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Design of Microstrip Antenna for 5G Wireless Applications

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Abstract: Antennas are gaining popularity in a variety of fields, including cellular and satellite communications, radar systems, and wireless local area networks. The antenna is a spiral slotted antenna with a defected ground structure. The proposed antenna is made up of a spiral slotted radiating patch, which has a simple structure. For the resonant frequencies, excellent matching is achieved. The antenna's simulation and measurement characteristics are reported, and it is shown that frequency adjustment has little effect on the radiation patterns. CST Studio Suite is used to conduct the simulations.

***Index Terms* – Spiral slotted antenna, CST studio, Microstrip.**

I. INTRODUCTION

The data rate of 5G technology, which employs millimetre wireless, will be greater than 100Mbps at maximum mobility and greater than 1Gbps at low mobility. All types of sophisticated features will be included in 5G technology, making it the most powerful and in high demand in the near future. Such a large amount of technology has been crammed into such a compact device. Mobile phone users benefit from greater features and efficiency thanks to 5G technology. Microstrip antennas are made up of a patch, which is an extremely thin metallic strip or sheet that is placed above the ground plane and separated by a dielectric substrate. The height of the substrate and its dielectric constant affect the performance of microstrip antennas. Microstrip antennas provide good performance on thick substrates with low dielectric constant substrate materials. The impedance bandwidth is reduced for thin substrates, which is a key constraint of microstrip antennas. The antenna size for handheld devices and wireless communication, on the other hand, should be minimal, and the height of the substrate should be as low as possible. Due to its simple structural design, the microwave component with Defected Ground Structure (DGS) has acquired popularity among all the ways documented for boosting the parameters. Defected Ground Structure refers to etched slots or faults on the ground plane of microstrip circuits. DGS can refer to a single or numerous flaws on the ground plane. DGS was first documented for filters below the microstrip line. To achieve band-stop characteristics and decrease higher mode harmonics and mutual coupling, DGS was utilised beneath the microstrip line. Following its successful deployment in the field of filters, DGS is currently in high demand for a wide range of applications. Defected Ground Structure refers to the compact geometrical slots implanted on the ground plane of microwave circuits (DGS). DGS can contain a single defect (unit cell) or a collection of periodic and aperiodic defect patterns. As a result, DGS refers to periodic and/or aperiodic flaws etched on the ground plane of planar microwave circuits.

II. RELATED WORK

Because of its appealing properties, such as low profile and weight, low cost, and adaptable construction for activating wide impedance bandwidth, dual- or multi resonance mode, and suitable radiation characteristics, the antenna with diverse structures has become a common choice. When the antenna size is reduced and the number of operating frequency bands rises, however, engineers face difficulties in designing antennas. The CPW antenna has been proposed so far for size reduction, bandwidth enhancement, and resonance-mode increment. The circular polarisation is produced using a CPW-fed antenna construction that looks like a spiral antenna. Two square slots are inserted on opposite sides of the feed to produce two orthogonal electric fields, and one of the slots has a spiral stub embedded in it. The single spiral slot in this CPW-fed defected ground structure (DGS) radiates a circularly polarised field.

III. PROPOSED SYSTEM

The Spiral patch is etched on a Rogers RT5880 substrate with an area of 20 mm x 30 mm and a thickness of h = 1.6 mm (r = 2.2, tan = 0.009) and a thickness of h = 1.6 mm (r = 2.2, tan = 0.009). A Defected Ground Assembly supports the entire antenna structure. The most common ground plane shapes are square, rectangle, circle, and ellipse. In contrast, a well-known ground structure known as a defected ground structure (DGS) is a simple and effective way to lower the antenna size while also exciting extra resonant modes.

