Circular Printed Monopole Antenna for 14GHz using Defected Ground Structure (DGS) Technique

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Abstract
In this paper, we propose a design of Circular Printed Monopole Antenna with a rectangular slot etched ground plane as DGS. The defected ground structure concept is used to improve the bandwidth and impedance matching. The bandwidth 1130MHz with respect to center frequency 13.965GHz in Ku band. The percentage bandwidth of 8.09% and the average gain of 3dBi are achieved.

Keywords
Circular Printed Monopole, DGS, Bandwidth Enhancement, Ku Band

I. Introduction

Perturbation of ground surface is named as Defected Ground Surface for slots on ground plane. Monopole antennas can easily configured for most complex multiband characteristics. Antennas which can work properly in more than one frequency region either for transmitting or receiving Electromagnetic (EM) waves, are termed as Multi-band antennas [1]. Circular Printed Monopole Antenna is designed by embedding suitable slots on the on the ground plane as DGS (Defected ground Structure).

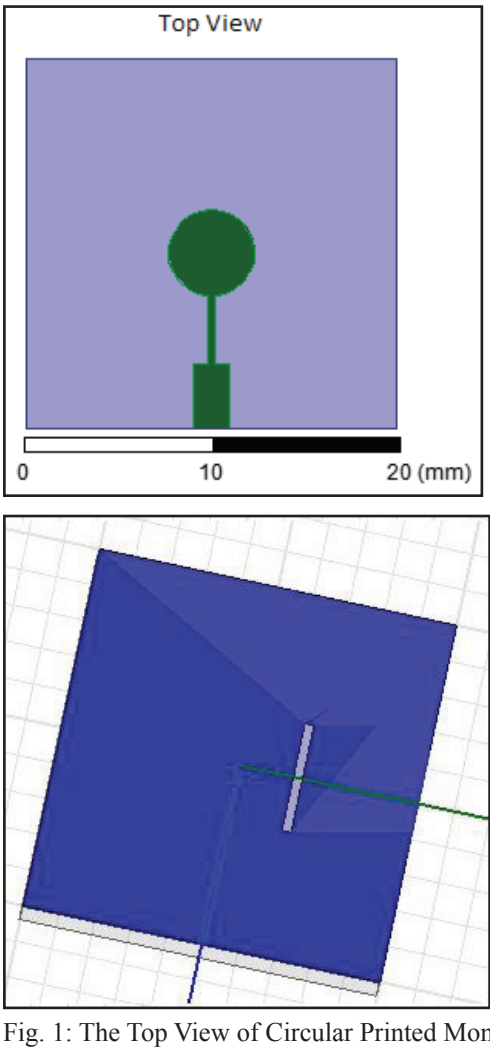


Fig. 1: The Top View of Circular Printed Monopole Antenna

II. Antenna Design

The antenna is fabricated on substrate of FR4_epoxy with relative permittivity $\varepsilon_r = 4.4$ and the thickness of 1.6mm. The radius of the radiating printed monopole and length and width of ground plane are calculated using the formulas given in [1], for the resonant frequency of 14GHz. The radius of the monopole to 2.3mm and length and width of ground plane is 20mm and 20mm respectively. Rectangular slot etched on the ground plane. This slot relocates the frequency to lower frequency.

III. Simulated Results

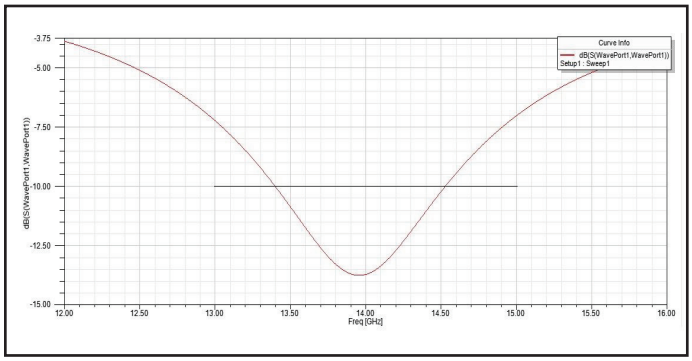


Fig. 2: Simulated Return Loss Versus Frequency of a CPMA

Simulated s11 can be seen from fig. 2 refection co-efficient is very less at resonance return loss of the antenna is less than 10dB from 13.4GHz to 14.53GHz which is 1130MHz.

