



## **DESIGNING AND ANALYSIS OF RECTANGLE PATCH ANTENNA USING DGS & HFSS**

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### **Abstract:**

Narrow bandwidth, cross-polarization, and poor gain are three outstanding characteristics of microwave circuits that can be improved with DGS. DGS is used in microstrip antennas to increase gain and bandwidth as well as for mutual coupling between elements, higher mode harmonic suppression, and to enhance the properties of the microstrip antenna radiation. This research suggests a Rectangular Aperture Disc Integrated Monopole Antenna for a UWB Application. For the full Multiband and the aforementioned integrated lower frequency bands, the antenna also demonstrates reliable radiation patterns.

A transducer is simply what an antenna is. It changes an electrical current at a radio frequency (RF) into an electromagnetic wave at the same frequency.

It is affordable, extremely dependable, and just needs Low installation area is required, and the antenna's output provides good gain. Making use of HFSS software.

In this HFSS software, as well as a network analyzer, we may create this antenna and analyze the output characteristics.

### **I. INTRODUCTION:**

Conventional microstrip antennas had some drawbacks, including the fact that they only operate at a single operating frequency, have a narrow bandwidth of impedance, have low gain, are larger in size, and have polarization issues. A variety of methods, including stacking, various feeding strategies, frequency selective surfaces (FSS),



electromagnetic band gaps (EBG), photonic band gaps (PBG), metamaterial, and others, have been reported for improving the characteristics of traditional microstrip antennas.

Due to its straightforward structural design, the microwave component with Defected Ground Structure (DGS) has been more popular among all the ways documented for upgrading the parameters. Defected Ground Structure refers to etched slots or faults on the ground plane of microstrip circuits.

DGS may refer to a single defect or a collection of defects on the ground plane. DGS for filters below the microstrip line was first reported. Under the microstrip line, DGS has been employed to achieve band-stop properties, suppress higher mode harmonics, and reduce mutual coupling.

Since DGS was successfully used in the filter industry, it is now highly sought-after for a variety of applications. The application of DGS has improved the radiation characteristics of microstrip antennas by increasing their bandwidth and gain as well as by suppressing higher mode harmonics, mutual coupling between neighboring elements, and cross-polarization. Ultra-wideband (UWB)

antennas are employed in microwave medical imaging systems as well as for communication purposes. Due to this, antennas created for the frequency spectrum of UWB applications have been such as slot monopole antenna arrays, metamaterial antennas, flexible antennas, and printed monopole antennas are utilized for cellular applications and medical imaging.

utilizing a microstrip Due to its many benefits, including their compact size, low cost, and straightforward design, printed antennas are typically used for this kind of application.

## II. LITERATURE REVIEW

Due to its straightforward structural design, the microwave component with Defected Ground Structure (DGS) has been more popular among all the ways documented for upgrading the parameters. The term "Defected Ground Structure" refers to etched slots or other imperfections on the ground plane of microstrip circuits. DGS may refer to a single defect or a collection of defects on the ground plane. DGS for filters below the microstrip line was first reported. Under the microstrip line, DGS has been employed to achieve band-stop properties, suppress higher mode harmonics, and reduce mutual coupling.

### DISADVANTAGES:



- Low efficiency
- Low power
- Poor polarization purity

#### ADVANTAGES:

- Low cost
- Low size required
- High gain

Defected Ground Structure refers to slots or other flaws integrated on the ground plane of microwave planar circuits. Narrow bandwidth, cross polarization, low gain, and other characteristics of microwave circuits are all improved by using the new approach of DGS.

This project involves designing and simulating a compact microstrip feed circular monopole antenna with a C-shaped DGS that operates over the (2.5 GHz - 4GHz) and wideband (WB:4.9-19.93GHz) frequency ranges. A modified circular radiating monopole with destructive ground designs is used to operate at the WB frequency. Additionally, a dual frequency band is created by slotting the radiating

patch's middle and then etching a half-wavelength circular arc from the patch. the location where simulation results are shown.

### III. PROPOSED SYSTEM

The constraints of conventional microstrip antennas included a single operational frequency, a narrow bandwidth of impedance, low gain, a bigger size, and polarization.

