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Design Of T Cut Microstrip Antenna With Defected Ground Structure For Wlan Applications

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Abstract: *In this wireless communication era, Antenna plays a vital role for reliable communication. The antenna which satisfies the design constraints and fulfills most of the requirements of wireless communication is microstrip antenna. The low power handling capability and easy fabrication of microstrip antenna helps to achieve compactness and reliability of the system. In specific, antennas for WLAN are a challenging one when designed with high frequency. The antenna proposed in here consists of a defected ground structure in the form of Meander in the ground plane and patch with a slot on the other side. The frequency of the proposed antenna is 4.9 GHz.The dielectric substrate used is FR4 with dielectric constant 4.4 and loss tangent 0.02.The proposed antenna is designed with return loss of -38.88 db, VSWR of 1.02 .The antenna parameters are analyzed by Antenna Design Software CST microwave studio.*

Keywords: *Defected Ground Structure DGS, Meander, WLAN, CST, Micro strip Antenna, IEEE802.11*

I. Introduction

WLAN is most commonly used wireless distribution standard for short distance network communication. A micro strip patch antenna consists of dielectric and ground plane. Micro strip patch antennas have numerous advantages such as Low profile, Low cost, ease fabrication and simple to design. The micro strip antenna is very unique because these antennas are easily printable one on a substrate. Feeding techniques of micro strip antenna are Microstripline feed ,coaxial feed, Aperture coupled and proximity coupled feed .The coaxial feed is used in the design is a contacting type has direct contact with the radiating patch. The impedance can be matched easily and surface wave radiations are less by coaxial feed. The coaxial feed may also have some disadvantages like narrow bandwidth ,inductive impedances, impedance matching problems it is chosen because of its simplicity compared to other feeds.

Under IEEE802.11 WLAN frequencies are 2.4 GHz, 3.6 GHz, 4.9 GHz, 5 GHz, and 5.9 GHz. This paper presents a novel design of a patch antenna for WLAN applications The antenna performance is analyzed by various parameters like VSWR, Return loss, Gain and Bandwidth. Many techniques are there to improve the parameters of micro strip Antenna like frequency selective surfaces ,magnetic conductors, Electromagnetic Band gap Structures etc. Introducing a defect in the ground plane is said to be Defected ground structure. A defect or a number of continuous and discrete defects constitutes a DGS. . Each DGS shape has unique characteristics and makes effect on the accomplishment of the device with respect to its shape and size. DGS is mainly used to miniaturization of antenna, without compromising bandwidth. gain , to avoid unwanted cross- Defected Ground Structure is approached in this proposed antenna to improve various parameters like Gain, bandwidth cross polarization, harmonic suppression and size reduction of micro strip antenna.. Meander line DGS is approached in this proposed antenna.The proposed antenna is also applicable for fixed link assisgnments ,fixed satellite services at UK broadband range ,4G mobile wireless systems etc .which resonates at 1.8 GHz, 4.2 GHz -5.5 GHz.In the meander DGS [1] with the dimensions of 1mm provides omni directional performance with reduced size and simple configuration .The antenna is very compact and provide optimum Bandwidth.A novel meander-slot Defected ground structure[2] is discussed in which high quality factor is obtained .The dimensions length and width of the meander slot is changed to get desired performance .Compared to other Defected ground structures Meander line DGS have good resonance This resonant characteristics is very much useful to determine the centre frequency for the WLAN application.In [3] and [4] the various feeding techniques and Antenna shapes are summarized .The rectangular patch is more conventional microstrip antenna and it is easy to design. The feeding techniques of contacting and non contacting methods are analyzed with the advantages and disadvantages.

A slot antenna has been investigated with reconfigurable meander slot [5].The wideband function is achieved through reconfigurable meander DGS integrated with the radiating patch. The side lobes are reduced

with good return loss.

The paper is organized as follows:
Section II describes the Proposed Antenna Design. Section III designates the antenna performance with meander DGS . Section IV endeavors the conclusion and future design considerations.

II. Proposed Antenna Design

In this section, the proposed antenna without T cut is analyzed .The meander DGS with single bend is analyzed with the help of CST. The performance metrics like VSWR, Return loss are measured .The parametric study is done for double bend DGS.The radiating patch is simulated using CST Microwave studio and the parameters are measured. The Antenna with T cut and antenna without T cut were designed and simulated . The DGS with the following dimensions is designed and DGS structure is also simulated and the results were measured.

A. Meander DGS

In the ground plane the defect is introduced in the form of meander in which the center frequency is not achieved unless the foremost and final cut of the defect covers the edge of the ground plane.This process leads to obtain the center frequency.