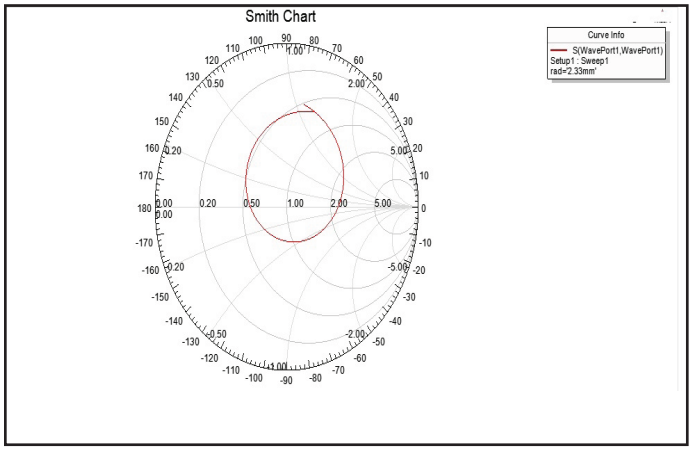
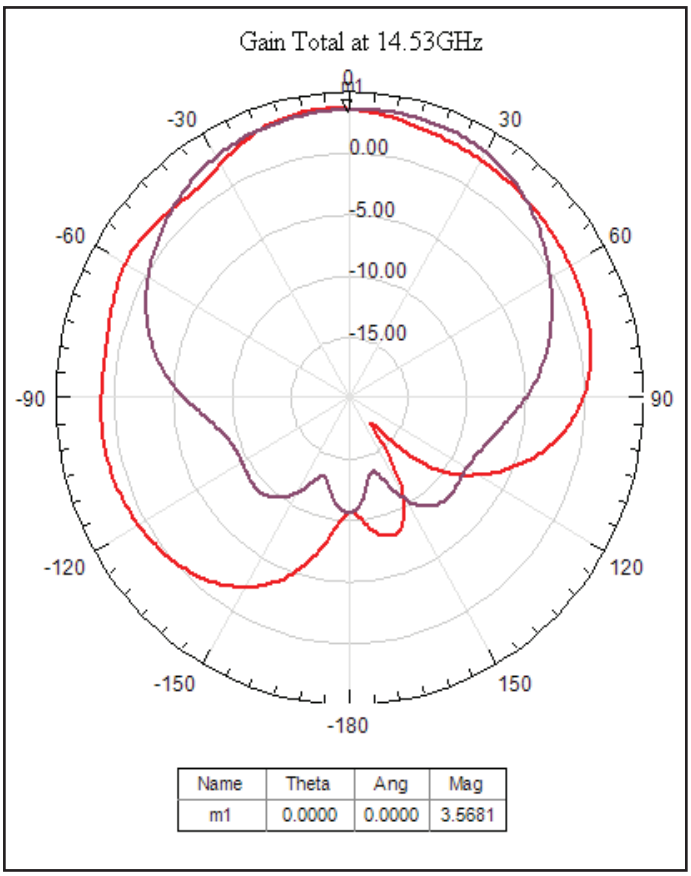


Fig. 3: Impedance Match

Impedance match of this antenna can be seen in fig.3, this clearly illustrating that the frequency of the interest is very near to point 1. Which is due to the DGS the impedance matching increased, this reduces the loss.

The radiation pattern of the proposed antenna showing the Gain total at different frequencies is shown in fig.4. Gain total at 14GHz is 3dBi, and the gain total at 14.53GHz is 3.5dBi.



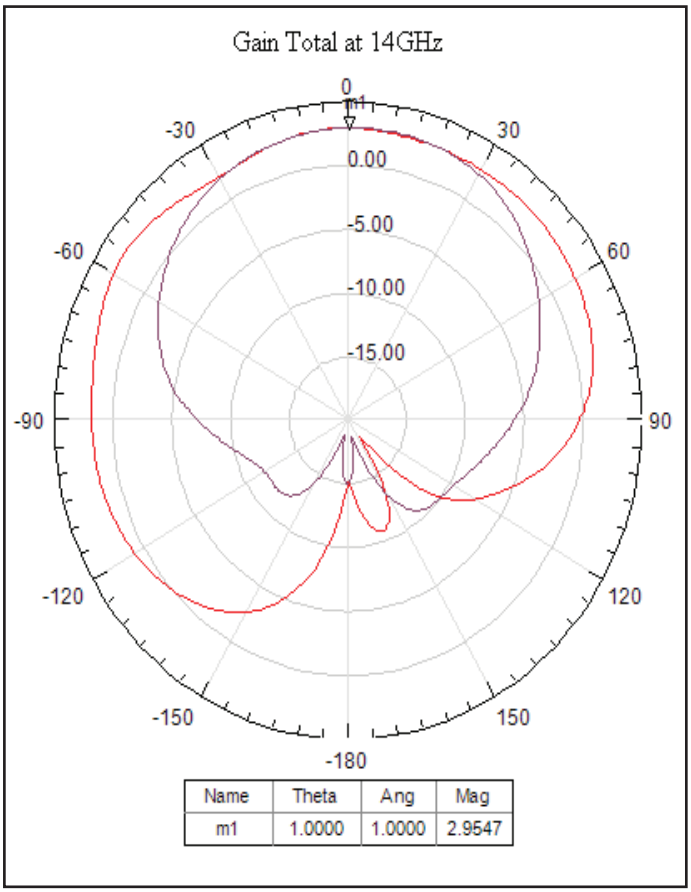


Fig. 4: Gain total at 14GHz and 14.53GHz

The important property of any antenna is VSWR in our proposed antenna we have achieved VSWR < 2 over the operating frequency. This can be seen in fig. 5

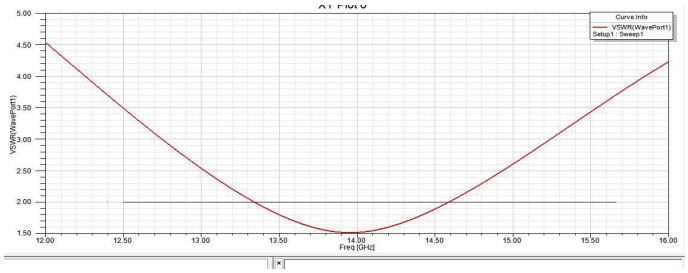


Fig. 5: VSWR of Proposed Antenna

IV. Conclusion

In this design we used effectively designed the Circular Printed monopole and used DGS technique to improve the bandwidth and reduce s11. It has bandwidth of 1130MHz, average gain of 3dBi.

V. Acknowledgement

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