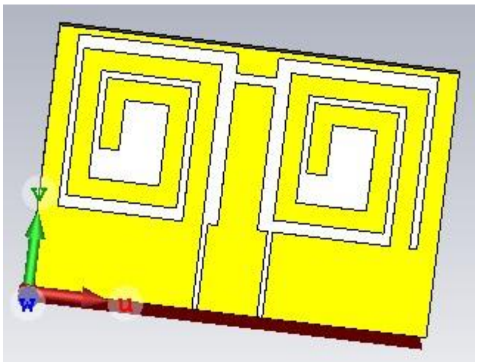

Fig.1 Single spiral slotted antenna

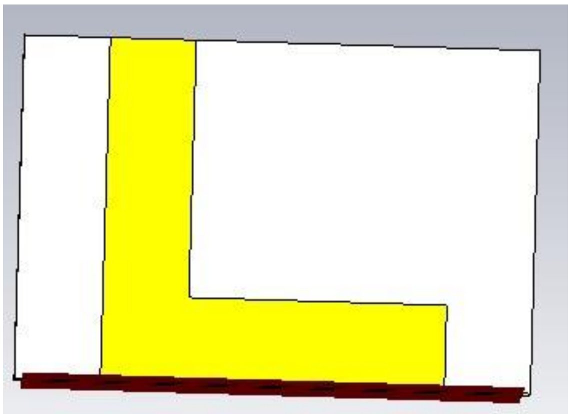

Fig.2 Defected Ground Structure 1

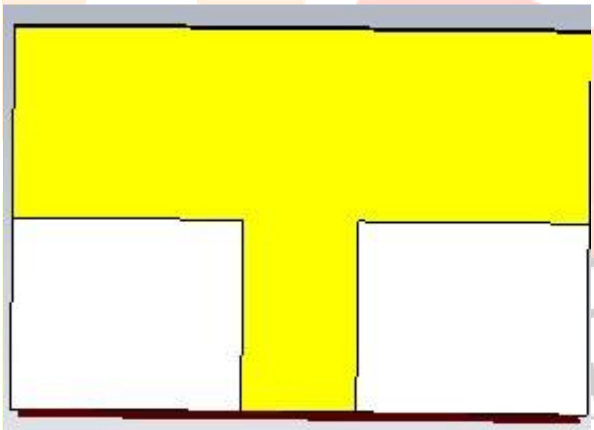

Fig.3 Defected Ground Structure 2

This antenna could be utilised in future 5G cellular communication systems to achieve high data rates via millimeter-wave communications with a broad bandwidth system. A Spiral slotted antenna with DGS that operates at 2.4 and 4.6 GHz is the antenna to consider. As an impedance, it consists of a 50 microstrip line. The proposed antenna is easy to construct. The substrate is made of Rogers RT5880, which has a dielectric constant of 4.4. The substrate has a height of 1.6 mm. Rogers RT5880 is a substrate with low dielectric constant and also have low dielectric loss. With these parameters RT substrate is suitable for high frequency or broadband applications. The advantage of the proposed antenna is that it operates in the 5G high frequency range (2.4–4.6 GHz) with what this entails in terms of future applications in the wireless communications industry. It is an easy to design. The size of the antenna is also small compared to other antennas. The antenna showed very good performance in terms of Gain, VSWR, return loss and radiation pattern.

VI RESULT

RETURN LOSS

It's a parameter that shows how much power is "lost" to the load and doesn't return as a reflection. As a result, a parameter to indicate how well the transmitter and antenna have been matched has been included. The return loss (RL) graphic can be used to calculate the bandwidth.

