

ELLIPSE SHAPED MICRO-STRIP PATCH ANTENNA FOR Ku, K AND Ka BAND APPLICATIONS

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Abstract- *The design and analysis of ellipse shaped broad band micro strip patch antenna are discussed in this paper. In modern wireless communication system at the higher frequency, this basically needs all its components to be in compact size. The proposed antenna inspired by ellipse shaped which offer the better performance compare to the conventional antenna. Here, the proposed antenna is one such component that operating in Ku, K and Ku higher frequency band. The impedance bandwidth and radiation characteristics of the designed structure are investigated with the CST software. The proposed antenna offers the VSWR<2 that is better performance in higher frequency band from 14GHz to 31GHz. Obtaining Impedence.*

Key Words: *Antenna geometry, Simulation result, Radiation pattern, and current distribution.*

1.INTRODUCTION

Now a day's, the researcher are interested in developing the fastest wireless communication system with have the high speed data rate such as satellites communication system [1,2,3]. Due to the rapid progress in wireless communication systems such as different Radar systems as synthetic aperture radar (SAR), remote sensing radars, shuttle imaging radar and other wireless communication systems operate in K, Ku, C and X bands, here micro strip antennas are the first choice for these high frequency bands due to its light weight and have broad bandwidth it is feasible to be structured conformal to the mounting hosts [4, 5]. Moreover, they are easy fabricated, have low cost and are easy to integrate into microwave printed circuits [6, 7]. Even though micro strip antennas have a lot of advantages but it is limited by their inherent narrow bandwidth. Various techniques like aperture coupling, by introducing defects in the ground plane structure and optimizing the feed and dimension of the ground have been proposed to enhance the bandwidth of micro strip antennas [8, 9, 10]. There are many varieties of patch structures are available. In these requirements, It is

required to that the device should be compact and light weighted and suitable for transmit and receive signals [11, 12, 13]. For this purpose, we used the Ellipse based antenna geometry which is generally provided the better performance compare to conventional microstrip antenna.

In modern communication system a broad band micro strip patch antennas have many attractive features like low radiation loss, less dispersion, easy integration for monolithic integrated circuits, so these types of antennas have recently become more and more attractive [14, 15, 16,]. In this paper, the proposed antenna geometry looks like a Ellipse shaped with rectangular feed which has a simple structure and the proposed antenna is successfully designed with a compact size on the epoxy FR-4 substrate with the dimensional 24 x24 mm that provided the a impedance bandwidth 13GHz (ranging from 17.5GHz to 30.5 GHz) and gain nearly 5.5dBi.

This paper is divided into 6 sections. The first section comprises of introduction. The proposed antenna design is described in section II. Discussion of simulation result has been shown in section III and conclusion is drawn in section IV.

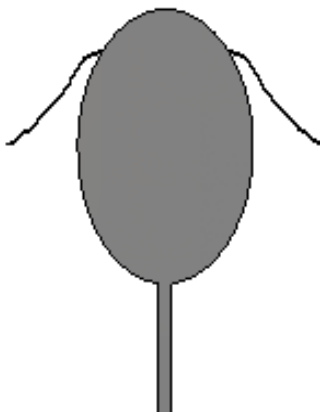
2. ANTENNA DESIGN

To design and simulate the patch antenna, the computer simulation technology software was used with a powerful tool CST microwave studio, which realization of all simulated result with respect to a set of parametric output of antenna such as 2D and 3D radiation patterns , gain , bandwidth, directivity, efficiency etc. The proposed design consists of one ellipse with the large radius 6mm and small radius 4 mm, substrate thickness/height (h) = 1.59mm. A defected ground technique is used for improve the antenna performance in the higher frequency band. The rectangular slots with dimensional shown in table 1 are used for this technique. The antennas are feed by a rectangular strip which offers the better impedance

