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ANNULAR RING STACKED MICROSTRIP PACTH ANTENNA FOR S - BAND APPLICATION

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ABSTRACT

This paper presents designing and study of an annular ring shaped Microstrip patch antenna which is further fabricated with stacking technique. We proposed it for S band frequency of 2-4 GHz. The DGS (Defective Ground Structure) implies a defective ground structure in place of a simple conventional ground structure. The developed design is succeed to achieve a low profile return loss. We simulate the prototype on HFSS with FR4 Epoxy material and fabricated also with FR4 epoxy with stacking. The proposed antenna achieved the bandwidth of 165 MHz

Index Terms – Microstrip Patch antenna, Annular ring patch, DGS, Stacking, Return loss.

I INTRODUCTION

The simple design structures with variety of new techniques are growing day by day as the need and requirement of new purposes also introducing every day. The designing of Microstrip patch antenna is the field which is regular improvising itself with new techniques and methods. The S band frequency region is basically uses for various navigational and surveillance satellites. Now the designing of such antenna generally consist some complex designing techniques and sometimes some complex designs too. In the discovery of simple designing and simple fabrication method, here, in this paper we introduce an annular ring patch antenna with DGS (defected ground substrate) technique. At the start simulation was done on 5 mm thick substrate of FR4 epoxy but as this thickness material is not available generally, we again design it on 4.8 mm thickness and we fabricate this by stacking technique. Reference [1] proposed a reconfigurable antenna by using an active EBG structure. The EBG structures have great properties like, surface wave suppression in frequency band and zero phase reflection coefficient for certain waves. The varactor diodes in EBG also used to achieve dynamic flexibility. As the capacitance of varactor diode changes with the bias voltage the working frequency of the EBG can be electrically tuned [1].

This is the one way to achieve improved parameters by using external electronics devices or amplifiers. The other way is to improve the patch geometry and ground structures for getting the better improved parameters. This method is called the optimization analysis. Now when we talk about the patch geometries, there are various patch geometries

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are available like, rectangular patch, circular patch, triangular patch, elliptical patch, polygonal patch, annular patch, etc. In all above geometries, the annular ring patch geometry, we found very suitable for these applications. The annular patch gives a very low profile return loss and easy to fabricate. FR4 epoxy is easily available material for fabrication.

II ANTENNA DESIGN

The proposed antenna is designed on annular ring patch with DGS (defected ground structure). The thickness of the prototype is 4.89 mm. Initially it was designed for 5 mm, but FR4 epoxy is not available in 5 mm thickness. The rest antenna parameters are given as follow –

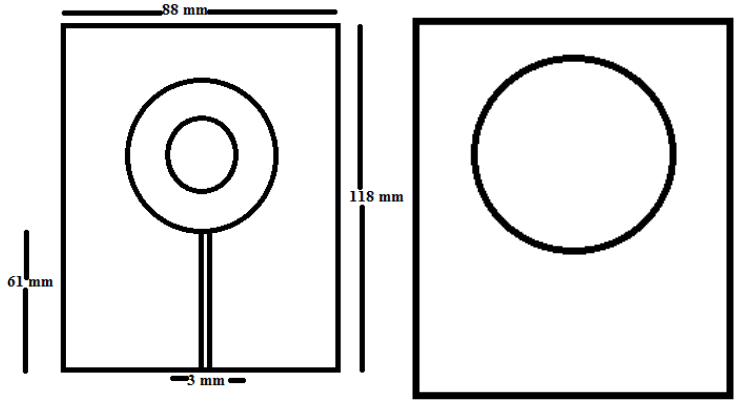

Fig. 1 – Patch and ground geometries

Length of patch = 118 mm	radius of outer circle = 25 mm
Width of patch = 88 mm	radius of inner circle = 12 mm
Length of feeding = 61 mm	radius of DGS circle = 30 mm
Width of feeding = 3 mm	width of the substrate = 4.8 mm

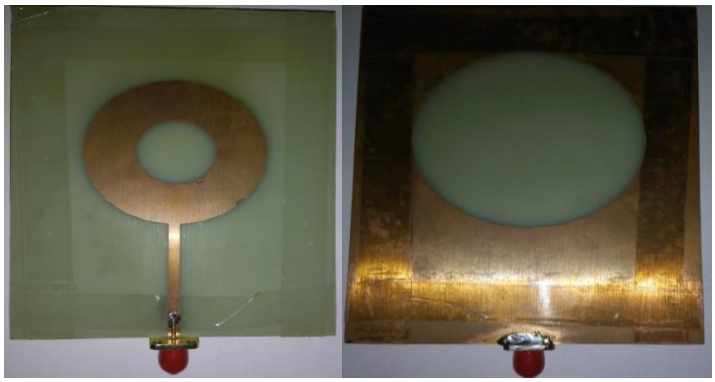

Fig.2 – Proposed Prototype design

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The fabrication was done on FR4 epoxy sheets. The three 1.6 mm sheets are stacked to meet the desire design. The stacking is done to increase the height of the antenna.

