STACKED PATCH ANTENNA FOR SUB 6GHZ APPLICATIONS WITH DGS

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ABSTRACT
In this paper, a dual layer Stacked Patch Antenna is presented for sub 6GHz applications. This antenna is resonating at a frequency of 3.9 GHZ having a 6dB impedance bandwidth from 3.5 GHz to 4.2 GHz (700 MHz) with VSWR < 2, suitable for 5G sub 6 GHz Applications. Usage of 5G Technology is extremely increased because of high data rates.This is designed and simulated using CST microwave studio 2018.ThisStack Antenna offers a wide range of bandwidth from 3.5 GHz to 4.2 GHz(700 MHz)and it is adopted with DGS technique to improve various parameters like Gain, Bandwidth and radiation characteristics. This dual layer stacked antenna designed with two identical substrates which are stacked one on another with dielectric Rogers RT5880 (lossy)and a copper (annealed) feed line with aperture coupling is provided for impedance matching. A H-shape patch is constructed in front end and DGS is constructed on back end of antenna to obtain the desired characteristics. By considering the overall results, this stacked patch antenna is proposed for 5G applications with a peak gain of 4.88dB at 3.5 GHz and 5.98 dB at 3.7GHz with a return loss of -16 dB at 3.9GHz which is suitable for n77,n78 sub 6 GHz bands in 5G applications.

Keywords: Stack Antenna, Defected Ground Structure(DGS), Bandwidth, sub 6GHz bands

I. INTRODUCTION
Humans are being updated day by day with latest technology and making their life more comfortable with technology. In which wireless communications has prominent role, wireless technology can't be possible without Antenna [1]. Micro-strip Antenna is now the most widely used type of antenna in the world. The low profile and low cost in circuit board 5g wireless communication antenna array that increases gain and it is simple to fabricate [2]. A H-Shaped patch antenna is designed using U-slot loaded with patch and provided various parameters like slot length, width along with substrate thickness to improve antenna characteristics [3]. Stacked patch has capability to provide dual frequency characteristics [5]. The fundamental properties of an antenna are Gain, Impedance [4,6-10].

In this research work, double layer stacked patch antenna with a thickness of 1.6 mm of RT5880 substrate is used to get the high gain suitable for n77, n78 sub 6 GHz bands in 5G applications using aperture type of coupling, due to which gain has enhanced. H-Shaped slot on the radiating patch as well as DGS on back end is proposed to radiate the antenna at a frequency of 3.9 GHz with a 6dB operating bandwidth from 3.5 GHz to 4.2 GHz with return loss of -16dB.In this paper, Section I has usage of Antenna for 5G Technology. Section II has Technical design of an Antenna. Section III has Antenna performance parameters

II. Technical design
Area of work : Antenna
Type of Antenna : Micro strip Stack Patch Antenna
Tools Used (Software Used) : CST
Substrate : RT5880 (Lossy)
Thickness : 1.6mm

III. Antenna Design

For the design of the antenna, the two substrate which are stacked and constructed as a multilayer designed circuit board. For design purpose, manually particular frequency should be selected layer the selected of substrate with certain parameters and dielectric contains should be done and the type of feed should also be considered for the design of the perfect antenna these parameters should be taken into consideration. The proposed antenna frequency is also following (I) 3.7 GHz and (II) 3.5 GHz.

The design parameters for the proposed antenna shown in figure 1 and all different dimensions of the antenna are listed in table 1.

