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Analysis of DGS on Microstrip Antenna for Wireless Communication Systems

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***Abstract*- This paper presents the diffferent slots of microstrip patch antenna for wireless communication devices has been proposed.The antenna designed with different slots . The first designed proposed the operating frequency and bandwidth of dual band antenna for LTE are 2.3 GHz, 2.5 GHz and 64 MHz, 122 MHz respectively and Second design proposed the frequency and bandwidth are 1.6 GHz , 2.7 GHz and 45 MHz and 165 MHz respectively . The different slots of antennas shows the Defected Ground Structure (DGS) which improve the performance of resonances and bandwidhth enhacement. The DGS of antenna differenciate the performance of antenna. The simulated results shows the good radiation pattern and stable gain which are very useful in wireless communication systems.**

Keywords – Wirelss Communication Systems, DGS, Microstrip Antenna, Slots

The micro strip patch antennas are very low profile, simple and inexpensive to manufactured using printed-circuit technology,They are generally usable where thickness and conformity to the surface are the main purpose [11]. In the general form of a microstrip patch antenna , on one of the side of a dielectric substate is the radiating patch while on the other side of patch antenna is a ground plane. Basically the patch is half wavelength long with a moderately higher ground plane to achieve the better performance of resonance.The generation of multiple antenna with different frequency is achieved by the U and L slot on microstrip antenna with a good radiation pattern and stable gain has been proposed [1]-[3],[10]. The Defected ground structure (DGS) is used for the different model of antenna which give the better resonance and harmonic reduction and has been found that the performance of antenna parameters is also enhanced[6],[7],[8]. The size and miniaturization of antenna is used by the various slot technique[4],[9]. In this paper we have to designed the first antenna in which one patch printed antenna with a dual U slot. This presented antenna is simple in structure and generate two resonant frequency at 2.3 GHz and 2.7GHz simulated results of the presented antenna with a bandwidth 64 MHz and 122 MHz respectively, second one also designed with one patch antenna and dual U slots with Rectangular shape slots cut on ground structure and generate two resonant frequenc and bandwidth 1.6 GHz, 2.7 GHz and 45 MHz, 165 MHz respectively which exhibit good reflection coefficient, stable gain and radiation pattern which are very suitable for wireless communication system and rectangular slot on ground plane is differenciate the performance of antenna.

Table 1, 2 lists the key parameters of antenna. The antenna consists of one patch and dual patch element with a microstrip line feeding. The complete structure of antenna is designed using the, HFSS V.11.2 on a FR-4 substrate with a thickness of 1.5mm and a relative permittivity of 4.4, and occupying an area of 50x50 mm^2 on one side of the substrate and an area of 50x42 mm^2 for the ground plane . This paper presented the how to improve the performances of antenna parameter with using different slots and defected ground structure and which is suitable for wireless communication system.

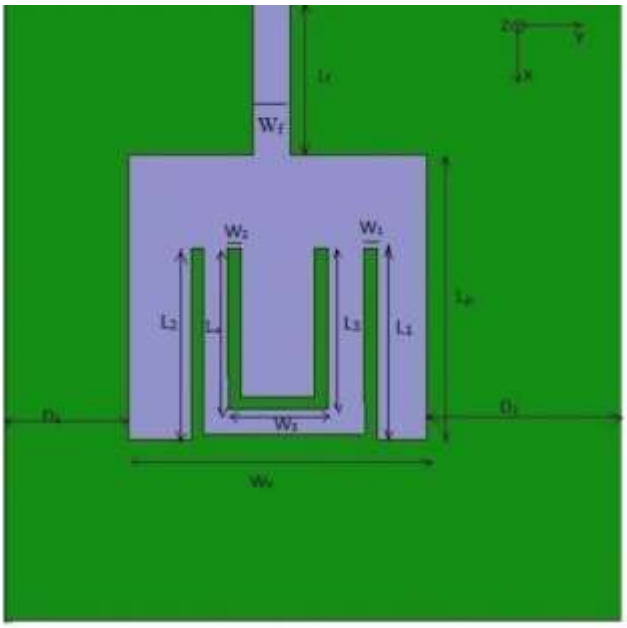


Fig-1.1 Structure of front face of antenna [1]

TABLE 1

DIMENSIONS OF FRONT FACE OF ANTENNA (mm)[1]