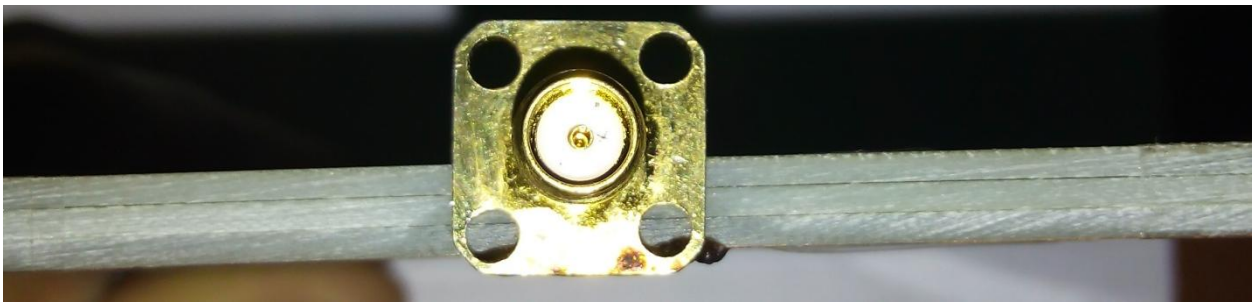

Fig. 3 – side view of the antenna

The side view of the antenna shows the three substrate of FR4 epoxy stacked together and a male SMA connecter connected for feeding purpose. The three substrates can be seen in the figure easily.

