	4.9	6.5	6.5
Upper cut-off frequency (GHz)	5.7	7.8	15.4
Bandwidth (GHz)	0.8	1.3	8.9
VSWR (dB)	2.21	2.24	0.72
Operation Band	C band	C band	X band

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