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Design and Simulation of Star Circular Micro Strip Patch Antenna

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Abstract*:. The first antenna was built in Heinrich Hertz German physicist. In this paper a star Circular micro strip patch antenna has been analyzed and simulated for radar communication and satellite communication. The proposed antenna can be simulated at 30 GHZ. This antenna was designed by using Rogers/duroid 5870 substrate material with die electric constant2.2 the antenna simulation has been realized using HFSS (High frequency structure simulator) software. And the result shows that the designed antenna resonates at 16.8GHZwith a Return loss of -11db and gain of the antenna is 7db.

Index Terms*: Star Circular Micro Strip patch antenna, Rogers/duroid substrate, *Return loss, HFSS software.

I. INTRODUCTION

In 1970 the micro strip patch antenna (MPA) was introduced. In the field of wireless communication the micro strip antenna technology has been developed day by day. This micro strip antenna contains a ground plane of one side and patch on the other side. In between the ground plane and patch there is a die electric substrate is presented. It has a dielectric constant $\in_r$ [1]. For using this Micro strip antennas

there is a some advantages like it has less profile, compact less, easy to fabricate, easy to install and also it has a low cost. In mobile phones or cell phones the MPA are very compactable in handheld devices for increasing the demand of wireless applications. The need of microstrip patch antennas with dual, triple band and multiband characteristics are increasing day by day[2]. There are many different patch shapes such as rectangular, circular, elliptical, circular ring,

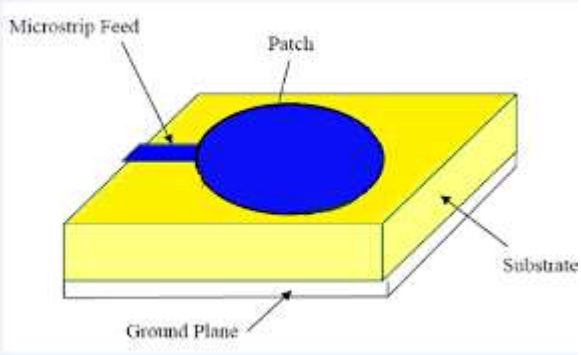

Fig.1 Basic circular Micro strip patch antenna

In the work a geometry of antenna the star shaped circular MPA with line feed .The main aim of this antenna is frequency bands are increased. Consider designing of an antenna need to ground plane,substrate,and circular micro strip patch antenna. Substrate can be taken as Rogers/duroid 5870. These antenna parameters are used in experimental communication, DBST (Direct Broadcast Satellite Television) and terrestrial micro wave communication etc….

II. DESIGN OF ANTENNA AND CONFIGURATION

The new designed antenna can be developed using Rogers/duroid 5870 substrate. And 30 GHz taken as resonant frequency. Calculating the length of patch, width of patch by using these equations.

Step 1 :-By calculating the patch width using the below equation

triangular and hexagonal. And also there are different techniques for feeding they are micro strip line feeding,

$$w = \frac{c}{f_o \sqrt{\frac{\in_r + 1}{2}}}$$

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coaxial probe feed and electromagnetically coupled[3]. The main disadvantages of these antennas are less power
(1)
handling capability, narrow band width[4]. The triple band characteristics help the various applications[5].Such as radar communications and experimental communication frequency band ranges are 39.2GHz (26.5- 40GHz) satellite communication frequency ranges 10.8GHz (12-18GHz).

Here W=patch width

c = speed of light

$\in_r$ = dielectric substrate value

Step 2:- By calculating the patch length using the below equation

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$$L_{eff} = \frac{C}{2 f \sqrt{\in_{reff}}} \quad (2)$$

communication. The design is simulated by the HFSS simulation 14.0 version software.

Designed a new antenna that is star circular microstrip patch antenna this frequency is the application of Ku-band,

The formula for the effective dielectric constant $\in_{reff}$ (2

$$\in_{reff} = \frac{\in_r +1}{2} + \frac{\in_r -1}{2}[1+12\frac{h}{w}]^{-1/2} \quad (3)$$

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

Here h=substrate height C=speed of the light.

L= Actual patch length.

$\in_r$ =Relative permittivity of substrate. L_{eff}=Effective length.

ΔL=Length extension.

$\in_{eff}$=Effective dielectric constant.

The length of the ground, width of the ground plane is alike to that of the length of the substrate and width of the substrate.