III RESULTS AND MEASUREMENT

The simulation results of the proposed prototype antenna are as follow-

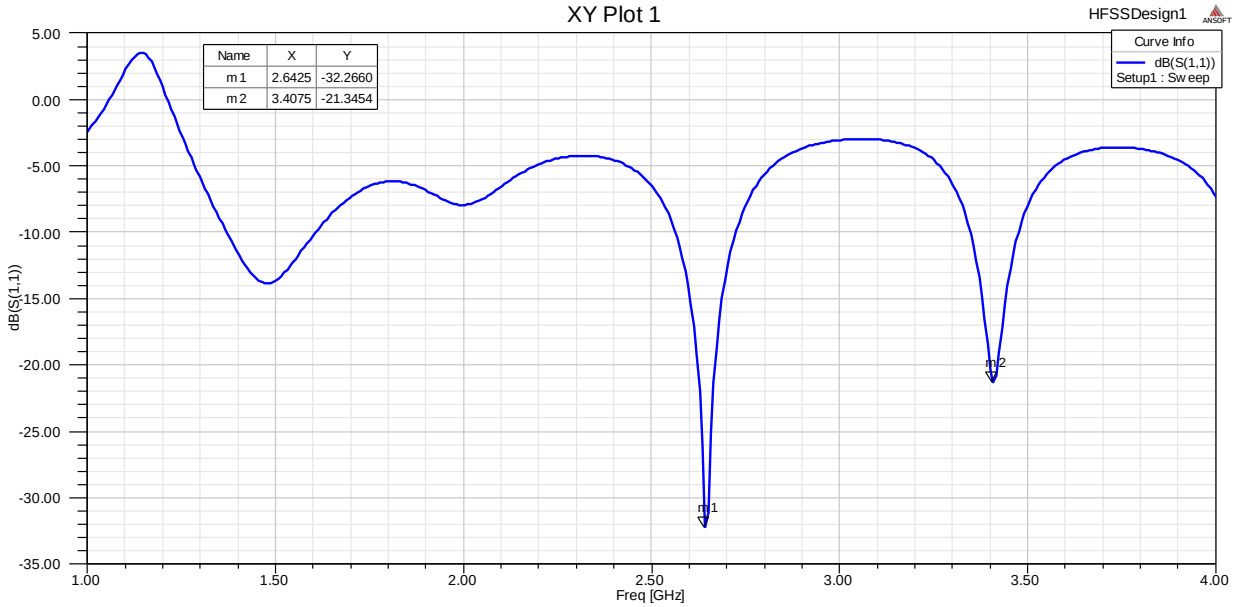

Fig. 4 – S11 Parameters Simulated

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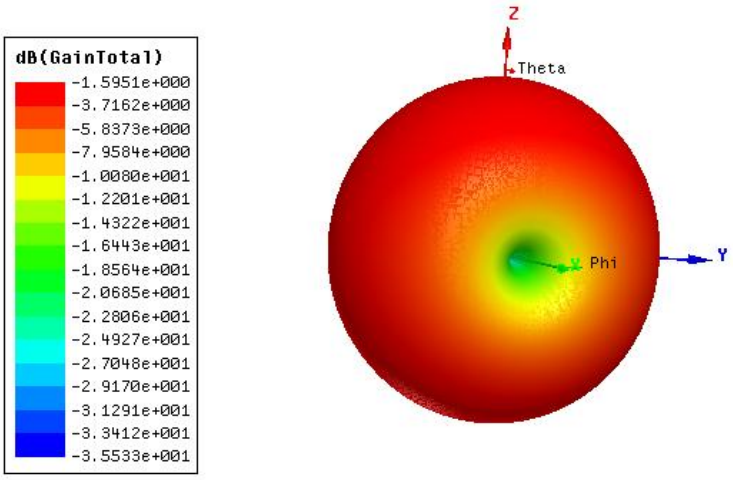

Fig.5 – 3D Gain plot

The simulated S parameters show that the proposed prototype has a very low profile return loss as -32 db at 2.6 GHz and uniform equal gain. The result is simulated on Ansoft HFSS. The driven modal is used to measure the electrical performance of the proposed antenna such as impedance bandwidth, return loss, gain, and directivity. It is noticed during the simulation that the gap between ground plane and patch is responsible for the multiband.The curve of the simulated VSWR for proposed ring shaped antenna with variation in feed and inner circle geometry is depicted in Figure 6.