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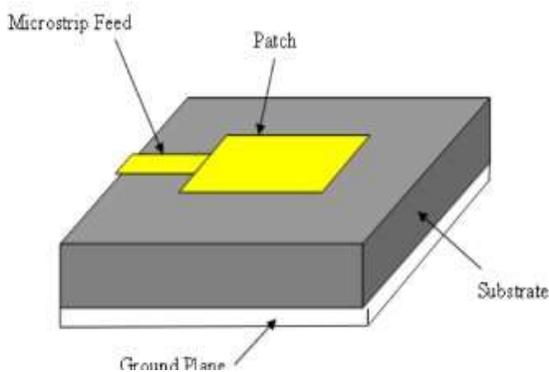
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#### System Architecture:



**Fig1.1 Rectangular Patch Antenna**

#### High Frequency Structure Simulator:

HFSS uses the well-known Microsoft Windows graphical user interface and is a high-performance electromagnetic (EM) field simulator for arbitrary 3D volumetric passive device modelling. It combines simulation, visualization, solid modeling, and automation in a user-friendly setting to produce quick and precise answers to 3-D EM challenges. In A soft HFSS, the Finite

FEM, adaptive meshing, and stunning graphics combine to provide you with

unmatched performance and insight into all 3-D EM challenges. To determine variables like S Parameters, Resonant Frequency, and Fields, a soft HFSS can be employed.

HFSS, or High Frequency Structure Simulator, is the name of the program. Tangential vector finite elements, adaptive meshing, and Adaptive Lanczos-Pade Sweep are a few of the technologies that A soft developed or implemented to pioneer. The use of the Finite Element Method (FEM) for EM modelling. (ALPS). With breakthroughs like Modes-to Nodes and Full Wave Spice, HFSS is still at the forefront of the industry today. An soft HFSS has developed over time with the help of several users and sectors. A soft HFSS is the industry standard for high-productivity research, development, and virtualization.

When designing high-speed components, such as on-chip embedded passives, IC packages, PCB interconnects, and high frequency components like antennas, RF/microwave components, and biomedical devices, engineers rely on the accuracy, capacity, and performance of HFSS. Engineers may create 3D electromagnetic fields (near- and far-field) and extract scattering matrix parameters (S, Y, and Z parameters) using HFSS.



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#### IV. RESULTS AND DISCUSSION

This project will be used to develop an antenna in software by this software we can fabricate a antenna model and develop the antenna and that

The only inputs needed are the geometry, the desired output, and a powerful, automated solution mechanism that underlies each HFSS solver. Then, utilizing the solution technology that has been chosen, HFSS will automatically build a mesh that is appropriate, effective, and accurate for solving the issue. With HFSS, the mesh is defined by the physics, not the other way around.

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antenna has high gain and the output was very efficiency and highly reliable and it doesn't require more space for installation it will be done in very low cost.

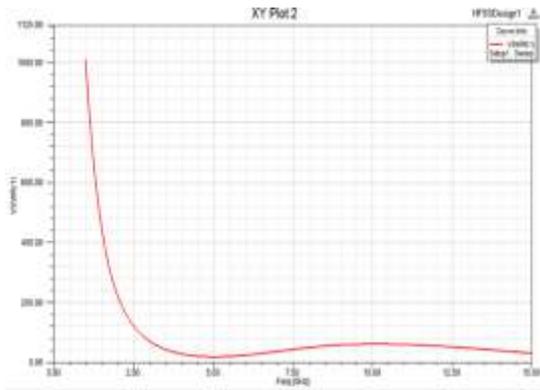


Fig 1.2: VSWR

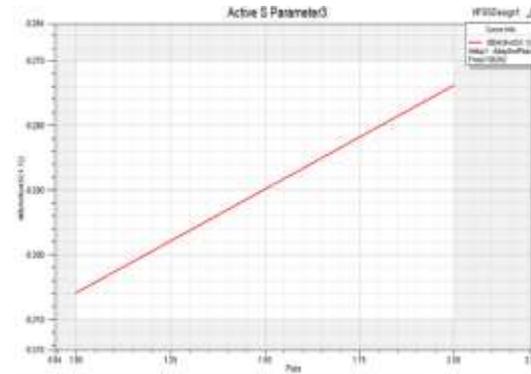


Fig 1.3: S-parameters

## V. CONCLUSION

Defected Ground Structure refers to slots or other flaws integrated on the ground plane of microwave planar circuits. Narrow bandwidth, cross This project involves designing and simulating a compact microstrip feed circular monopole antenna with a C-shaped DGS that operates over the (2.5 GHz - 4GHz) and wideband (WB:4.9-19.93GHz) frequency ranges. The results obtained demonstrate strong performances in terms of gain, size, gain patterns, and bandwidth. The antenna has a VSWR of less than 2, an S11 of less

than -10 db, and a frequency range of 4.5 GHz to over 12.5 GHz.

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