Impact Factor (SJIF): 3.632

International Journal of Advance Research in Engineering, Science & Technology

e-ISSN: 2393-9877, p-ISSN: 2394-2444

(Special Issue for ITECE 2016)

Bandwidth Enhancement OfRectangular Microstrip Patch Antenna For WLAN Application Using DGS.

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Abstract— *Defected Ground Structure (DGS) helps in improving the characteristics of many microwave devices. The ground plane of the antenna is etched to change the various properties of the structure. The DGS on the ground plane increases the fringing fields which introduces parasitic capacitance. This introduced parasitic capacitance increase the coupling between the ground plane and the patch, as a result we get enhanced bandwidth. Hence the DGS can be assumed to be an equivalent LC resonator circuit. The position and size of the defect determines the value of LC at a given frequency. The design is suitable for WLAN 3.6/4.9 Ghz and WLAN 5-5.25 Ghz frequency. The simulation is carried out using HFSS simulator.*

Key Words*—Transmission line model, Defected Ground Structure (DGS), Rectangular Microstrip patch antenna.*

I. INTRODUCTION

Micro strip patch antenna has become very popular as the use of microwave frequency increased[5]. Also micro strip patch has the advantage of low profile and low cost, light weight and small size, planar geometry and many more[1]. It also suffers from a disadvantage of narrow impedance bandwidth. With the advancement in telecommunication, now a days the need of higher bandwidth is a must. Technology today demands that a single antenna may be used for different applications and for more than one allotted frequency band.

Here we demonstrate a design that uses one of the simplest geometry, and a comparatively simple feeding technique. The antenna presented here uses coaxial feed technique. This technique when used alone is not good for its bandwidth but it can give good impedance matching.

But by introducing defected ground structure, we here demonstrate the enhanced impedance bandwidth with satisfactory other parameters for a frequency range of nearly 2.7 Ghz. The VSWR is also plotted and is fairly enhanced for a wideband antenna. A VSWR of less than 2 is obtained for entire frequency range. Return loss of less than 10db is obtained for desired frequency range.

II. ANTENNA DESIGN

The dimension of the antenna can be estimated by the transmission line model. Analysis on the basis of transmission line model was selected because it is the simplest of all models in the matter of complexity of analysis. The model no longer gives the exact dimensions after introducing the defects in the ground. But with some trials we get a design that is even smaller and more effective than the calculated design.

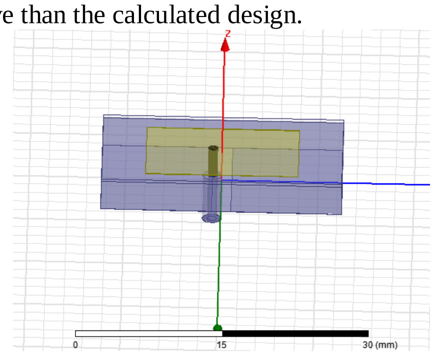

Figure1. Micro strip patch with DGS.

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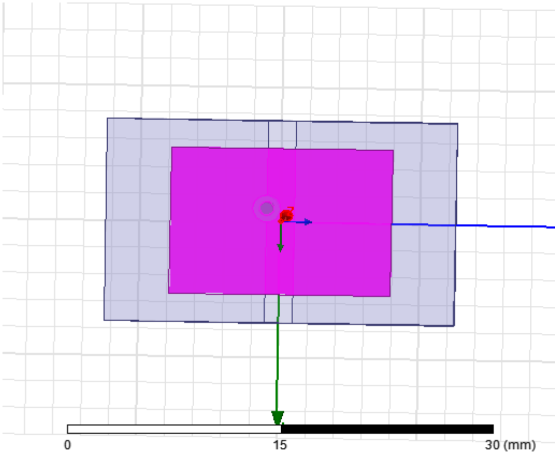

Figure 2(a). Patch in the proposed design.

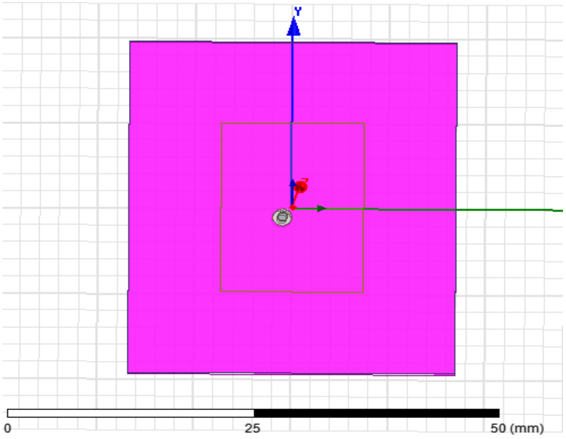

Figure2(b). Ground in the design. (without defect).

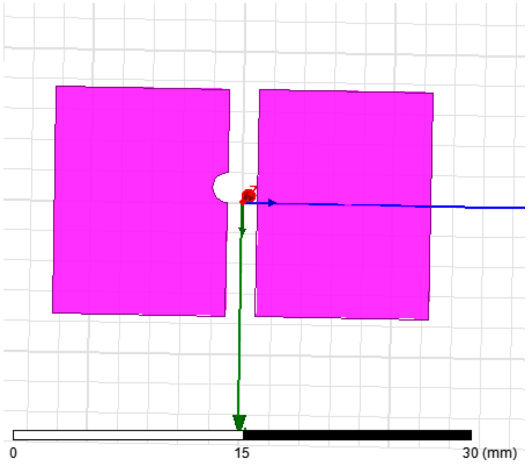

Figure 2(c). Highlighted defected ground.

