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DGS (Defected Ground Structure) Microstrip Antenna for Bluetooth Applications

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ABSTRACT: This paper illustrates the designing of microstrip patch antenna utilizing defected ground structure. The major purpose of designing such kind of antenna is to attain multiband purpose which is vital for requirement of technology nowadays. Initiation of such kind of antenna with imperfect structure of ground increases the antenna functioning. In this case the ground element of the recommended antenna is regarded as defected ground structure (DGS). Moreover the optimization of this kind of antenna is made so as to achieve a return loss of -10db. Furthermore in comparison to simple ground, the recommended design augments the bandwidth and develops the input return loss of the antenna. The antenna design parameters and performances have been studied by means of simulations. The substrate utilized behind designing is of glass with a dielectric constant of 2.2. Moreover the design invariants of antenna consist of single layer thickness of 2mm as well as operating frequency of 4 GHz. The design was optimized so that we can get the finest probable effect. To conclude the microstrip antenna without DGS effects in narrow bandwidth with high return loss. In contrast, microstrip antenna with DGS offers higher operating bandwidth with less return loss.
KEYWORDS: Microstrip Antenna, Defected Ground Structure, IE3D.

I. INTRODUCTION

In recent times the communication performs an outstanding task in the global society and almost all the communication systems are altering quickly from wired to wireless. Wireless communication is a very flexible means of communication and antenna is the most significant ingredient of it. The distinctive method utilized for improvement of bandwidth is by decreasing the dimension of the patch and to defect the ground [1].Defected Ground Structure was initially invented by Park et al in the year 1999 retaining the notion of Photonic Band-Gap Structure (PBG) [2].Nevertheless Defected Ground Structure is essentially comprehended on the base of periodic or non-periodic defect in ground plane. The impedance and surface current of the antenna is affected by DGS.

On the whole description of DGS is dependent on the stop band slow wave consequence and high impedance of the antenna. These are mainly utilized in construction of microstrip antennas for various applications like antenna size reduction, cross polarization reduction, mutual coupling in antenna arrays and harmonic suppression [3]. It is also helpful in controlling the excitation and electromagnetic waves propagating all through the substrate. Lastly DGS is extensively utilized in microwave appliances so that the device is made compact and effectual.

II. ANTENNA CONFIGURATION

The antenna geometry illustrated in Figure.1 (a) possesses a square patch on the upper plane of the antenna and etched meander shape construction on the ground plane. Antenna is devised by a Co-axial feed to resonate at frequency of 2.4 GHz. The Figure 1(b) demonstrates the procedure of constructing the new formed DGS square patch antenna

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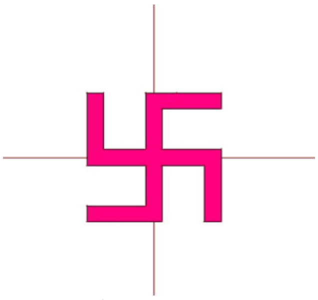

Fig.1 (a) Geometry of DGS Antenna

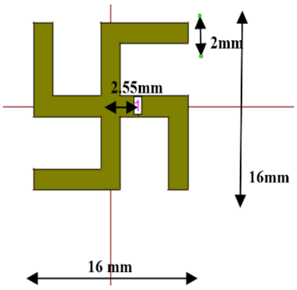

Fig.1 (b) Feeding Structure of DGS Antenna

. The measurement of Swastika shaped DGS are as follows: length= 16 mm, width= 16mm $\varepsilon_r = 2.2$ and distance from centre to its feed = 2.55 mm

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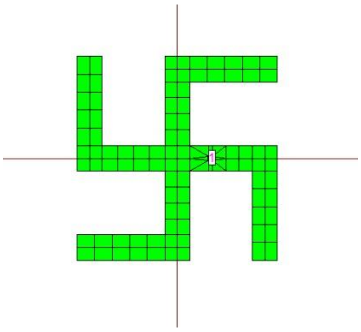

Fig.1 (c) Meshed Structure of DGS Antenna

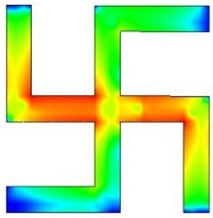

Fig.1(d) Current Distribution of DGS Antenna

The Figure 1(c) shows the star like shaped antenna at GHz frequency with 30 cells for every wavelength which looks like a meshed structure. Above all it is done so as to progress the bandwidth and diminish the cross polarization of the antenna measurements of gain. The figure shown in Fig.1 (d) illustrates the current distribution performance of E-Shape patch at 2.4 GHz excitation. The important alterations in radiation pattern of arrays can be attained by varying current distribution array of the antenna.

III. DESIGNING FLOWCHART

Figure 2 demonstrates the flowchart to design the antenna. It begins with attaining the necessary parameters, which is followed by designing the recommended antenna and chosen proper size of DGS utilizing IE3D software. After that, if the frequency response is adequate, the antenna is prepared to be manufactured. But if it is not so, the optimizing step should be repeated unless it comes across the antenna's requirement. Once the fabricating procedure is finished; the antenna is calculated utilizing IE3D. The consequences between simulation and measurement are evaluated and studied [3]. With the aim of designing the frequency reconfigurable microstrip patch antenna, there are numerous associated condition that should be utilized.

