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DESIGN AND IMPLEMENTATION OF DGS BASED MICROSTRIP PATCH ANTENNA FOR RADAR COMMUNICATION

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ABSTRACT: Wireless communication is one of the fast emergent fields of the communication engineering. The Radar announcement has received a proportion of consideration from both academe, commerce and significant exertions have been made to progress dissimilar aspects, such as data rate, latency, mobility, reliability and QoS. This paper offering the intention of a compact size band patch antenna for Radar communications. This wideband antenna was designed on a flexible substrate (20 x 15 x 0.8 mm) and is compact. It contains of a emission patch and a defective ground structure (DGS) using polyimide material. A pattern of the antenna and different considerations such as return loss, gain, radiation pattern, and voltage standing wave ratio (VSWR) are obtainable and chatted. The simulation result of return loss, voltage standing wave ratio and bandwidth is improved and also reduce the size of an UWB antenna. Output result reveals efficient performance with respect to wideband operation.

Index terms - T-shaped antenna, UWB, DGS, Multi band, Bandwidth, Miniature

I. INTRODUCTION

The present smart world is living in 4G communications to provide user high-speed data services along with high-quality voice and video communications. As smartphone consumers are growing day by day; it rises the essential for best mobile setup attention, to avoid data congestion, provide high data rates. Conventional 4G communication operates on the band of frequencies 2–8 GHz providing a bandwidth in range of 5–20 MHz to fulfill consumer needs. The future communication technology is footing in 5G communications. The prime need for a communication system is to provide high gain antennas that are accomplished of providing 5G frequencies and bandwidths. The several 5G antennas are invented with geometrical figures of circular [1], rectangular [2] patch antenna. The obtainable circular patch antenna covers planetary borne radar uses that are functioning over a frequency range of 9–10, 10.45 and 23.15–23.6 GHz; it does not cover mobile frequency bands like 28/38 GHz. Ultra-Wide-Band technology is evolving sequentially few years in different applications, such as domestic, military, and industrial. This technology used in the radio communications field has become the most promising today and the many studies on the subject have allowed defining and realizing electronic circuits to specific applications. This technology can be exploited at a very low power density for communication at high data rates over short distances. It consists of using signals whose spectrum is spread over a wide frequency band [3]. We frequently conversation about a band from 500 MHz to more than a few GHz.

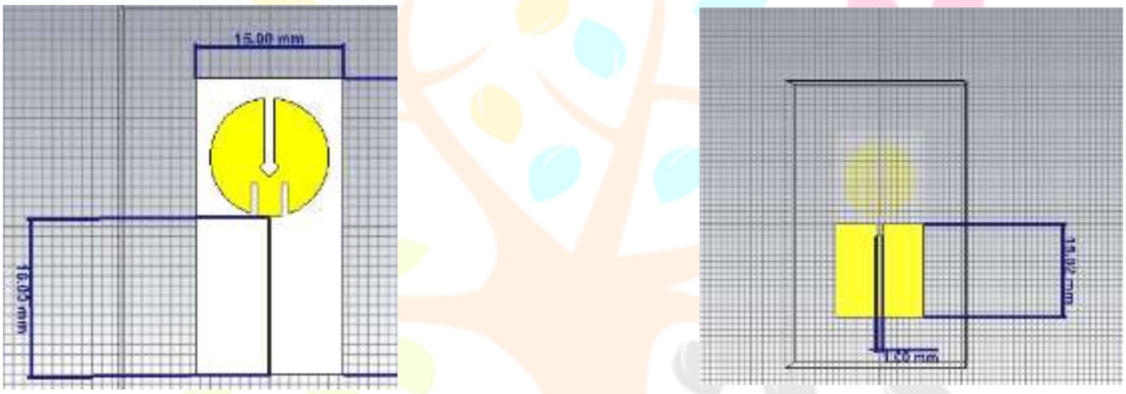
In 2002, the FCC unrestrained the usage of frequency band from 3.1 to 10.6 GHz [4]. In recent times, several antennas have been developed for UWB communications; containing an ultra-wideband part circular micro strip monopole antenna has been reported in [5]. That occupies a dimension of 35 x 25 x 1.6 mm^3. The antennas distinguished in Reference [6] attain the bandwidth from 3.2

to 14.3 GHz having the measurement of 20×20×1.51 mm^3. A printed semicircular figure patch antenna has been denoted in [7]. A compact UWB planar antenna with corrugated stepladder ground plane is offered in [8] that attain 2.4-11.4 GHz bandwidth. In Reference [9], a CPW fed UWB antenna that has a measurement of 40 x 50 x 1.60 mm^3 that attain 2.7 - 9.3 GHz bandwidth.

