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Design and analysis of Microstrip Patch antenna on 1.7Ghz, 2.4Ghz and 5.8Ghz

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Abstract: In this paper the design of micro strip patch antenna named as slotted patch- defected ground structure is presented in which slots are made and this antenna is designed for operating frequency of 5.8GHz, having applications lies in the ultra high frequency range and the substrate used in the design is Rogers RT/Duroid 6006 with the dielectric constant value of 6.15, the results such as VSWR, Return loss, and Radiation Pattern are simulated and verified on the antenna designing software HFSS (high frequency Structure Simulator), also compared with 2.4Ghz and 1.7GHz Antenna designs.

Keywords: Antenna, HFSS, Return Loss, VSWR, Radiation Pattern

1. INTRODUCTION

Microstrip antennas are important because of their light weight, likeness and minimal effort. These antennas can be coordinated with printed strip-line bolster systems and dynamic gadgets. This is a moderately new zone of antenna building. The radiation properties of smaller scale strip structures have been known since the mid 1950's. The use of this sort of antennas began in mid 1970's when conformal antennas were required for rockets. Rectangular and round small scale strip thunderous patches have been utilized broadly in an assortment of cluster designs.[1][2] A noteworthy contributing variable for late advances of microstrip antennas is the present unrest in electronic circuit scaling down achieved by improvements in vast scale coordination. As customary antennas are frequently massive and expensive piece of an electronic framework, smaller scale strip antennas in light of photolithographic innovation are viewed as a building achievement. [3][4]

In its most basic frame, a Microstrip Patch antenna comprises of a transmitting patch on one side of a dielectric substrate which has a ground plane on the opposite side as appeared in Figure 1. [5]The fix is for the most part made of directing material, for example, copper or gold and can take any conceivable shape. The transmitting patch and the bolster lines are typically photograph scratched on the dielectric substrate.[6]

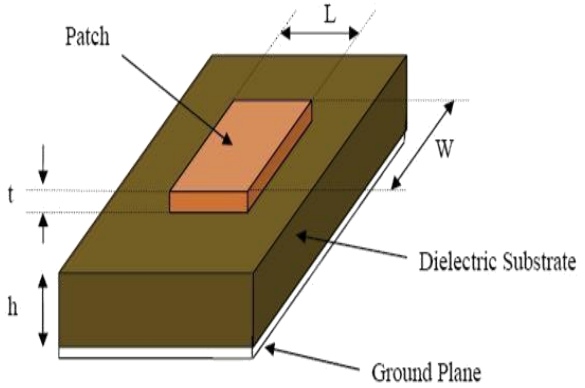

Figure 1Structure of a basic Microstrip Patch Antenna.

The main patent of a microstrip antenna configuration was granted to Gutton and Baissinot in France in 1955 [2]. In the mid 1970's the principal reasonable microstrip antennas were manufactured. [8][9]The mid 1980's was an essential period in productions, down to earth authenticity and assembling of the microstrip antennas. Exhibit day framework prerequisites, for example, minimized, light weight, low profile conformal antennas that can be specifically coordinated into an assortment of microwave circuits are a critical factor in the advancement of printed antennas. Their minimal effort and simplicity of creation on printed circuit board (PCB) make them more alluring than the generally utilized lumped component antennas. Microstrip antennas might be made of any geometrical shape and measurement. [7][16]

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2. PROPOSED DESIGNS IN HFSS

With the rapid growth of wireless communication, it has become important that the antenna which is used for transmitting and receiving signals should be compact in size so that it can be easily installed in portable devices. Microstrip patch antenna is one of the antennas which have various advantages such as small size, less weight, easy fabrication and installation etc. which makes it suitable to be used for wireless applications.[10][11] It consists of a substrate which is having a ground plane on its bottom side and a conducting patch on its top. The substrate is made up of dielectric material with particular permittivity and the patch and ground should be of perfect electric conductor (PEC) material.[12][15] The patch can take any shape such as rectangular, circular, elliptical, ring etc. The main drawback of microstrip patch antenna is that it has narrow bandwidth and low efficiency. A step slotted patch has been used with reduced ground plane having defect on it. With the use of step slotted patch, the size of the antenna has been reduced and bandwidth has been also sufficiently improved. It has been also analyzed that the defected reduced ground plane provides better results in terms of bandwidth enhancement than full ground plane structure