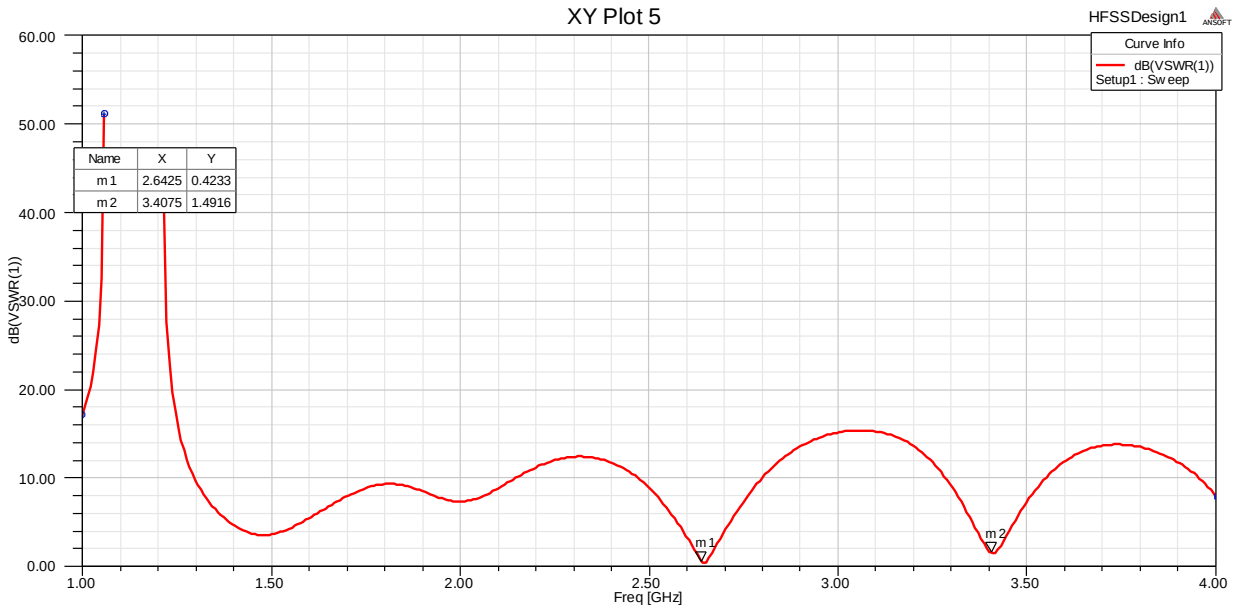

Fig. 6 – VSWR Simulated

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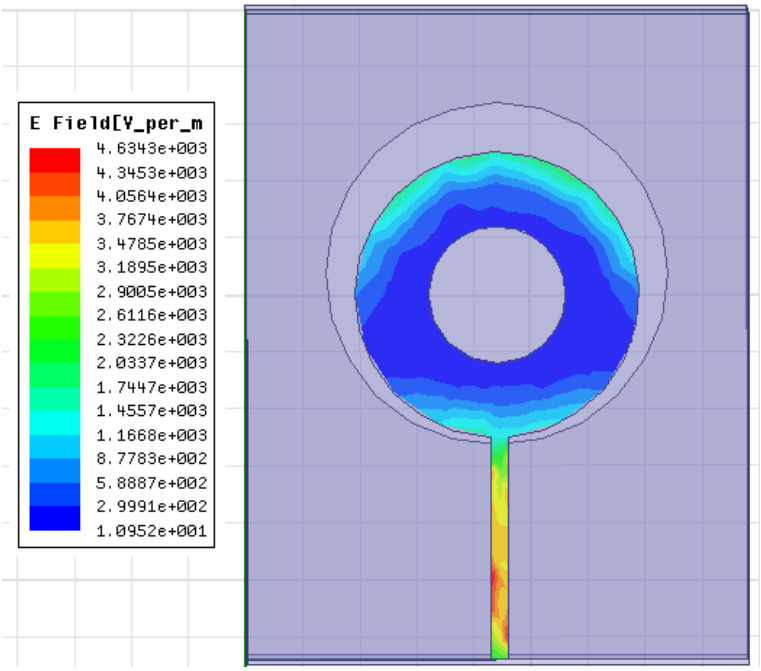

Fig.7 – Mag E surf

As shown in fig-7, the current is mainly distributed along the edge of the feed of the ring shape antenna. This is reason why the first resonant frequency is associate with the diameter of the circular disc. The ground plane, the current is mainly distributed on the upper edges along the x- axis direction, that explain the performance of antenna which is critically dependent on gap between ground plane and circular patch.

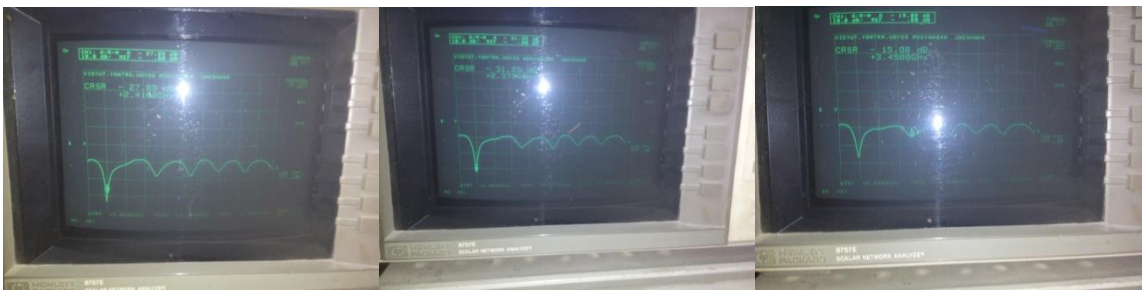

Fig.8 – Measured S11 Parameters

There are slightly difference between simulated and measured results due to various losses like coupling losses, plumbing losses, connector losses and fabrication losses. We also stacked the three layers which also a minor

reason of this. Over all the design fabricated successfully and all parameters are calibrated successfully.

IV CONCLUSION

The circular ring type multi band antenna is proposed. The measured result of the fabricated antenna show stable radiation pattern over the entire bandwidth. The good impedance matching characteristics, constant gain is obtained. The disadvantage of this antenna is that the band which is obtained is very sharp. So for the future perspective it should be further modified by variation in geometry. The stacking was done to achieve the desire thickness of the substrate because 5 mm FR4 epoxy substrate is very rare. The simulations were also done on the Rogers Rt duroid, but FR4 has better cost value and properties over other materials. The size of the antenna also is a future aspect which should be reduced for the further applications.

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