Lg= 6h+w Wg= 6h+w

Table 1: Parameters values of designed antenna

S.No	parameters	Description	Values (mm)
1.	L_S	substrate length	20

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2.	W_S	Substrate width	20
3.	L_F	Length of feedline	10
4.	W_F	Width of feedline	1

To increase the performance of antenna while designing a star shape has been introduced. The dimensions of the new antenna are 20mm × 20mm. it is the length & width of the ground plane. It is alike to that of substrate length and substrate width. And also substrate height is h=0.3mm. The
patch antenna radius is 7mm, and thickness of the patch is 2mm.The designed by using the substrate Rogers/duroid 5870 has a dielectric constant 2.2. Fig.2 & Fig.3 represents the imitation structure of planned antenna.

III. PROPOSED WORK

The main purpose of designed antenna is operated in Triple band and its application of Radar and satellite

K-band, Ka-bands especially used in experimental communication like NASA, Kepler space craft is the first NASA mission to use Ka-band DSN communication.

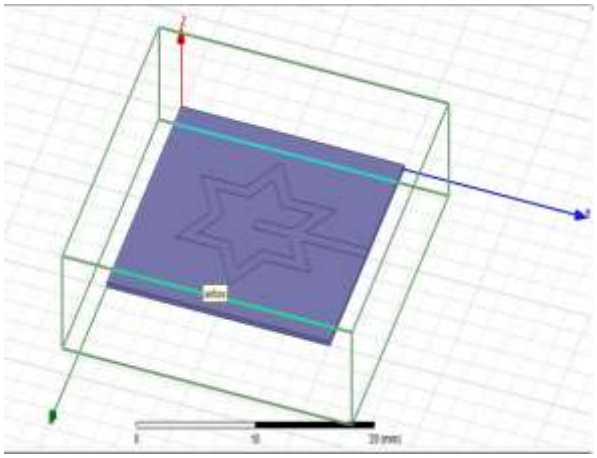

Fig.2 Single Star shape design

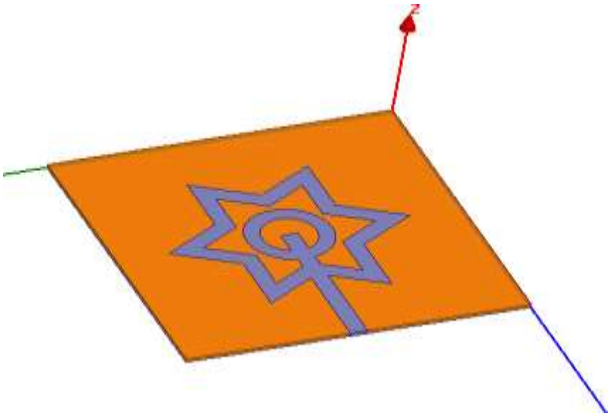

Fig.3 Star with circular Microstrip patch antenna

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IV. RESULTS AND DISCUSSION

HFSS is used for antenna simulation for the planned antenna. The below Figures shows the simulated and measured results of Retunloss for the base geometry of planned antenna and it works at three bands of frequencies.