Figure 1 shows the design that was simulated in HFSS. The defected ground can be seen in the design.
In the figure 2(a), the dimension of the patch is 10.834mm×15.8mm. Here we select a cheap and easily available substrate, FR4 epoxy. Selecting this substrate makes it easier to fabricate the proposed design. The dimension of the substrate is 15mm×25mm.The length and width of the ground is same as that of the substrate. It can be seen in figure 2(b). Now a

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rectangular strip of dimension 2mm×15mm is etched from the center of the patch. It can be seen in figure 2(c). The position of the feed is varied initially to get the optimum point, but now it is fixed.

III. RESULTS & DISCUSSION

As we can see the return loss graph in figure 3(a), it is clear that the effective bandwidth that we calculate below -10db is from 2.6 to 5.31 Ghz.

This range of frequency covers many allotted bands in WLAN applications. After the design is fixed, we move our feed location in the plane and find an optimized feed location that matches the feed impedance.

By trial and error method here we obtain a feed location and set our feed point. At this point we get the maximum performance.

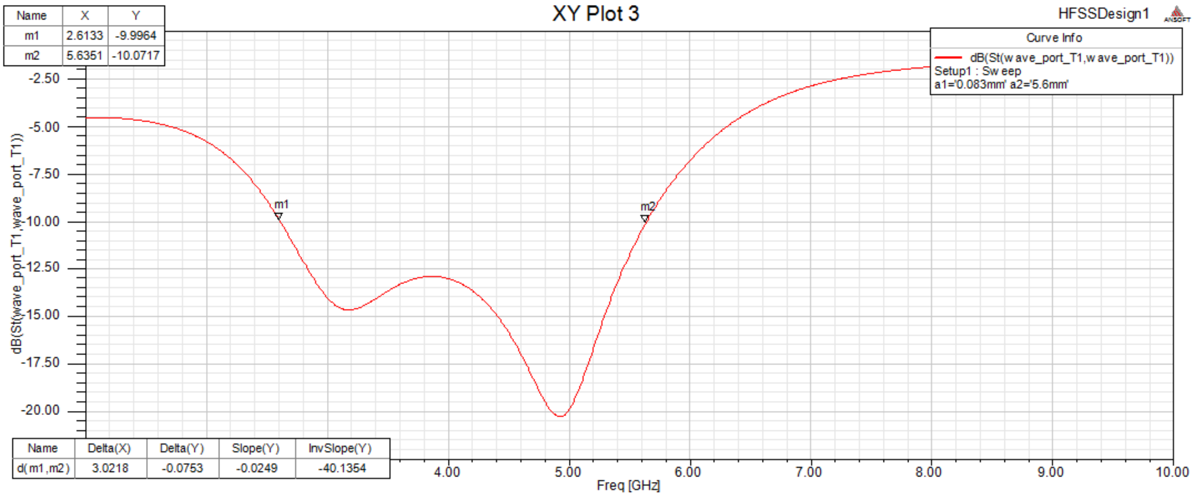

Figure 3(a). Return Loss

Figure 3(b) shows the plot of VSWR v/s frequency. A VSWR below 2 is acceptable. It is clear that we get desired values of VSWR between 2.6-5.65 Ghz.

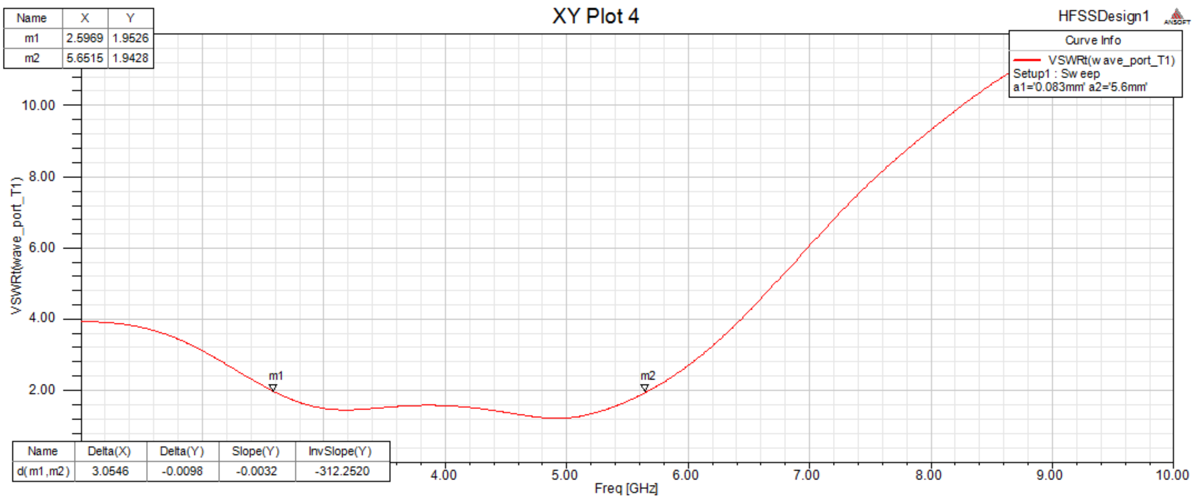

Figure 3(b). VSWR

IV. CONCLUSION

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Advantage of using defected ground structure is shown in this paper. Wide band characteristics are demonstrated by inherently narrowband antenna by using DGS. Other shapes of defect can also give good results.

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