L_f	L_p	W_p	L_1	L_2
12.6	23	24	15	15
W_2	W_3	W_1	L_3	D_1
1	8	1	12	10
D_2	L_4	W_f	Total Volume 50x50x1.5	

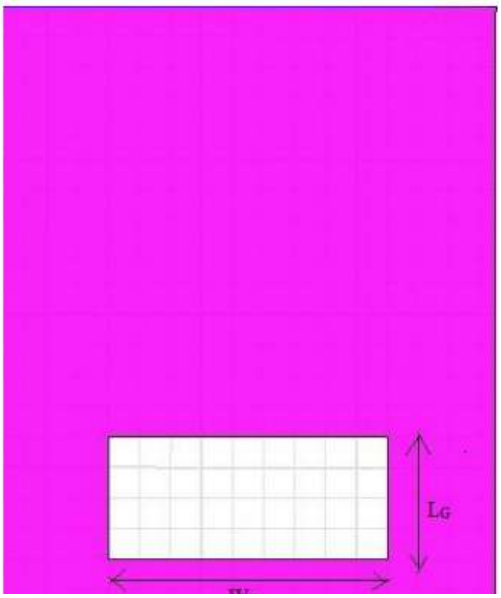


Fig-1.2 Structure of back face of antenna [1]

TABLE 2
DIMENSIONS OF BACK FACE OF ANTENNA (mm)[1]

W_G	L_G	Total volume
18	8	40x32

1. **DESIGN ANALYSIS** 1:-

In order to describe the operating mechanism and the effect of the various portions of the antenna clearly, we have carried out the antenna design process step by step, Firstly designed Main patch with U slot and second Left and right Strip slot and then after defected Ground Srtructure of rectangular slot. The rectangular slot shows the better return loss and bandwidth at 2.3 GHZ and 2.5 GHz.

2 *SIMULATION AND RESULT*

The simulated result has been analyzed by using the HFSS software. The presented antenna works at dual band at 2.35 GHz and 2.5 GHz and the performance of antenna parameter has been analazed .

A. RETURN LOSS:

The simulated S11 is shown in fig 3. This is the final simulated structure of followed by steps 1,2,3 .The simulated impedance bandwidth (S11<-10dB) cover 2.3 GHz and 2.5 GHz which are applicable for LTE frequency band. The first resonance frequency obtained at 2.3 GHz with the return loss value of 15.5 dB. The second resonance frequency of 2.5 GHz with the return loss value of -23dB.

B. *RADIATION PATTERN*:

The figures below showing the antenna radiation pattern with principal E-plane and H-plane for different frequencies at 2.35, 2.5 GHz . We can observe that the H-Plane patterns and o E-Plane patterns both have a omnidirectional shape pattern.

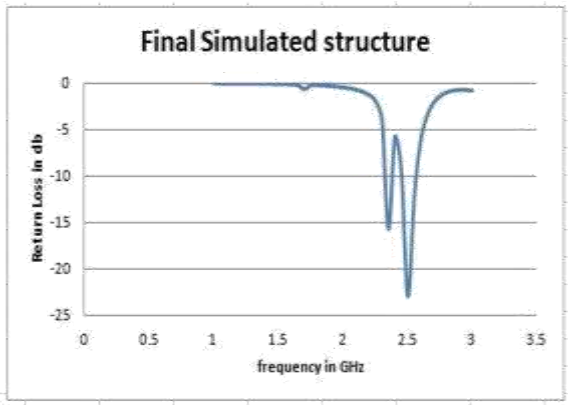


Figure1.3: Return Loss at 2.35 GHz and 2.5 GHz[1]