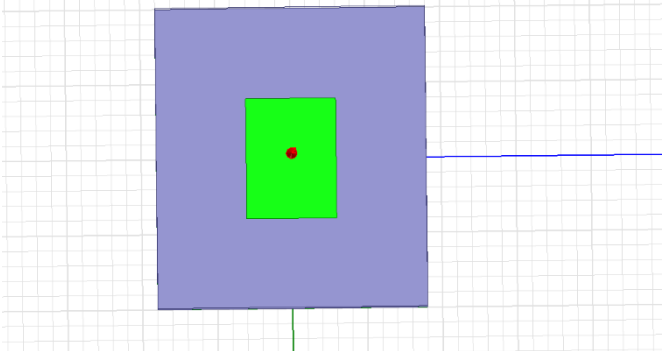

Figure2 Micro strip patch antenna Design for 2.4Ghz

Since there are numerous developments have been done in the field of micro strip patch antenna designing from basic rectangular patch to slotted micro strip patch and each design should be made by keeping mind that it should be light weight, less fragile, compact and application oriented that fulfil the requirement.[14] And the proposed design is totally fruitful to accomplish the required application of WLAN at the frequency of 5.7 GHz. And for the purpose is follows as in this way. Figure 4 and 3 shows the proposed antenna design. A microstrip patch antenna consists of a conducting ground plane(here copper is used), a dielectric substrate (Rogers RT/duroid, εr=6.15), and a patch of same conducting material. The patch is etched using printed circuit technique. The geometry of the antenna is calculated using the standard formulae and taking operating frequency as 5.7 GHz.

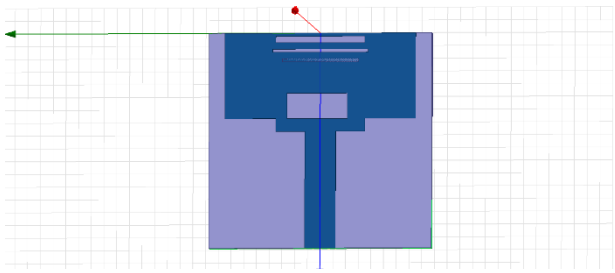

Figure 3 Slotted patch design in HFSS

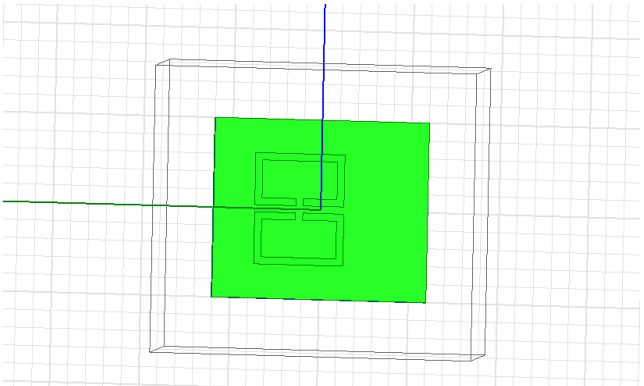

Figure 4 Defected ground view in HFSS

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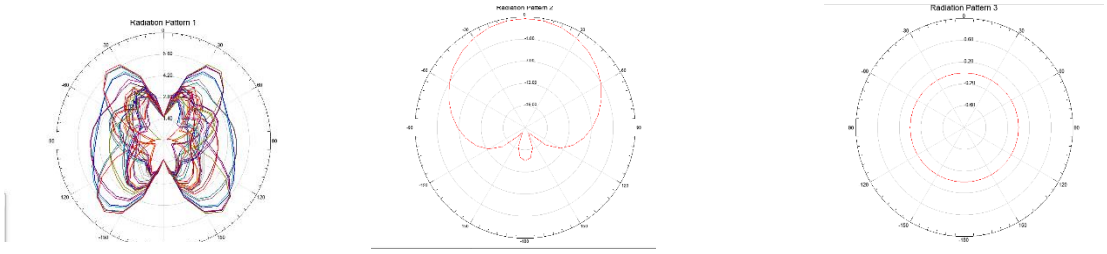
RESULTS

In this sections results of all three antenna are given on the basis of Radiation pattern, VSWR and Return Loss. Figure 4 shows all antenna radiation pattern

