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Low Profile Microstrip DGS – Based Wideband Slot Antenna for Wireless Applications

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Abstract - A low profile microstrip DGS-based wide band slot antenna for wireless applications is designed and simulated successfully. It is a defected ground structure - based antenna augmented with a rectangular slot and it is simulated by using CST studio suite 2010. The total size of the final optimized antenna is only 35mm x 30mm. It has simpler structure than other antennas designed for realizing DGS – based wideband slot antenna characteristics. It is just composed of a microstrip feed line, a substrate, and a ground plane on which some slots are etched. Then, prove the validation of the design is simulated. The simulated data show that the antenna can provide four impedance bandwidths centered at 2.4 GHz, 3GHz, 3.5 GHz, and 5.6 GHz. Desirable radiation performance, including relatively stable radiation patterns, are obtained over this range. The VSWR has been calculated. Since a simulated antenna covers the wider range bandwidth, the antenna will be having very much useful for wideband applications.

Key Words – DGS-based wide band, slot antenna, rectangular slot, microstrip, radiation performance

I. INTRODUCTION

In wireless communication systems, multi band antenna has very important role for wireless service requirements. Wireless local area network (WLAN) and Worldwide Interoperability for Microwave Access (WiMAX) have applied in mobile devices sand intelligent phones. These techniques have been widely recognized as a cost-effective, and high-speed data connectivity solution, enabling user mobility. With rapid development of wireless communication system, antenna design turned to focus on wide multi band and simple structures are easy to fabricate. To adapt complicated and diverse WLAN and WiMAX environments, several promising dual & multiband antenna designs have already proposed in [1]–[12]. In [3], a crooked U-slot and a radial stub make the antenna to achieve a dual-band operations. It has a simple structure to be fabricated easily, but only dual bands can be supplied the same as the antennas in [1] and [2]. In [4]–[6], though proposed antennas have good characteristics for both WLAN and WiMAX applications, they are complicated and large in size. Besides slot and monopole antennas, there are many other implementations for multiband applications, such as patch antennas [7]–[9], dipole antennas [10], [11] and antennas using composite meta material resonators [12], etc. Compared to regular antennas, the slot antenna fed by micro strip line has good characteristics, including large bandwidth, less conductor loss, and good isolation between the radiating element and feeding network [13].

Compact wide band of microstrip antenna of the proposed antenna consists of rectangular and trapezoidal-slot design on glass epoxy FR4 substrate is obtained. The antenna size is very compact (35 mm x 30 mm x 1.6 mm) and covers 2.4GHz to 6.4 GHz and can be used for various applications (Bluetooth, Radio Navigation, WLAN & WiMAX). The antenna is fed from a single 50Ω coaxial cable. Using CST Microwave Studio 2010 software package for antenna design, according to the set size, the antenna is simulated. The computer simulation results show that the antenna can realize wide band characters with each band having better impedance bandwidth.. The composite effect of integrating these techniques offers a wide operating frequency and compact antenna element. Compared to regular antennas, the slot antenna fed by micro strip line has good characteristics, including bandwidth, less conductor loss, and better isolation between the radiating element and feeding network.

II. ANTENNA DESIGN

As shown in Fig. 1, the configuration of the DGS-based wide band slot antenna is designed and simulated on a substrate with FR4, relative permittivity of 4.4, and a tangent loss of 0.02. The entire size of the antenna is only 35 x 30 x 1.6mm .Without loss of generality, a microstrip line feed at 50Ω impedance with a width of 3 mm is adopted for centrally feeding the antenna at one side of the substrate. In proposed system, a new operating frequency band has been introduced which is about 2.43 to 3.58GHz for radio navigation application. VSWR have been calculated and it is less than 2.

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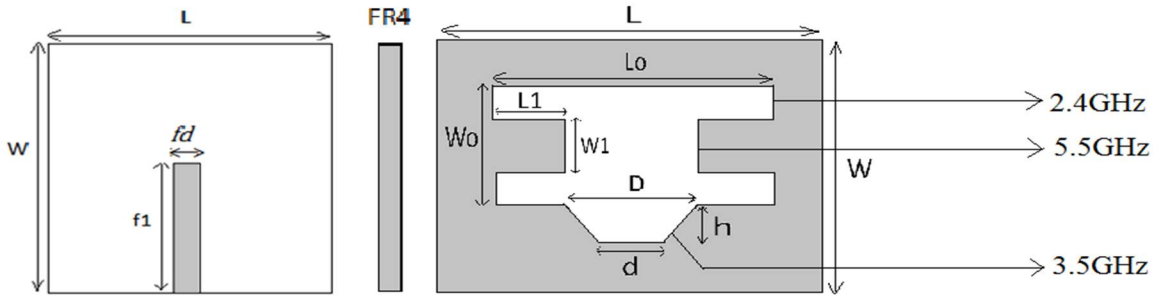

Fig.1 Configuration of Proposed Antenna (a) Top. (b) Side. (c) Bottom.