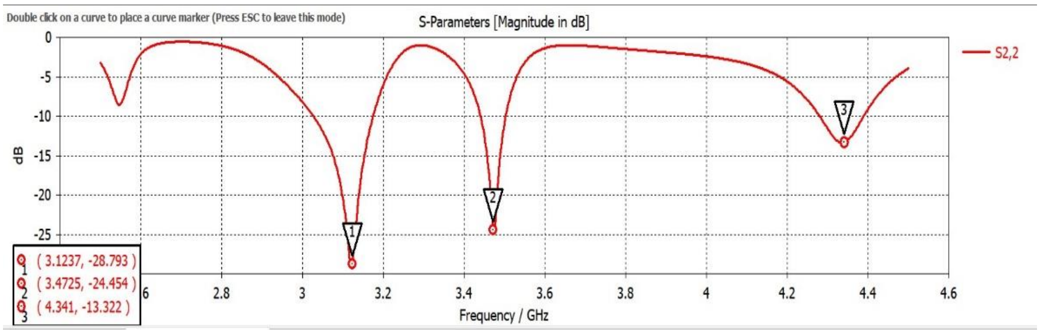

Fig.4 S parameter for DGS1

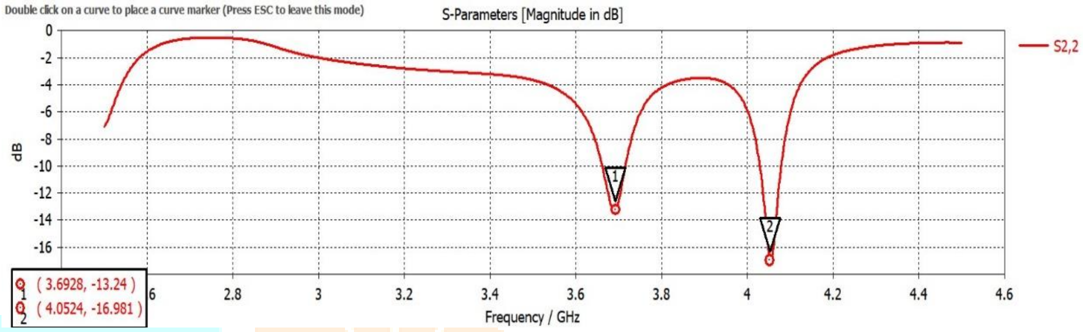

Fig.5 S parameter for DGS2

VSWR (VOLTAGE STANDING WAVE RATIO)

The Voltage Standing Wave Ratio (VSWR) is a measure of the impedance match's quality. SWR is a common abbreviation for VSWR. A high VSWR indicates that the signal is reflected before it is transmitted by the antenna. Different techniques of measuring and expressing the same phenomenon are VSWR and reflected power.