In this work, a diminished structure is proposed for ultra-wideband applications using triple 'T' with 'E' couple shaped radiator patch, partial ground plane. The proposed design has a compact size (7 ×7 mm^2). The result shows that the offered antenna succeeds a bandwidth from 3.3 GHz to more than 35GHz, which the simulation is performed using a time domain based commercial electromagnetic simulator (CST Microwave studio). Assessment of the offered antenna with the previous described antennas in terms of bandwidth, and measurements are obtainable.

II. ANTENNA DESIGN

Fig.1. Describes the measurement and configuration of proposed Miniature Novel patch UWB antenna, which is designed on a Roger 5880 (lossy) substrate with relative permittivity equal to 3.3, loss tangent of 0.025, and thickness of 0.75 mm. The radiating element is a circle with E couple shape patch on one side of the substrate and on the other side a partial ground plane. The dimensions of the offered design are 15 x 25 x 0.75 mm^3.



a.) b.)

Fig.1. Proposed antenna structure: (a) Top View. (b) Bottom View

III. RESULT AND DISUSSION

The proposed antenna scheme is simulated using CST microwave studio suite simulator [10]. The computer-generated return loss (S11) in contrast to frequency of the original antenna is shown in Fig. 2. The return loss of the proposed antenna less than -10dB is from 6 GHz to more than 15 GHz cover almost the complete band. The return loss is given as -41.83 dB at 6.15 GHz, -35.99 dB at 7.58 GHz and -43.39 dB at 15.136 GHz.

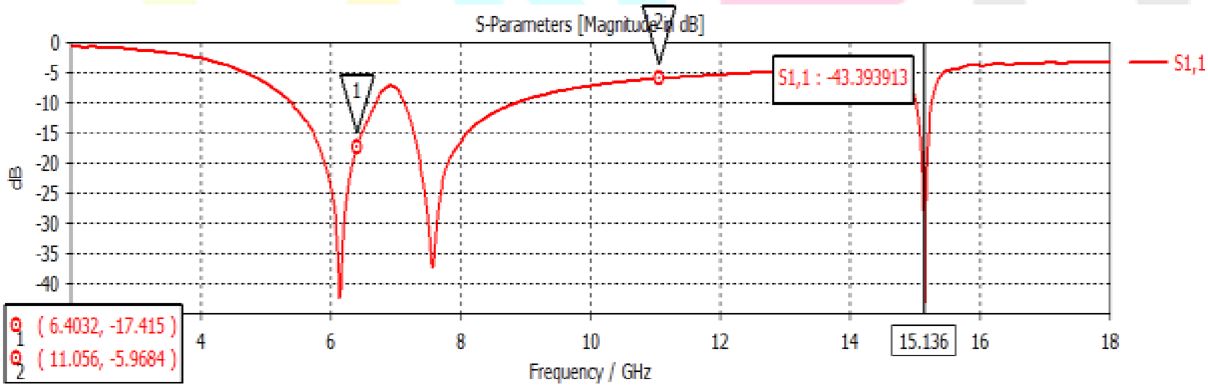


Fig. 2. Return loss

The output of voltage standing waves ratio (VSWR) compared to the frequency of the proposed T antenna are showed in Fig 3. The described antenna shows a multi-band performance from 6 GHz to more than 15 GHz for VSWR < 2.