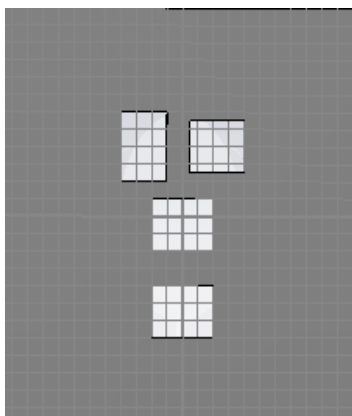
bandwidth (13GHz). The proposed antenna geometry of the front view and rear view are shown in fig -1:

Table -1: Four different configurations of slots in ground plane

Slot No.	Slot dimensional (x, y)
1	4,3
2	4,3
3	3.5,3
4	3,4



(a) Front view



(b) Rear view

Fig -1: Proposed antenna design

3. RESULTS AND DISCUSSIONS

The simulated reflection coefficient is shown as in the fig - 2: It is found that the simulated values are shown is below -10dB nearly -40dB that the antenna has a good performance (less than -10dB). The resonant frequency of the antenna is the frequency at which minimum dip in magnitude of S11 is obtained. The proposed antenna has the return loss of -32.5dB, -39.5dB, -20.8dB, -32.5dB and -19.0dB at their resonant frequency 21.8GHz, 25.8GHz, 27.6GHz, 29.03GHz respectively which provided the high bandwidth 13GHz. Availability of this result provides the major requirement in Ku, K, Ka band application.

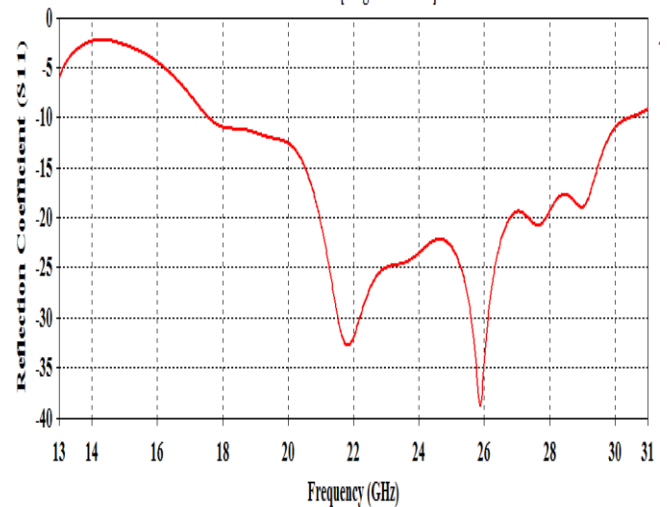


Fig -2: Return loss of proposed antenna

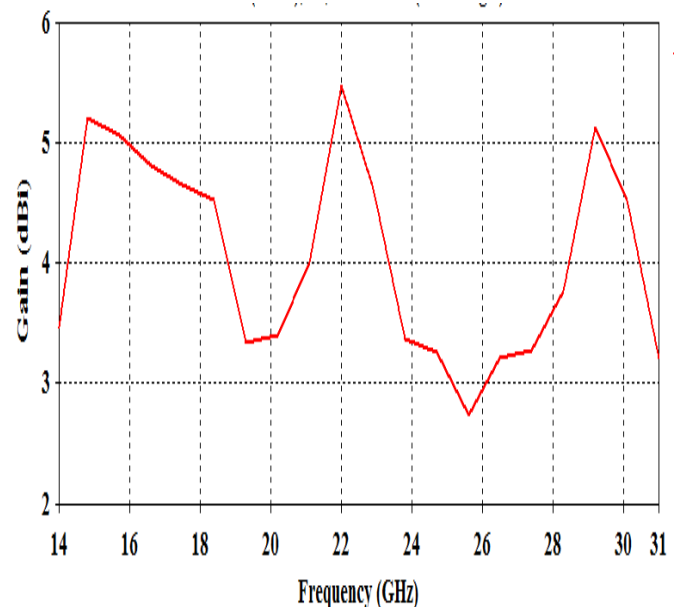
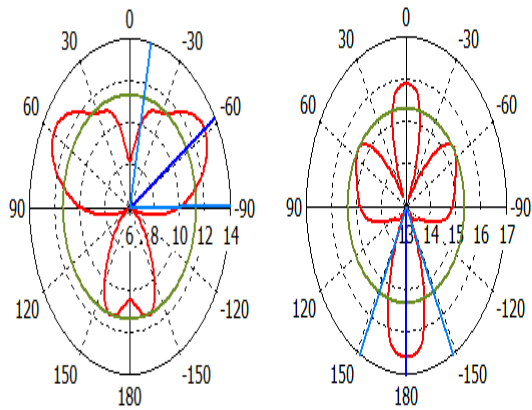