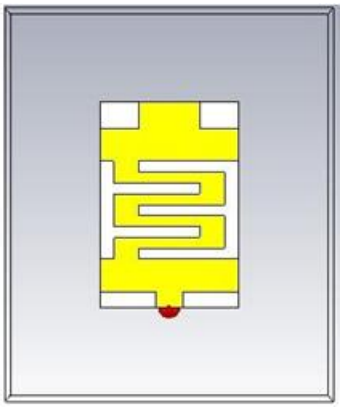


Fig1. Ground plane with DGS

The performance of DGS is analyzed for meander with single bend with the return loss of -32.529 dB as shown below.

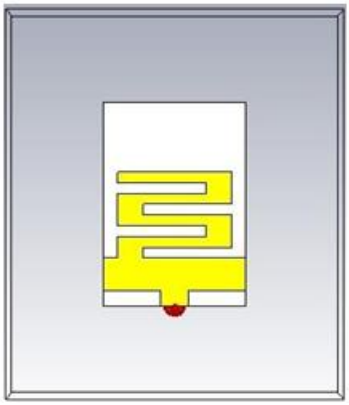


Fig2. Meander DGS with Double Bend

Dimensions of the DGS is as Follows:

The length is 38mm^2 And the width is 25 mm^2.The results were analyzed for DGS with single bend and Double Bend.The Centre frequency changes by adjusting the length of the DGS as well as changing the meander lines.The defect in the ground plane improves the gain, VSWR and Operating Frequency. The return loss is also less when changing the single bend into Double Bend.

B. Radiating Patch :

The radiating patch has the dimensions L=13mm, e=2.4mm, a=7mm, b=2.5 mm , h=0.6mm, c=9 mm, g= 8.5 mm, d= 12.18 mm, h= 2.5 mm and f = 10.6 mm.The antenna performance is analyzed with and without the T cut slot in the patch .The parameters of the antenna are also measured for both T cut patch and without T cut Patch.

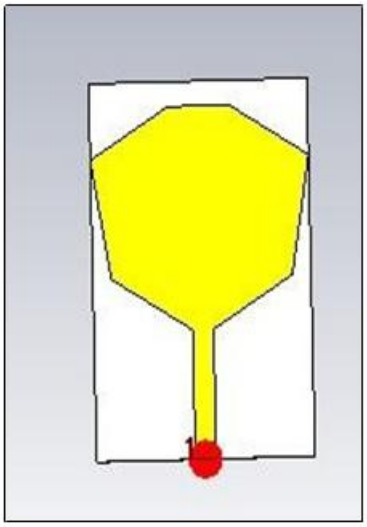
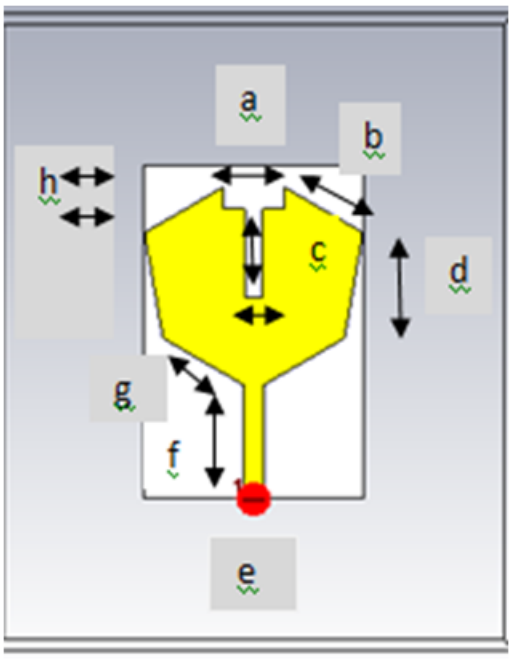


Fig3: Radiating Patch without T cut



Parameter	Specification
a	7 mm
b	2.5 mm
c	9 mm
d	12.18 mm
e	2.4 mm
f	10.6mm
g	8.5 mm
h	0.6 mm