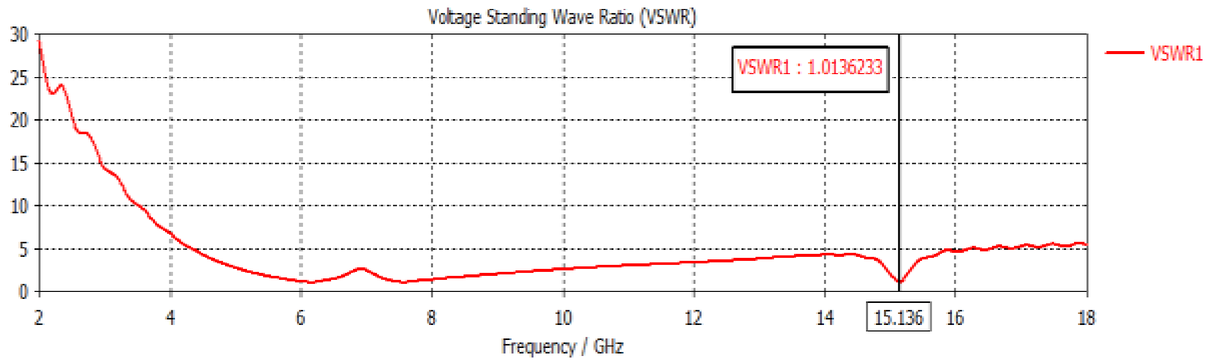


Fig. 3. VSWR

Figure 4. shows the bandwidth1 of an offered antenna for difference of two frequencies like 5.407 GHz and 6.679 GHz achieved for 1.2726 GHz.

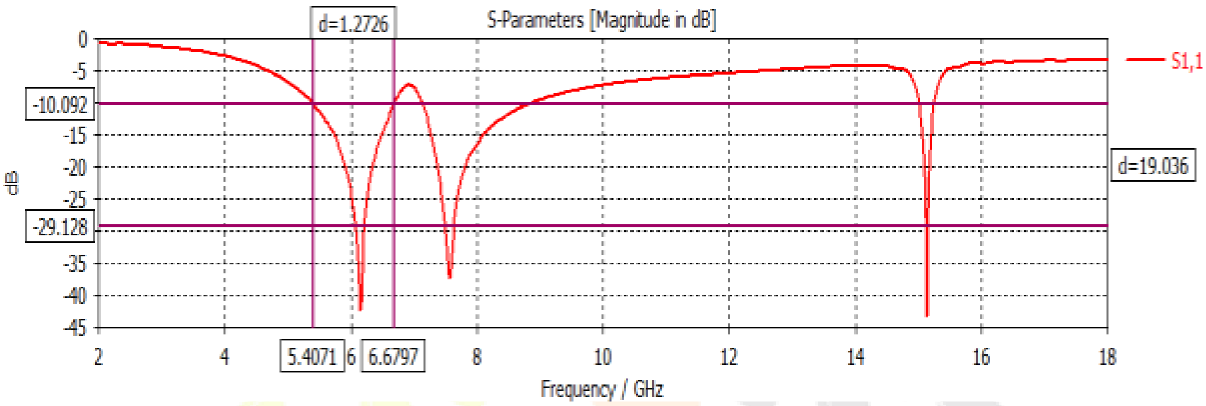


Fig 4. Bandwidth 1

Figure 5. shows the bandwidth2 of an offered antenna for difference of two frequencies like 7.15 GHz and 8.8315 GHz achieved for 1.6 GHz.