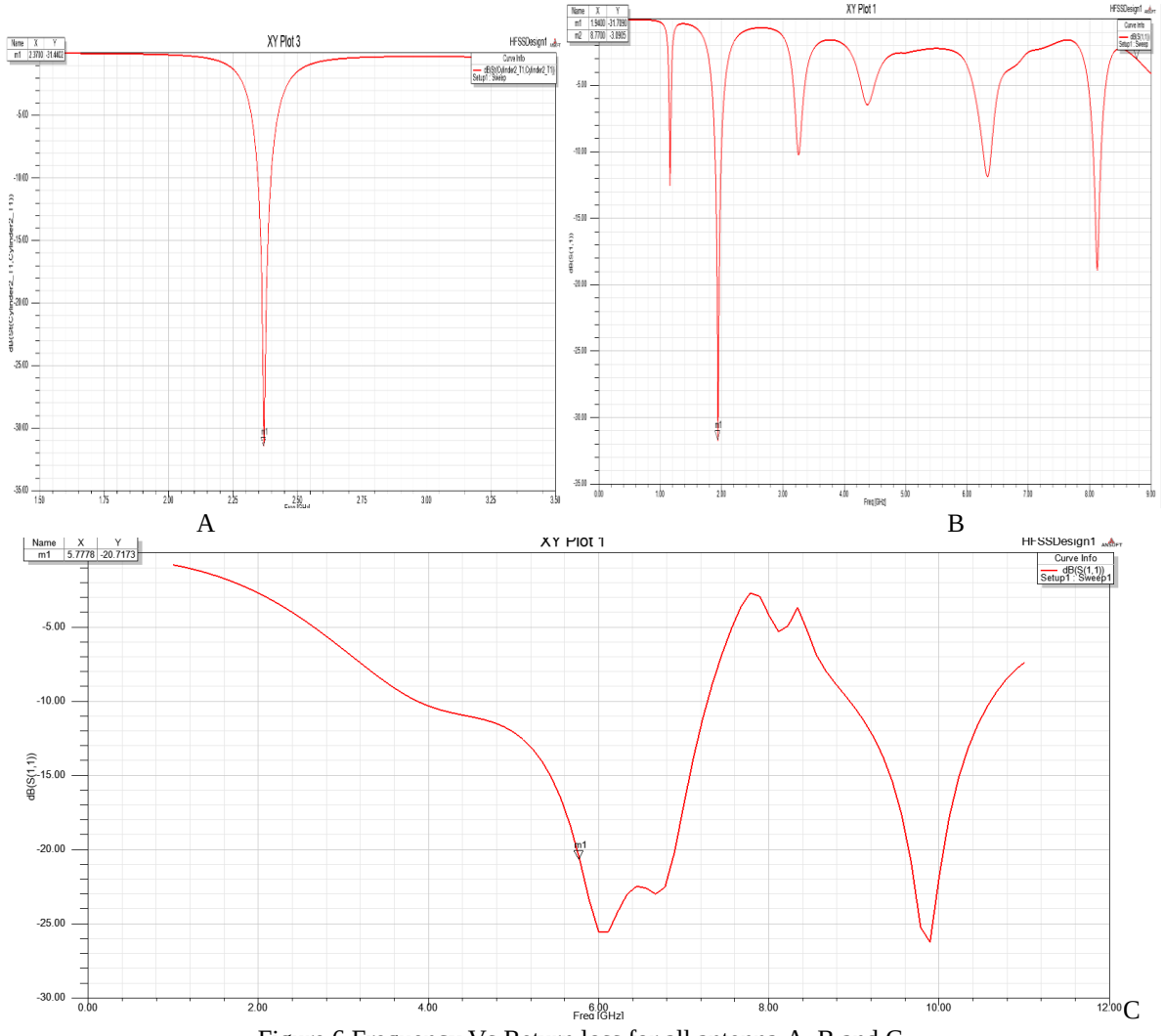


A **B** **C**

Figure 5 A.Radiation Pattern for 2.4Ghz(Polar plot) B.Radiation Pattern for 5.7Ghz(Polar plot) C.Radiation Pattern for 1.9Ghz(Polar plot)

Return Loss:

In telecommunications, return loss is the loss of power in the signalreturned/reflected by a discontinuity in a transmission line or optical fiber. This discontinuity can be a mismatch with the terminating load or with a device inserted in the line. It is usually expressed as a ratio in decibels (dB).And the return loss in the proposed antenna is below -10dB i.e. -14.431 dB for the operating frequency of 1.6 GHz. (Fig 6)