Fig -3: Gain (dbi)/ frequency

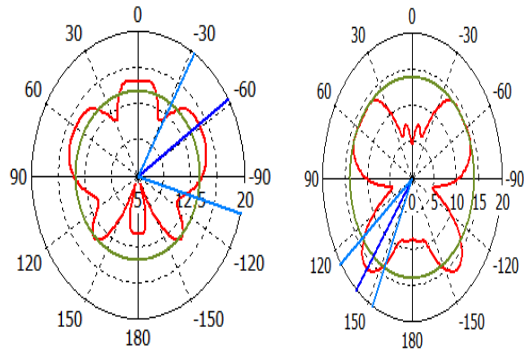
The maximum gain of the proposed antenna provided at 5.5dBi at 22GHz frequency, its value decreases rapidly and provides the minimum gain at third resonance frequency shown in above fig-3: .The maximum gain of the proposed antenna provided at 5.5dBi at 22GHz frequency, it's value decreases rapidly and provides the minimum gain at third resonance frequency shown in above fig-3:.

Farfield E-Field(r=1m) Abs (Phi=0) Farfield E-Field(r=1m) Abs (Phi=0)



Theta / Degree vs. dBV/m Theta / Degree vs. dBV/m

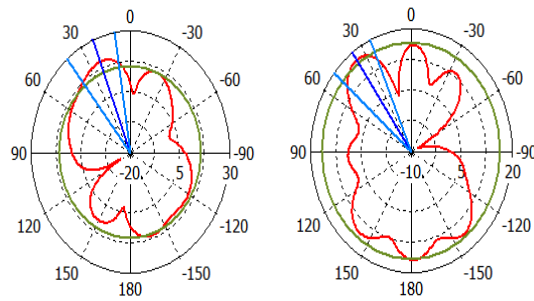
Farfield E-Field(r=1m) Abs (Phi=0) Farfield E-Field(r=1m) Abs (Phi=0)



Theta / Degree vs. dBV/m Theta / Degree vs. dBV/m

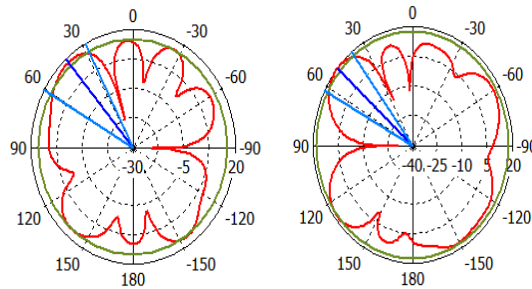
(a)

Farfield E-Field(r=1m) Abs (Phi=90) Farfield E-Field(r=1m) Abs (Phi=90)



Theta / Degree vs. dBV/m Theta / Degree vs. dBV/m

Farfield E-Field(r=1m) Abs (Phi=90) Farfield E-Field(r=1m) Abs (Phi=90)



Theta / Degree vs. dBV/m Theta / Degree vs. dBV/m

(b)

Fig -4: (a) E and (b) H plane Radiation pattern at 21.8 GHz, 25.8GHz, 27.6GHz, and 29.03GHz

Fig- 3: shows the 2D radiation pattern of E and H plane of the proposed antenna geometry at their resonance frequency .It is seen that Ku, K, Ka Band. Micro-strip Patch Antenna design radiates in all almost desired directions. Hence it proves that the antenna is an isotropic antenna with directivity nearly 5.55dBi.