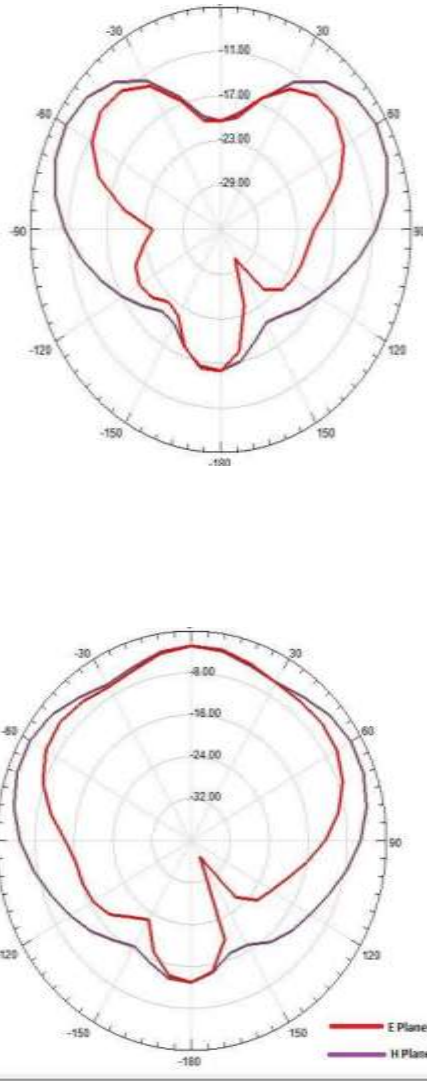


Figure 1.4 Radiation Pattern for frequency 2.3, 2.5 GHz respectively.

II DESIGN ANALYSIS 2-

In this design here using microstripfeed line with two U slots..This proposed antenna cut the rectangular slot in ground plane which improve the bandwidth and reduce the size of antenna. This proposed antenna give a band at resonate frequency 1.6 GHz and second band resonate 2.7 GHz and they cover the GSM/ DCS/ PCS/IMT band. The band width of proposed antenna is 46 MHz and 160 MHz. The value of S11 at 1.65 GHz is around -15.53 dB and 2.75 GHz is around at -16.83 dB.

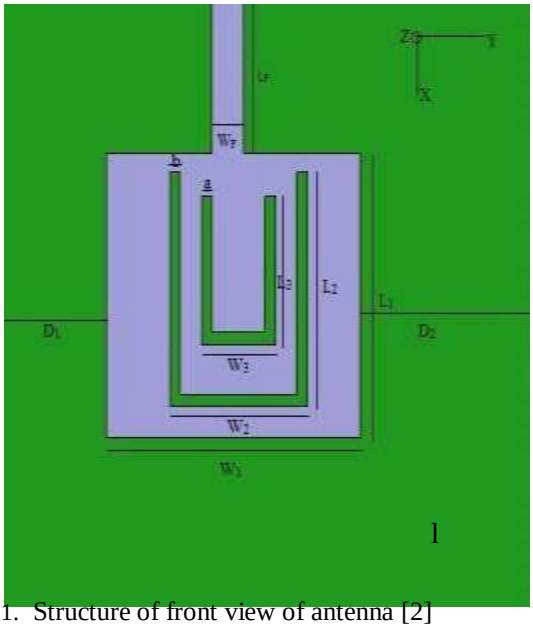


Fig-2.1. Structure of front view of antenna [2]

TABLE 3:- Dimensions of Front View Of Antenna (mm)[2]

L_f	L_1	W_f	L_2	L_3
12.6	23	3	13	12
W_2	W_3	W_1	D_2	D_1
13	6	24	10	16
a	b	Total Volume 50x50x1.5		
1	1			

1 .Simulated Results:

A. Return Loss and Antenna Bandwidth:

Figure (2.3) shows the Dual band antenna first band covering the GSM and PCS band at first resonate frequency (1.6 GHz) having a bandwidth of 45 MHz (1.4-2.1 GHz) and second resonate frequency (2.7 GHz) having a bandwidth 165MHz (2.35-2.96 GHz) covering DCS and IMT band. so the proposed antenna is called dual band antenna but also the center point or return loss of both the dips is below 10 dB so it

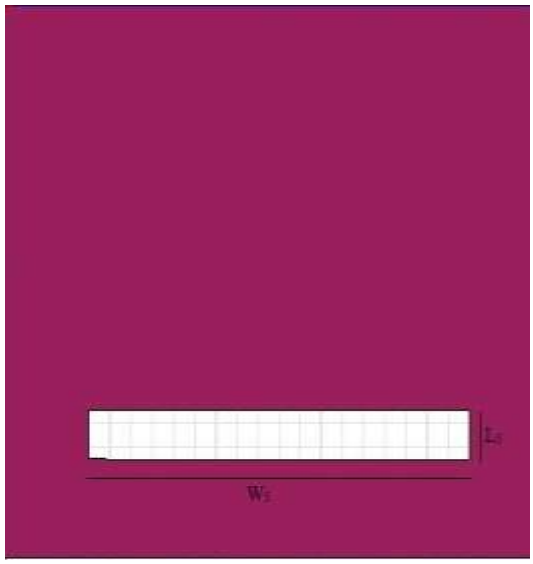


Fig-2.2 structure of back view of antenna

Table 4 :- Dimensions Of Back View Of Antenna (Mm) [2]

is called dual band antenna, covering the better range of frequencies. The value return loss first dip of center point of

L_f	W_1	
4	36	Total Vol. 50x45

S11 at 1.65 GHz is around -15.53 dB and 2.75 GHz is around at -16.83 dB.