A B C

Figure 6 Frequency Vs Return loss for all antenna A, B and C

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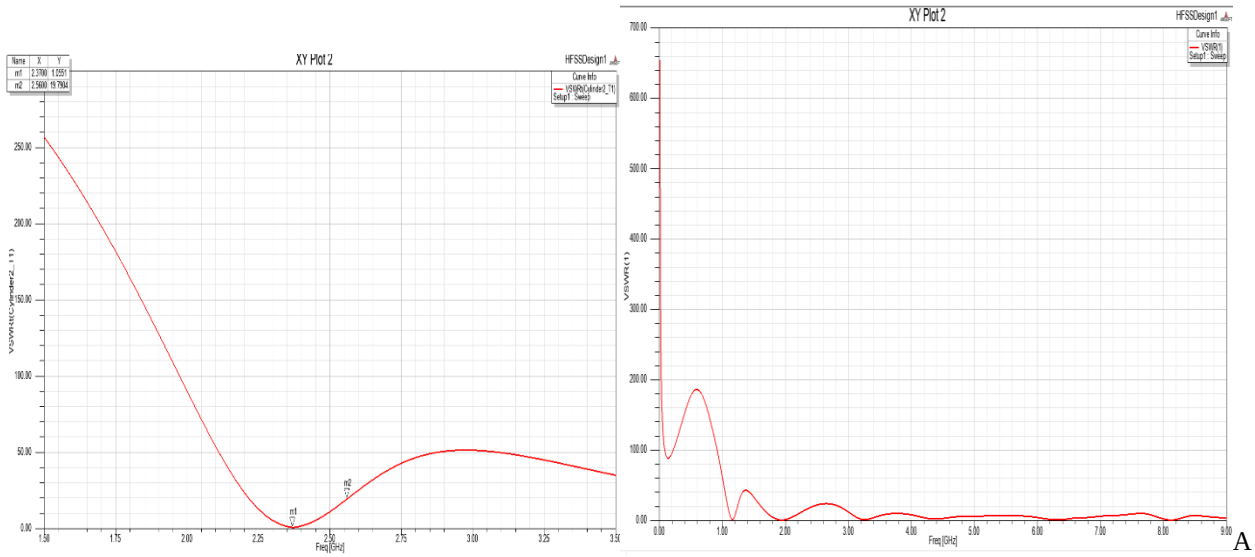
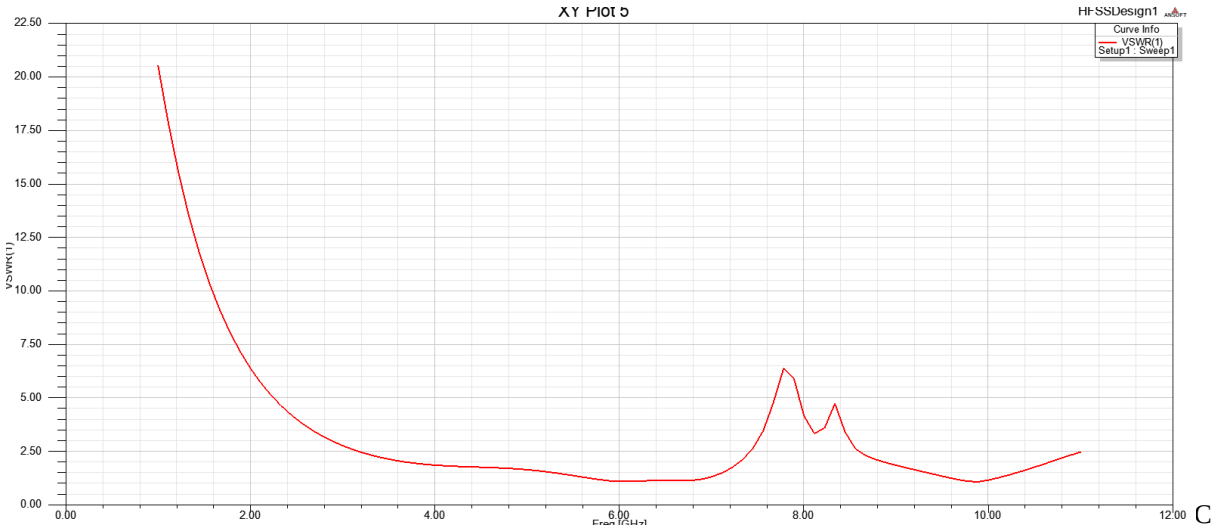
VSWR Results



A

B



C

Figure 7 VSWR for all antenna A, B and C

3. CONCLUSION

In this report the design of micro strip patch antenna named as slotted patch- defected ground structure is presented in which two slots are made with dimension of 4X4 and 16X4 respectively and this antenna is designed for operating frequency of 5.7GHz, having applications lies in the ultra-high frequency range and the substrate used in the design is Rogers RT/Duroid 6006 with the dielectric constant value of 6.15, the results such as VSWR, Return loss, Impendence, Radiation Pattern and efficiency are simulated and verified on the antenna designing software HFSS (high frequency Structure Simulator).

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