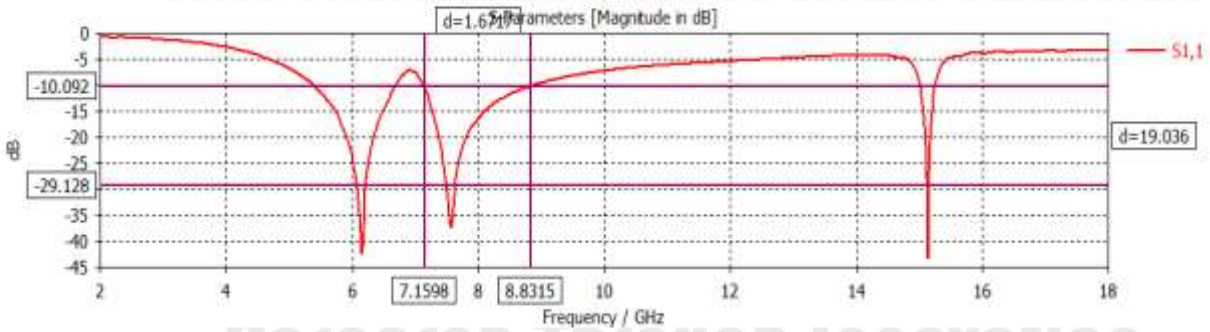


Fig 5. Bandwidth 1

Fig 6. Shows the radiation pattern of an antenna at 15.136 GHz with center lobe of 1.67 dBi, side lobe level is given as −2.8 dB, which means smallest power, is propagated at undesired path and angular width is 64.2 deg to the main lobe directions of 143.0 degrees.

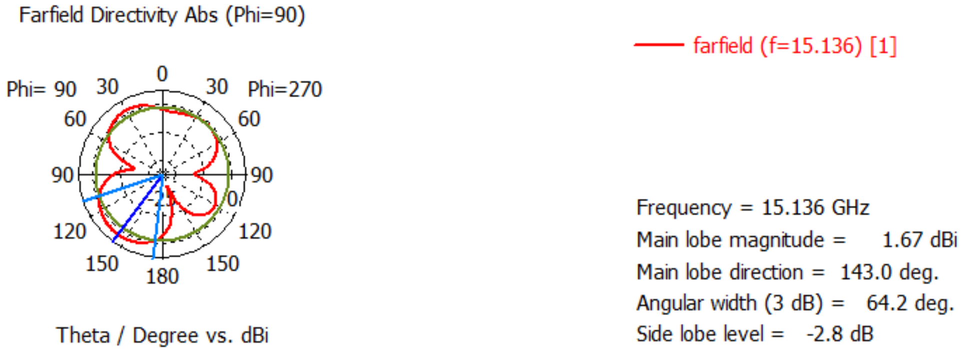


Fig. 6. Polar plot at 15.136 GHz

Fig 7 shows the 3D radiation patterns at 15.136 GHz. The gain of an antenna is given as 4.27 dB.

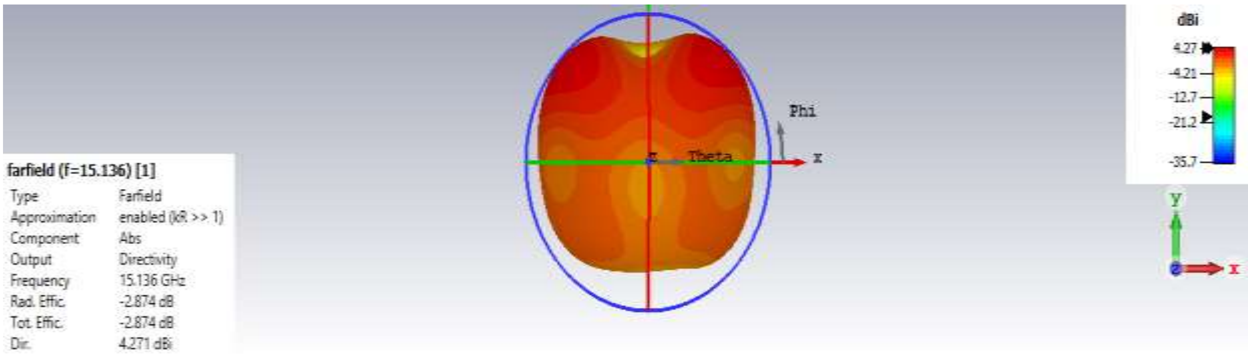


Fig 7. 3D radiation patterns at 15.136 GHz

The assessment of the offered antenna with the earlier described antennas in positions of bandwidth, and dimensions are obtainable in Table 1. It is obviously strong that the offered proposal has a small size and less weight with flexible manner.

IV. CONCLUSION

In this proposed work, Miniature Patch antenna is planned for ultra-wide band applications which determination performance a significant role. It is establishing that the offered method moderates the small size of an antenna and bandwidth is also improved. It also reveals small dimensions: 15 × 25 × 0.75 mm^3. The result shown that the small UWB antenna usually shows a decent enactment hence is a good aspirant for ultra-wide band applications.

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