DESIGN & ANALYSIS OF CIRCULAR PATCH ANTENNA FOR Ku-BAND APPLICATIONS

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Abstract: **In this paper a circular microstrip antenna is designed for Ku band application. The design consists of a Circular patch having elliptical slot with defected ground substrate. It is observed through analysis that dimensions & slots are key factor for improving the bandwidth of this geometry. The antenna is fabricated on FR4 Substrate & S-parameters are optimized.**

***Index Terms*: Circular Antenna, Defected ground, Elliptical slot, Ku band, Microstrip.**

I. INTRODUCTION

Microstrip antennas is most widely used in recent wireless communications devices because of some advantageous features such as small size and light weight, cost effective, compact and planner structure, easy interconnection with solid-state devices. Recently, frequency reconfiguration has attracted significant attention due to the introduction of future wireless communication concept such as cognitive radio which employs wideband sensing and reconfigurable narrowband communication [1]. Frequency reconfigurable antennas have the potential to reduce the size of front end system and allow pre-filtering at the receiver. Thus, it can support many wireless applications in one single terminal system [2].Many techniques have been proposed Such as stacked patches, etc. Recently a new technique of defected ground structure (DGS) is being used to enhance the bandwidth of microstrip antennas. In DGS intentional defects are introduced in the ground plane or slots of different shapes are cut in the ground that give rise to size reduction and desired radiation performance.

II. PROPOSED ANTENNA DESIGN

In the present work, an antenna is designed for a frequency of around 13 GHz that is in the Ku band. The proposed antenna consists of an elliptically slotted patch with a defected ground structure. The antenna has a compact size of 30X30 mm having a circular patch having 20 mm diameter as shown in Fig.1. It is fed by a 50 ohms microstrip line. The antenna is printed on FR4 substrate having a thickness of 1.59 mm. Further an elliptical slot is cut on the patch having 4 mm and 3 mm as major and minor axis respectively as shown in Fig.2. Now the ground plane is truncated to get a DGS structure as shown in Fig.3. The dimensions of the ground plane are 30X19 mm. DGS is now widely used to enhance the performance of microstrip antenna [3]. DGS often used for size reduction. The ground width is varied to get a DGS structure [4-5].

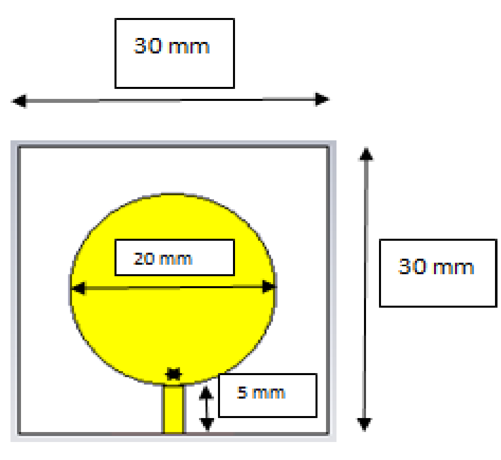

Fig.1. Top view of proposed antenna having circular patch.

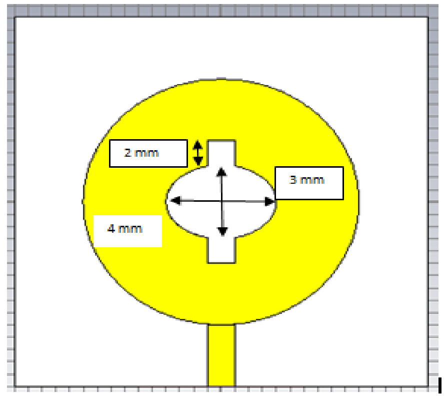

Fig 2. Top view of proposed antenna with elliptical slot.

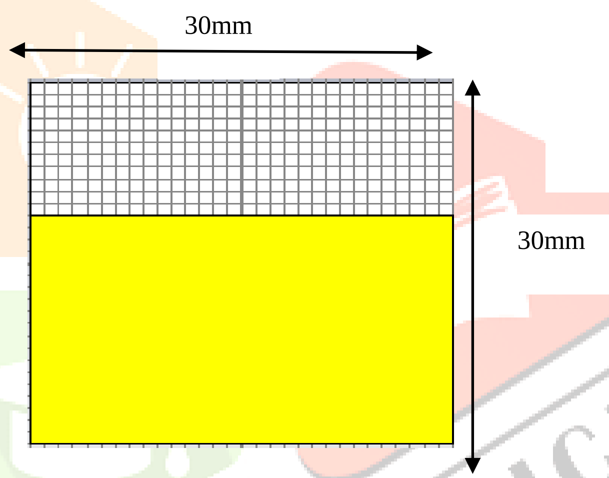

Fig.3 Bottom view of proposed antenna showing defected ground.