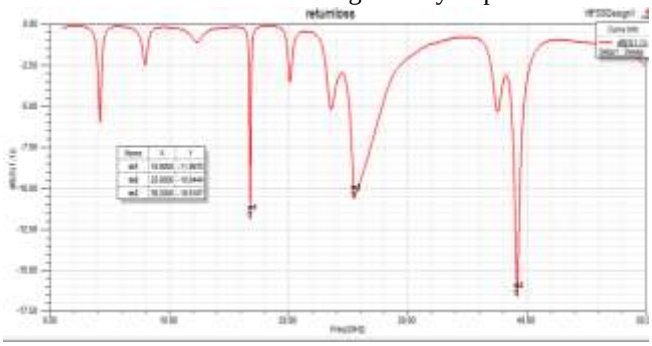

Fig.4 Retunloss Vs frequency of proposed antenna

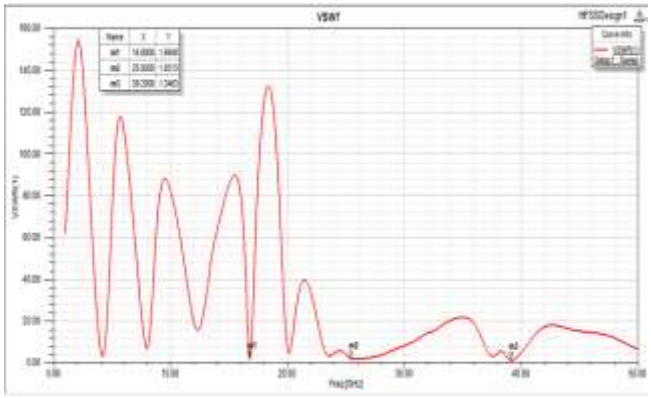

Fig.5 VSWR v/s frequency plot of planned antenna

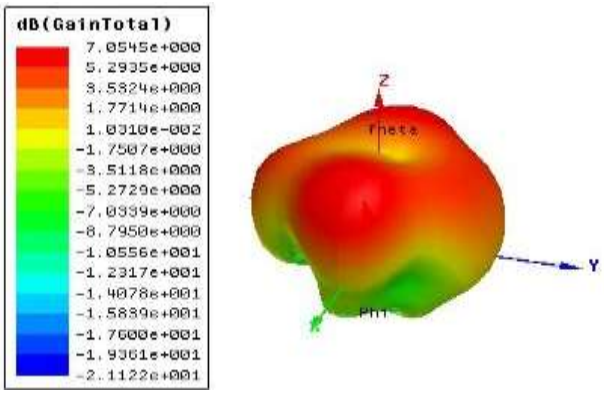

Fig.6 Total gain of the planned antenna

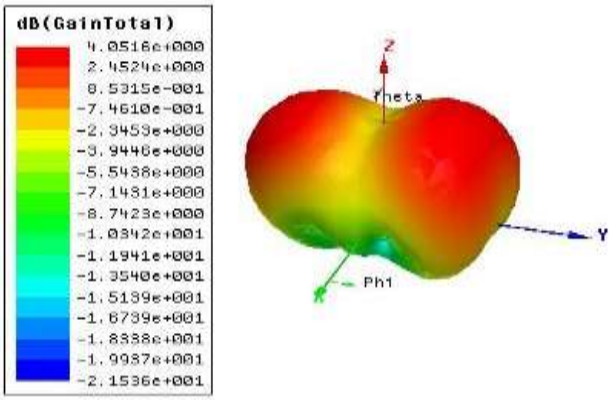

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Fig.7 Gain of the planned antenna at Ku-band

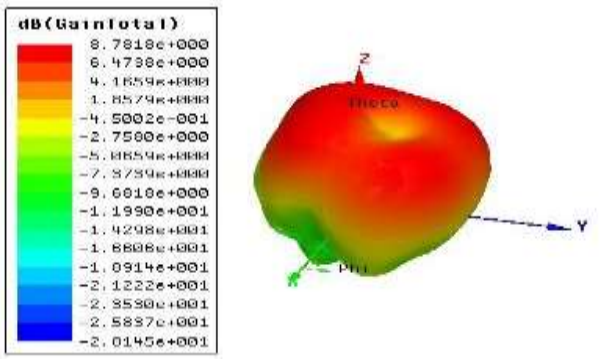

Fig.8 Gain of the planned antenna at K-band

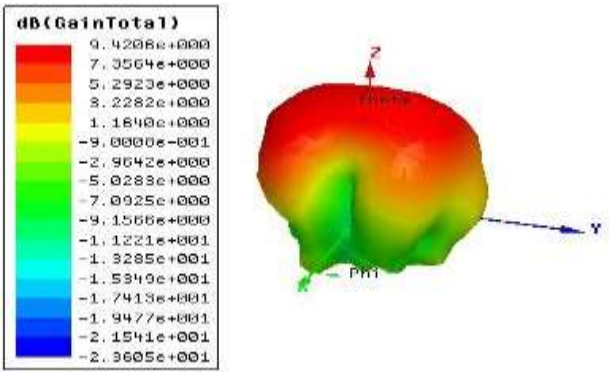

Fig.9 Gain of the planned antenna at Ka-band

V. CONCLUSION

From the obtained results it can be concluded that the ‘’A new Star shaped circular Micro strip patch Antenna’’ can be designed. And also simulated by observing this antenna return loss, VSWR, and gain. By obtain frequency of this antenna can be used in the satellite communication, radar communication and also especially in police traffic speed detectors. This antenna operated at the frequency band of Ku- band, K-band, Ka-band.

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