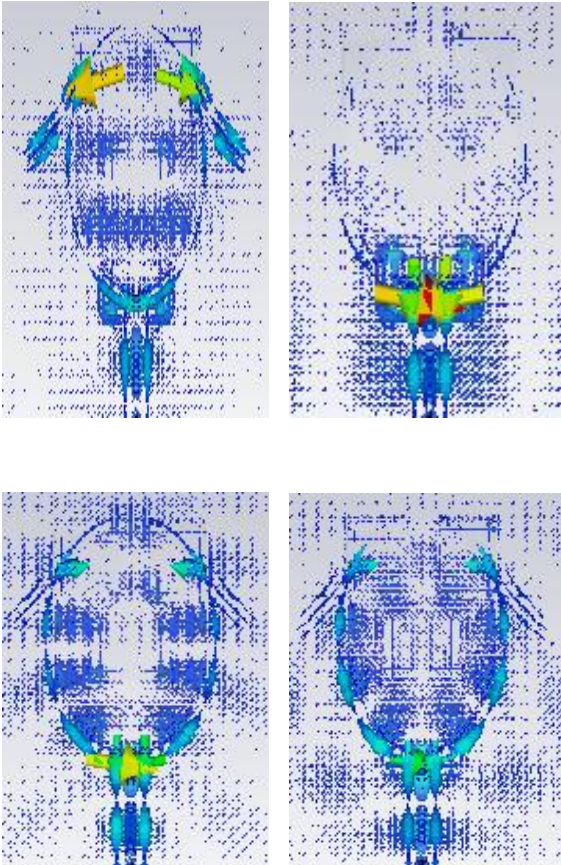


Fig -5: Surface Current distribution at 21.8 GHz, 25.8GHz, 27.6GHz, and 29.03GHz respectively

Current distribution on the patch geometry of proposed antenna is shown in fig-5: By examine, current distribution across the boundary such flow of the current indicates the perfect impedance matching that means maximum power transfer by existence of the maximum power theorem. Such current distribution on patch plays an important role in reducing the return loss and VSWR. Fig- 6: shows the value of VSWR approximately 1.

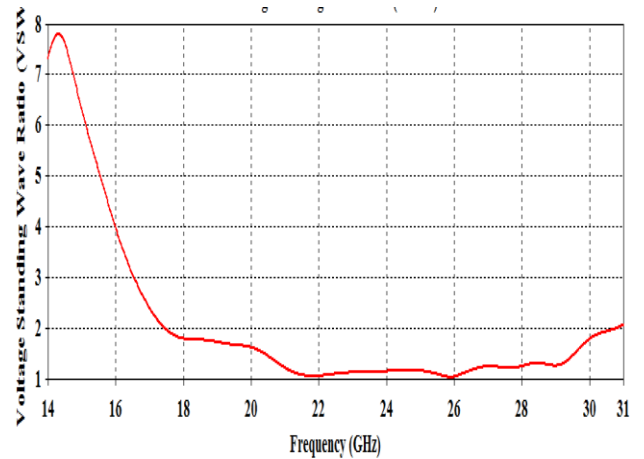


Fig -6: Variation in VSWR with respect to the Frequency

4. CONCLUSION

In this paper, it is clear that the above proposed antenna geometry is much suitable for Ku, K, Ka band application such as nanosatellite and radar system applications. It is show the well mention performance with respect to better gain and bandwidth and operates at higher frequency band (14GHz to 31GHz). By varying the antenna’s design parameter such as feed dimensional, ground dimensional, patch dimensional and chose different substrate material, with better performance is our future vision.

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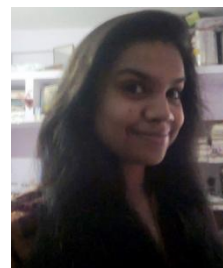
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BIOGRAPHY



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