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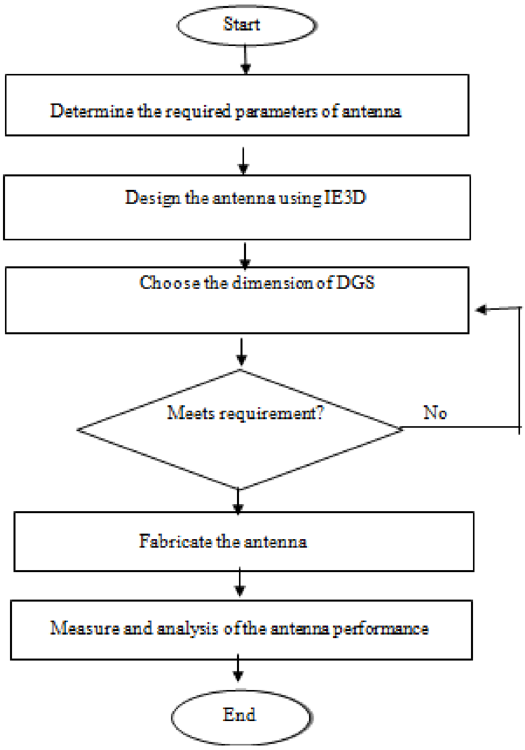

Fig.2 Flow Chart designing process of microstrip antenna with DGS

The method presumes that the particular information comprises the dielectric constant of the substrate (ε_r), the resonant frequency (f_r) and the height of the substrate (h).In this case we have assumed the design parameters as follows: f=4 GHz, h=2mm, ε_r =2.2 and have attained the feed point distance as follows : 2.557mm,l=16mm,w=16mm.

IV. SIMULATED RESULTS

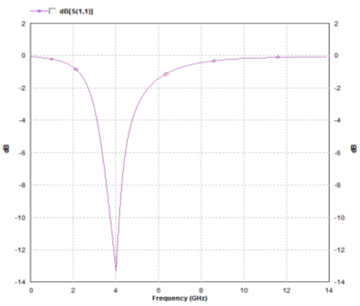

Fig.3 (a) Return Loss Graph of Microstrip Antenna with DGS

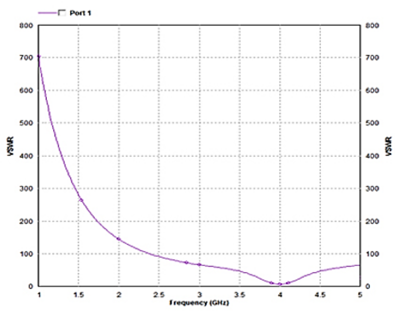

Fig. 3 (b) VSWR Graph of Antenna with DGS

Figure 3 (a) demonstrates the reflection coefficient or return loss of the antenna which is described as the ratio of reflected power to the incident power. In case of practical antenna its value should be less than – 10 dB. In case of designed microstrip antenna the simulated return loss is – 13.6Db at resonant frequency 4 GHz. Figure 3 (b) illustrates the VSWR of the antenna which should be smaller than 2 for the antenna to emit. It comes to be 1.2 in case of designed microstrip antenna.

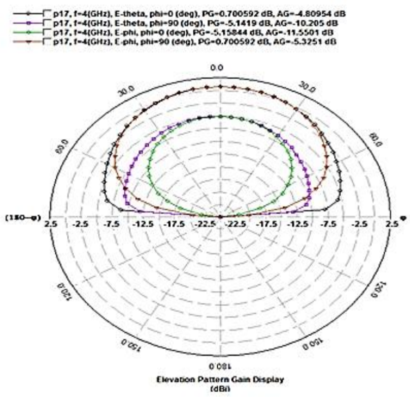

Fig.3(c) 2-D Gain plot of Microstrip Antenna with DGS

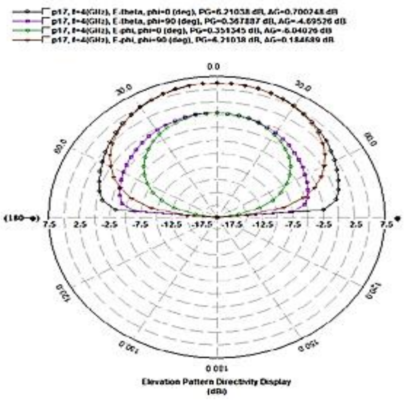

Fig.3 (d) 2-D Directivity plot of Microstrip Antenna with DGS

Figure 3(c) demonstrates the two dimensional polar plot of antenna along with DGS at E-theta and E-phi of phi=0^0 and phi=90^0, exciting at 4 GHz. Figure 3(d) illustrates the two dimensional polar plot of antenna directivity acquired at E-theta and E-phi of phi=0^0 and phi=90^0, exciting at 4 GHz.

V. DISCUSSION

From the study of simulation of the designed antenna it is observable that the designed Swastika shaped microstrip antennas possess superior VSWR i.e. 1.2 at 4 GHz frequency with optimized return loss smaller than -10 db.i.e. -13.6Db.The optimum outcomes of recommended antenna is demonstrated and tested by using IE3D simulator. This antenna possesses a simple construction and can be fabricated without difficulty because of the existence of FR4 substrate. The recommended antenna characterizes improved directivity and return loss. The designed antenna with DGS not only develops the parameters of the antenna, but also offers a smaller size of radiating patches resulting in overall decrease of antenna dimension. Therefore the new patch antenna with defected Ground Structure (DGS) shows attributes of better return loss, VSWR bandwidth, enhanced gain of the antenna in comparison with the usual antenna. Another method accepted to improve the directivity and gain of antenna is DGS compelled by Meta materials arrangement and a lot more. Work is going on to acquire yet better consequences along with excellent axial ratio.

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