Fig4: Radiating Patch with T cut

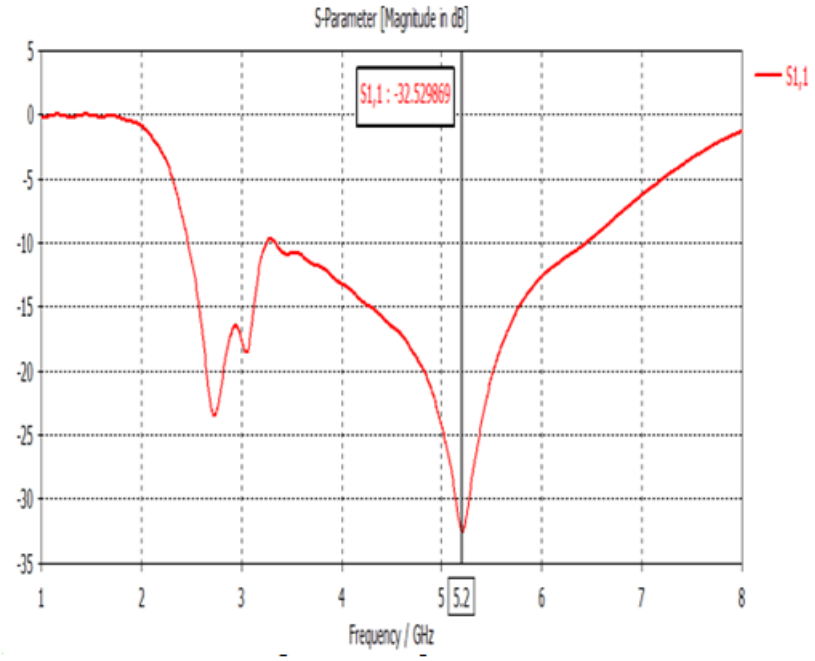


Fig5: S11 of Proposed Antenna

The return loss is measured with the centre frequency 4.9 GHz for T cut Micro strip Antenna. The The return loss is -38.88 db with the VSWR of 1.022 The return loss for without T cut is poor with the VSWR is 1.02.The VSWR should be less than 2 is achieved .The substrate FR4 with loss tangent of 0.02 and dielectric constant 4.4 is very easy to simulate and it is very cheaper. The coaxial feed can be fixed in desirable positions in order to get good performance and impedance matching between the patch and feed.

III. Simulated Results

The simulation is done using Antenna software CST microwave studio. The antenna parameters Return loss, Gain , Farfield pattern and Radiation pattern were observed ucing CST microwave studio. The simulated results are as follows:

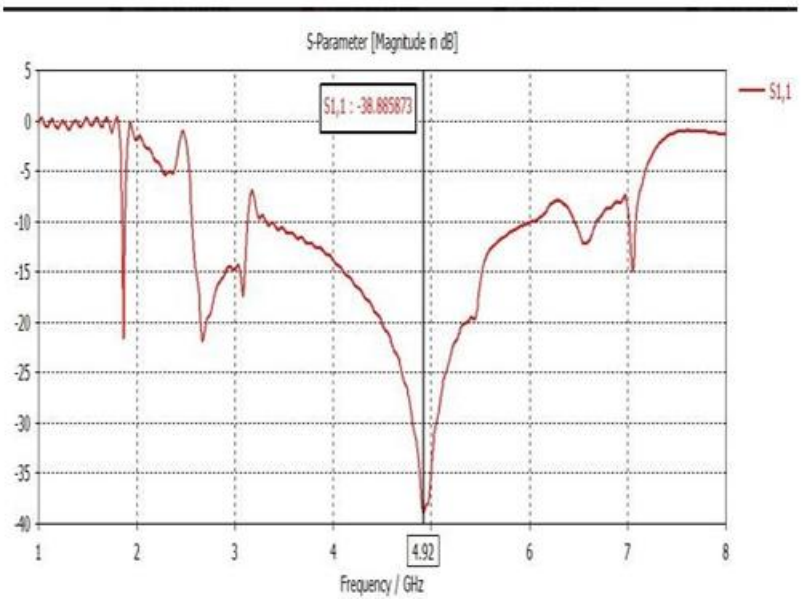


Fig:6 S11 at 4.9 GHz

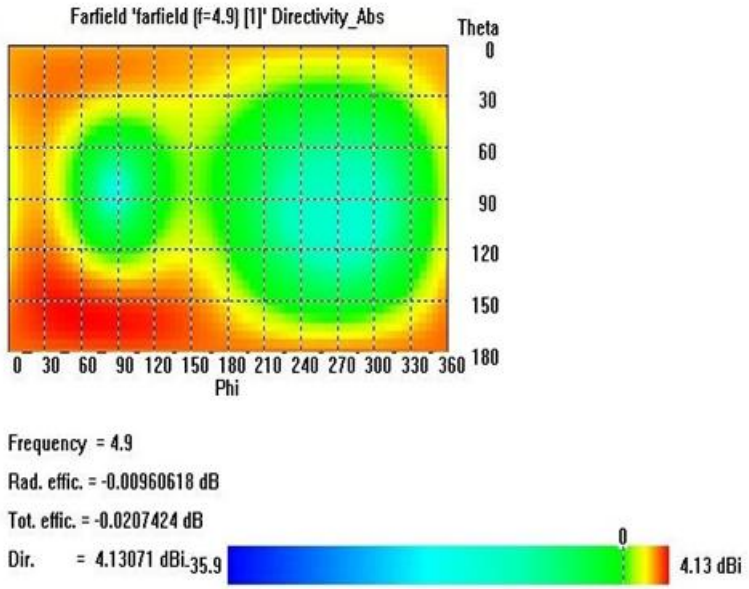


Fig 7: Far Field Pattern

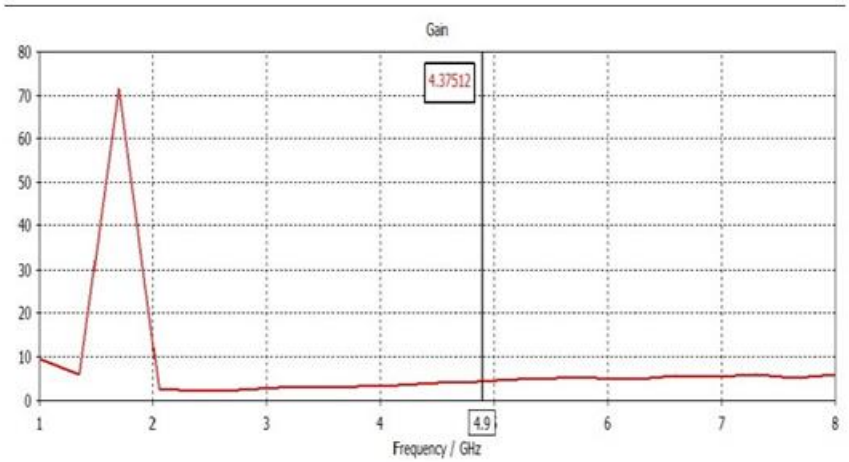


Fig 8: Gain Plot

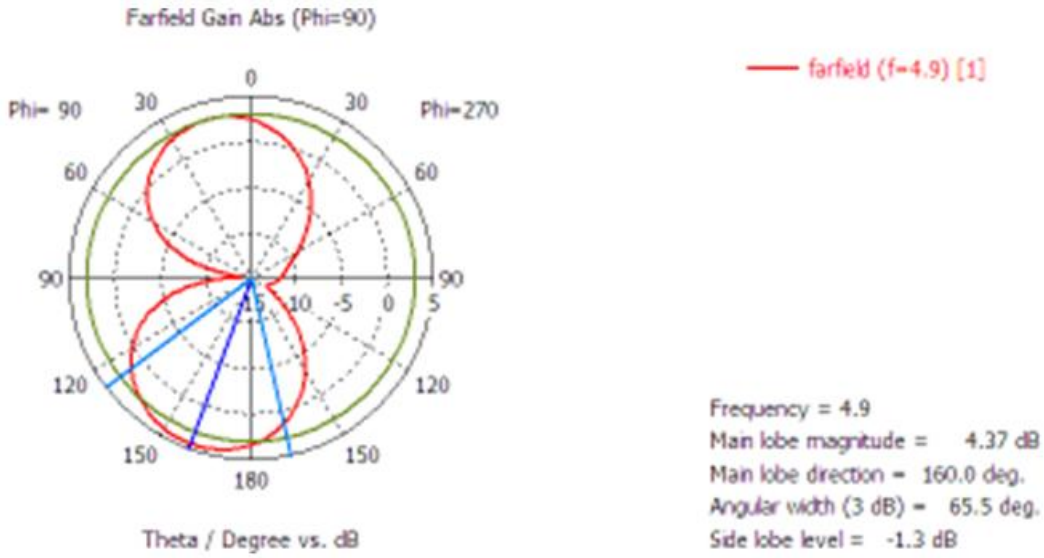


Fig 9: Radiation Pattern

Fig 10: Fabricated Front and Rear view of Antenna

IV. Conclusion

A simple micros trip antenna with DGS and T cut is designed and analyzed for various parameters. The performance parameters like reflection loss, VSWR , peak gain and radiation pattern were obtained and the results are simulated using CST. The antenna resonates at 4.9 GHz as intended and has satisfactory performance in terms of gain and low reflection loss. It can be observed that the return loss does not increases above-10dB clearly beyond the first resonant frequency of 4.9GHz and drop below-10dB at the second resonant frequency as ideally expected of an antenna operating precisely in the desired band.

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