III. Simulation Results

The proposed antenna design is simulated using CST Microwave studio [6]. The simulated results for S11 is shown in Fig 4. The minimum return loss is −62 dB at 13.2 GHz and−23dBat 14.8GHz. We can see that both the bands are used for Ku band applications but return loss is much less at a frequency of 13.2 GHz so we select this frequency and calculate other results on this frequency. The VSWR plot with frequency is as also shown in Fig 5. We can see that VSWR is touching a value of almost one for the above two frequencies thus showing a good matched condition at the above frequencies. We have further simulated the far field results at the frequency of 13.2 GHz as shown in Fig 6. The main lobe is at an angle of 42 degrees. We can also see the plots for H field and E field respectively in Fig 7 and Fig 8 respectively.

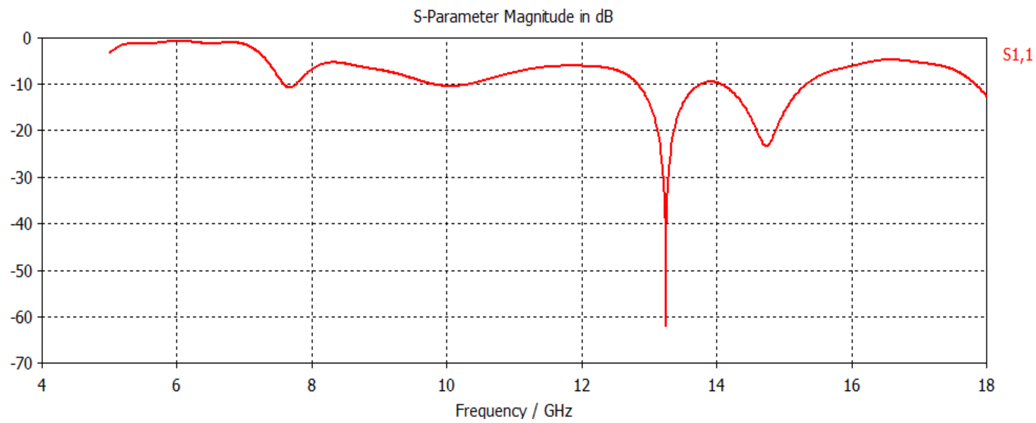

Fig .4 S_{11} plot vs frequency.

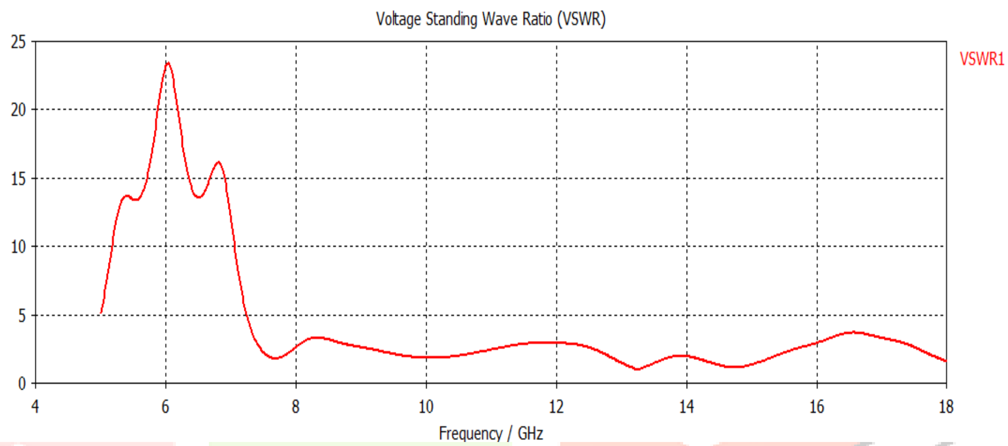

Fig. 5 VSWR plot vs frequency.