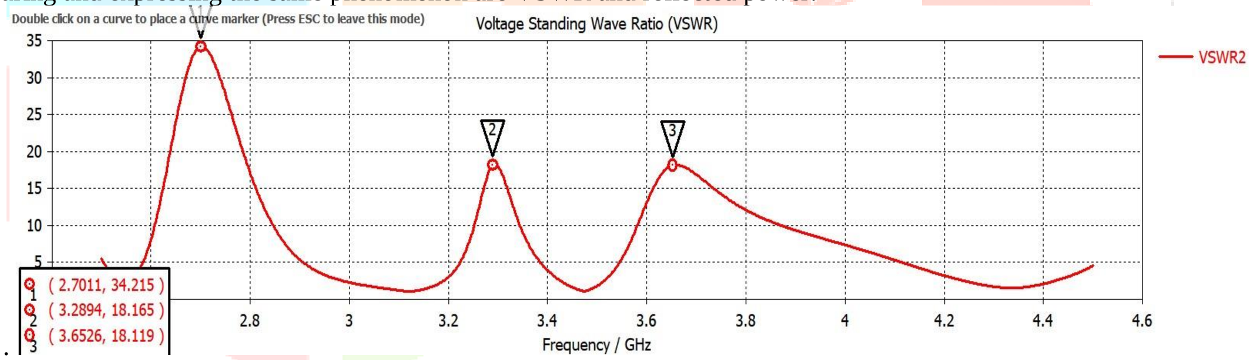

Fig.6VSWR for DGS1

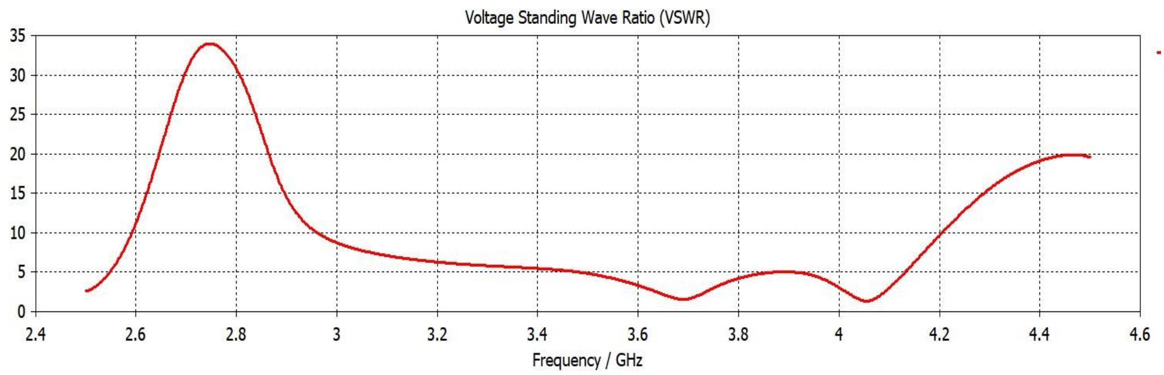

Fig.7 VSWR for DGS 2

GAIN

Gain is an antenna attribute that refers to the ability of an antenna to direct its radiated power in a desired direction, or to receive energy preferentially from a desired direction. The suggested antenna has a gain of 4.59 dB and 6.71 dB.

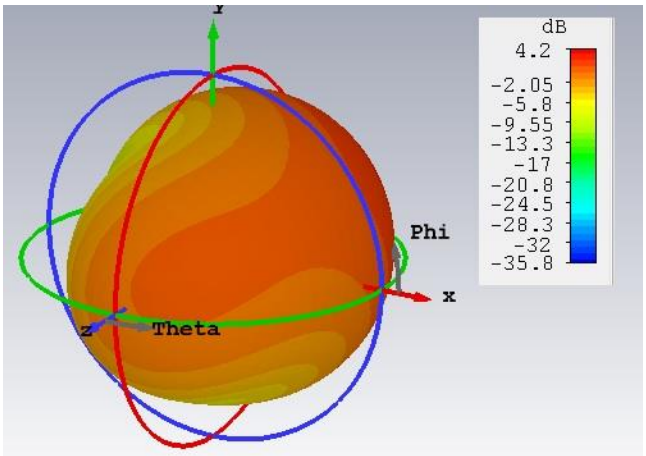

Fig.8 Gain for DGS1

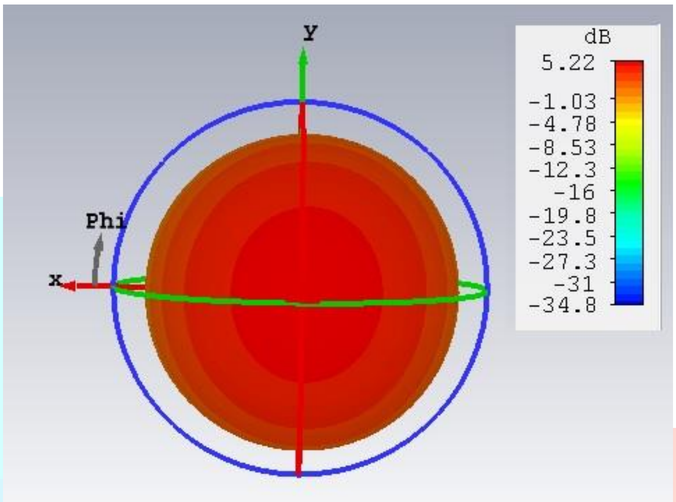

Fig .9 Gain for DGS 2

V.CONCLUSION

This project suggests using CST Studio Suite to design a spiral slotted antenna with DGS. CST Studio Suite software was used to design and test the antenna. Other than the present system, the simulated and measured results for the return loss and gain pattern are in good agreement. Optimizing antenna parameters can result in significant gains in overall system performance, such as improved accuracy, improved aerodynamics, and reduced weight, among other things.

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