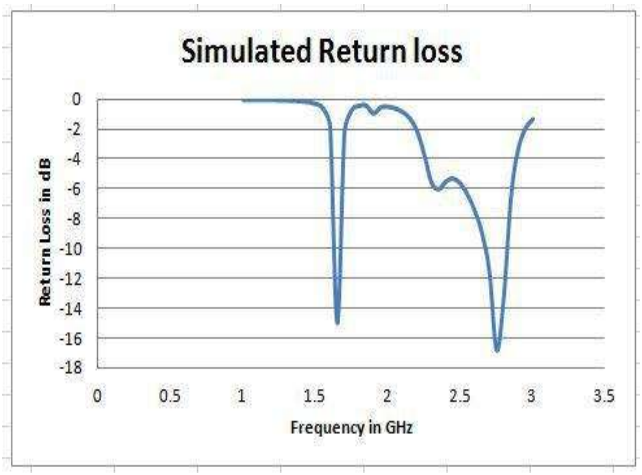
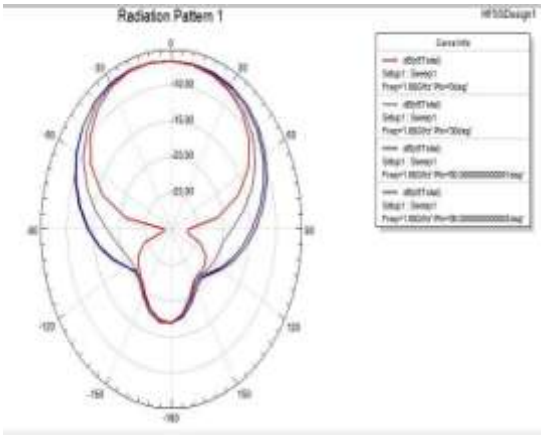


Figure2.3: Return Loss at 1.6 GHz and 2.7GHz[2]

B. RADIATION PATTERN:

The radiation pattern of proposed antenna decribes the realative strength of radiated field in different direction. The proposed antenna has been unidirectional radiation pattern at frequency 1.6 GHz and omnidirectional radiation pattern at

frequency 2.7 GHz which demand for wireless communication systems. The radiation



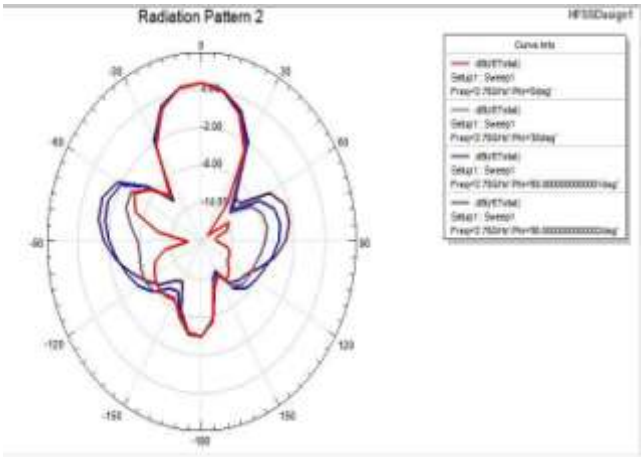


Fig 2.4 Radiation pattern of frequency 1.6 GHz and 2.7 GHz.

CONCLUSION –

In this paper presented the antenna with different designed of antenna . The main purpose of this designed antenna is to differnciate the return loss and radiation pattern of first designed of antenna to the second designed of antenna . The simulated result shows both the antenna is very good impedance matching and give bettern gain of antenna The defected ground structure on ground plane is clearly demonstrated of both the antenna shows the better performance in return loss and radiation pattern as well as better result for the wirelss communication systems.

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