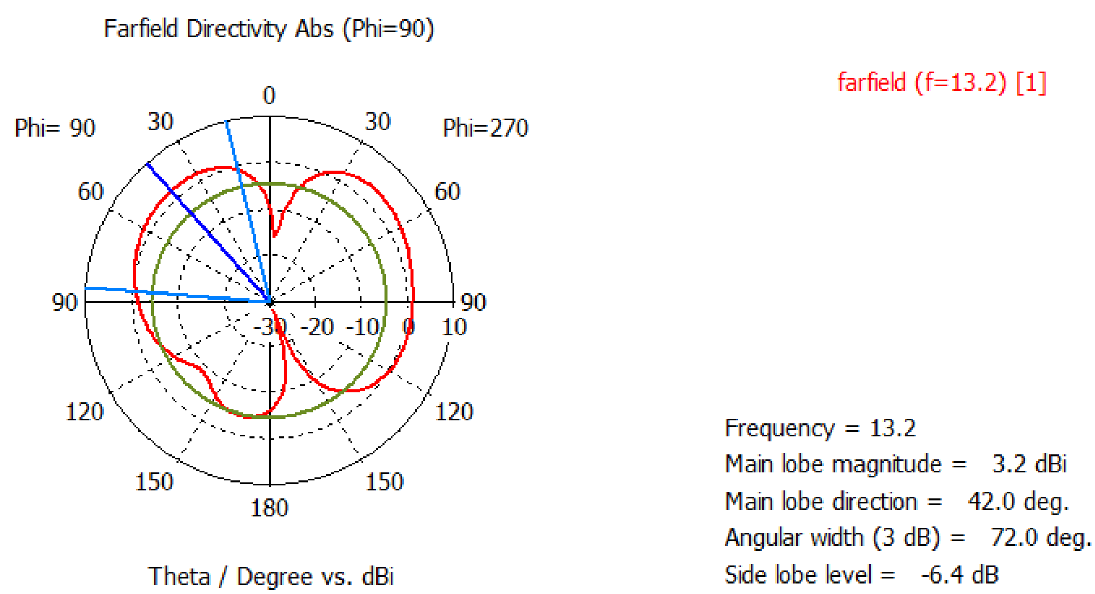

Fig. 6 Farfield pattern.

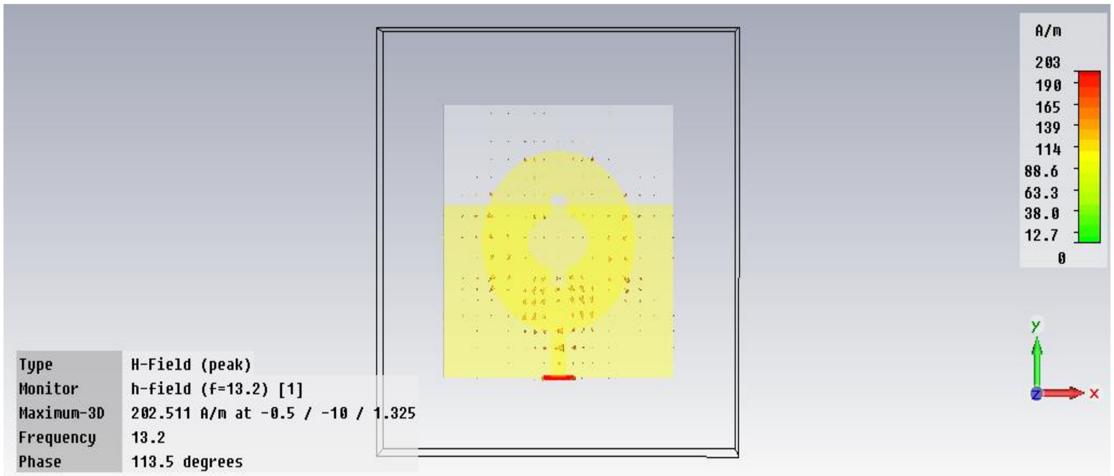

Fig. 7 H field pattern.

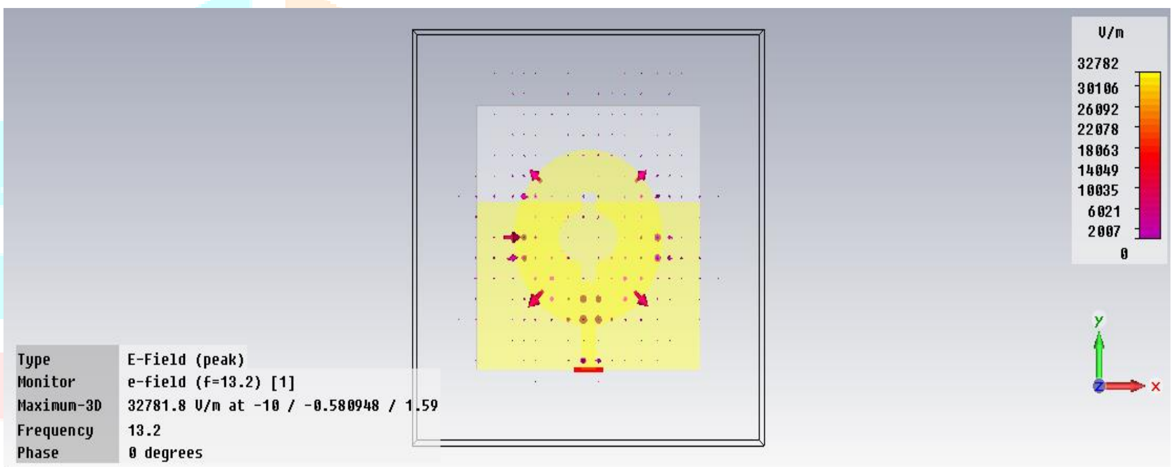

Fig. 8 E field pattern.

IV. CONCLUSION

A novel defected ground microstrip slotted patch antenna is simulated. It has been observed that using the defected ground geometry and optimizing antenna dimensions results in good impedance matching. The design of a circular microstrip patch antenna has been simulated and from simulated results it is clear that the proposed antenna is useful for the 13.2 GHz and 14.8 GHz frequency range. This frequency finds application in Ku band, and it is also used for direct broadcast satellite services.

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