We obtained the return loss as - 11.17dB and the gain as 3.6dB for the operating frequency at 3GHz. The radio navigation was the Radio Direction Finder, or RDF. By tuning radio station and using a directional antenna, one can determine the direction of the broadcasting antenna. A second measurement using another station taken. Using triangulation, the directions can be plotted on a map where their intersection reveals the location of the navigator. A rectangular microstrip slot antenna fed by a microstrip line, which achieve bandwidth on a relative thin substrate, is presented. Performance is achieved by a combination of a rectangular slot in the ground plane, and microstrip line perpendicular to the rectangular slot. Simulated and measured results show that 46% fractional impedance bandwidth is achieved with respect to the centre frequency of 2.4GHz and stable pattern with change of frequency. A trapezoidal slot patch antenna with an embedded strip is proposed for wireless local area network and world-wide and interpretability for microwave access application simultaneously. The proposed antenna consists of a rectangular patch with an etched trapezoidal slot on the bottom. By carefully selecting the width of the radiation patch and the length of the ground, the proposed antenna can generate two separate bands. Furthermore, good Omni-directional radiation pattern with appreciable gain are obtained over the operating bands.

III. RESULTS

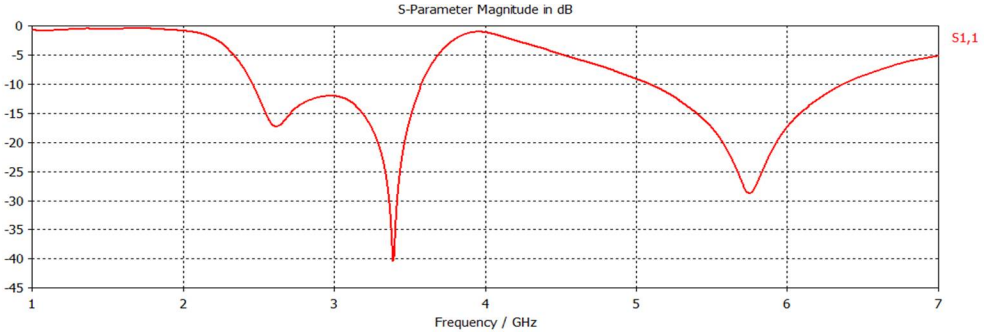

Fig.2 Stimulated Return Loss

Table 1. Parameters of Proposed Antenna

PARAMETERS	VALUES(mm)
L	35
W	30
f_1	15
fd	3
H	1.6
L0	30
W0	14
L1	9
W1	3
D	18
d	3
H	6

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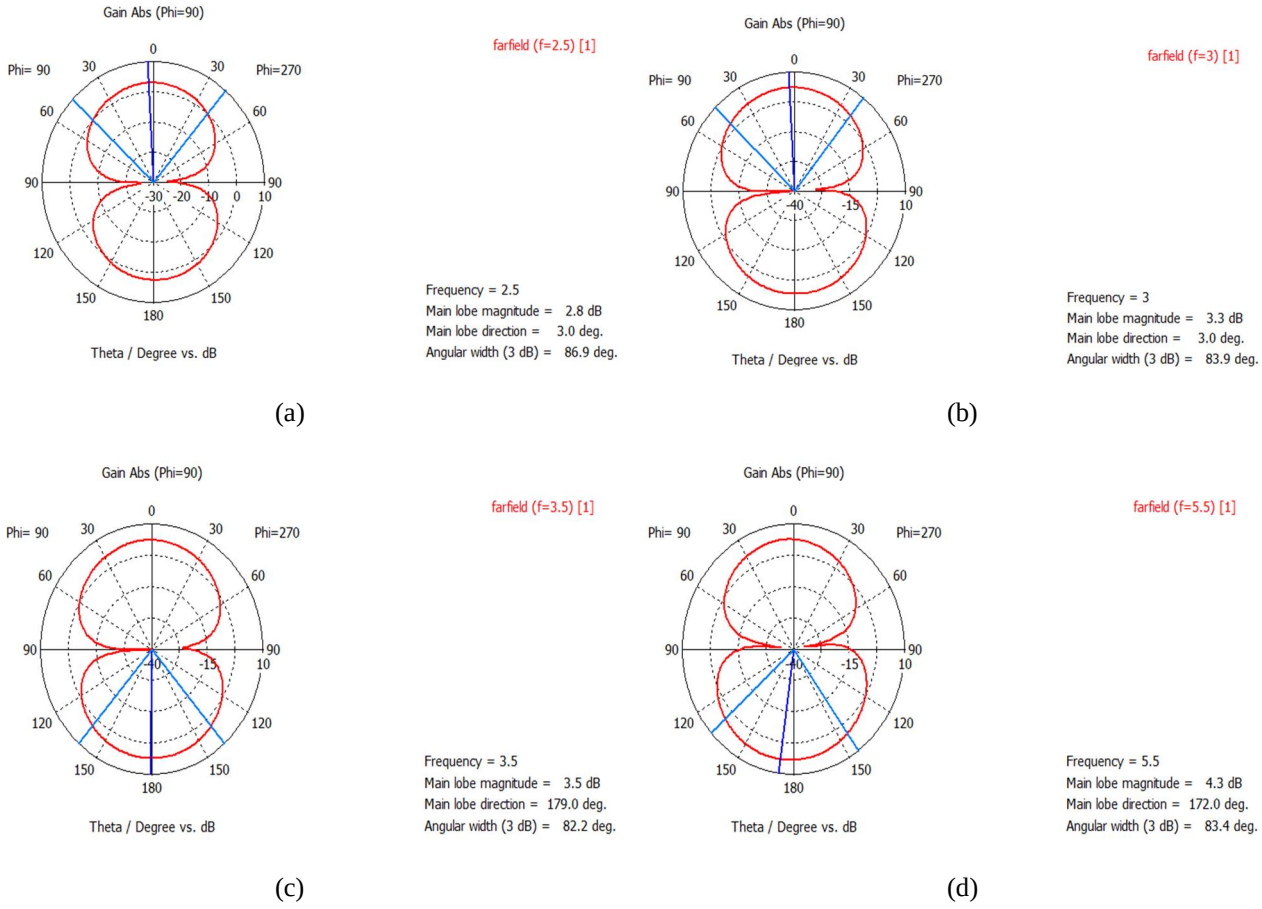

Fig. 3. Radiation patterns of the proposed antenna. (a) 2.5 GHz. (b) 3 GHz. (c) 3.5 GHz. (d) 5.5 GHz.

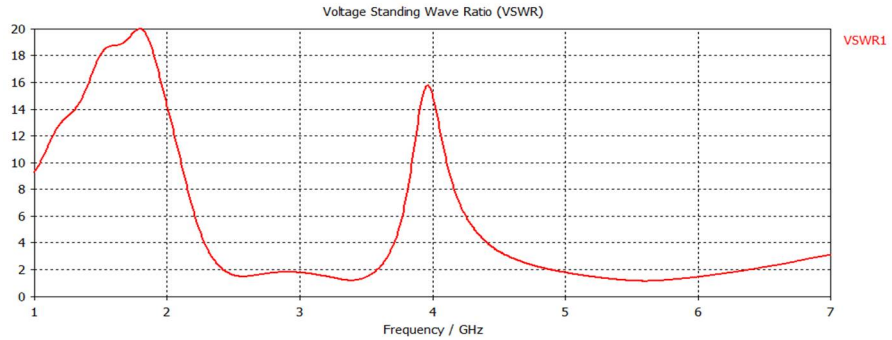

Fig. 4. Stimulated Return Loss

IV. CONCLUSION

The microstrip patch DGS-based slot antenna with fed ground was designed for the wide band applications and radio navigation application. The performance of the antenna was studied in terms the antenna parameters and the -10 db return loss achieved in the operating frequency range of 2.4 GHz, 3GHz, 3.5 GHz, and 5.6 GHz. The obtained results were in accordance with the simulated results showing that the antenna is well performing at the required range with considerable slot dimensions.

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