- Ground: (Copper-annealed)L=20mm W=25mm
- Lower Substrate: (Rogers RT5880-lossy) L=20mm W=25mm Hs1=1.6mm
- Upper Substrate:(Rogers RT 5880-lossy)L=20mm W=25mm Hs2=1.6mm
- Feed Line:(Copper annealed)L=20mm, w=3mm
- Patch: (Copper-annealed) L=13.50mm W=17.50mm
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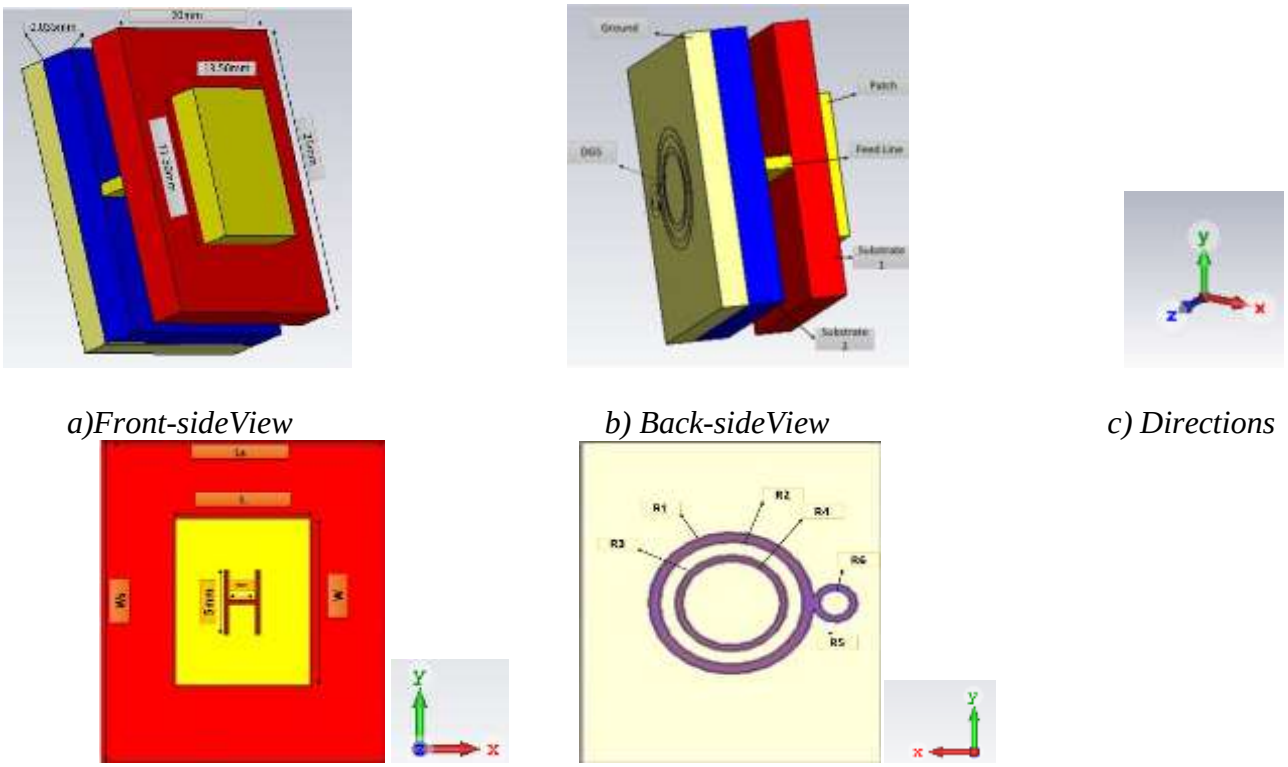


a)Front-sideView *b) Back-sideView* *c) Directions*

d)Front View *e)BackView(DGS)*

Fig, 1: Proposed antenna

Table 1 : Dimensions of the proposed Antenna:

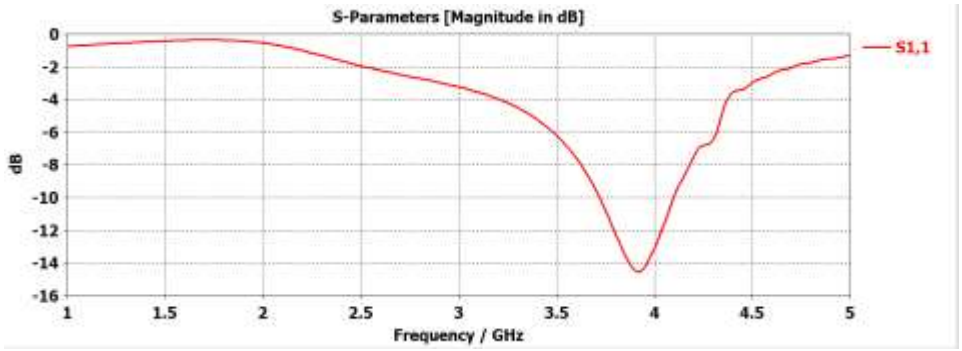
Parameters	Dimensions in mm	Parameters	Dimensions in mm
Ls	40	w	26.08
Ws	50	ht	0.035
Hs2	1.6	wf	2.27
L	18.98	Hs1	1.6
R1	11	R2	9.5
R3	7.5	R4	6.5

R5	3	R6	2.5

IV. *SIMULATION RESULTS:*

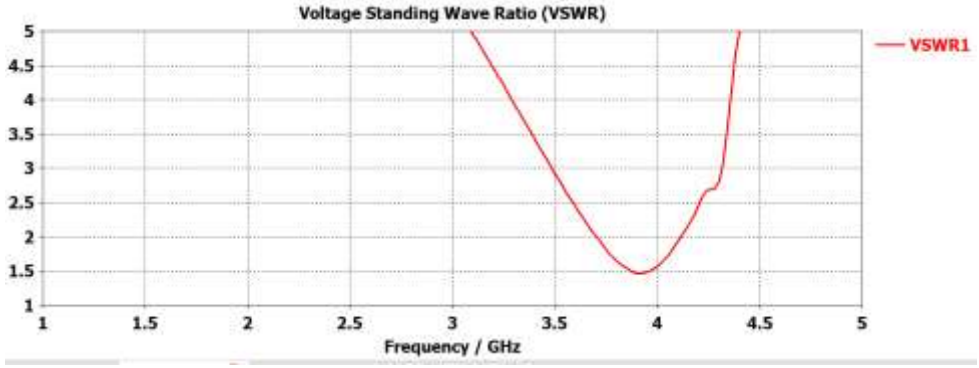
The CST Suite studio 2018 software is used for designing and simulating the antenna. The various parameters used to observe the performance of the antenna are return loss, Voltage standing wave ratio, Current distributions and gain as shown in the following figures for the proposed design is depicted in figure 2.

i) ***Scattering Parameters****:*



a) *Return Loss*

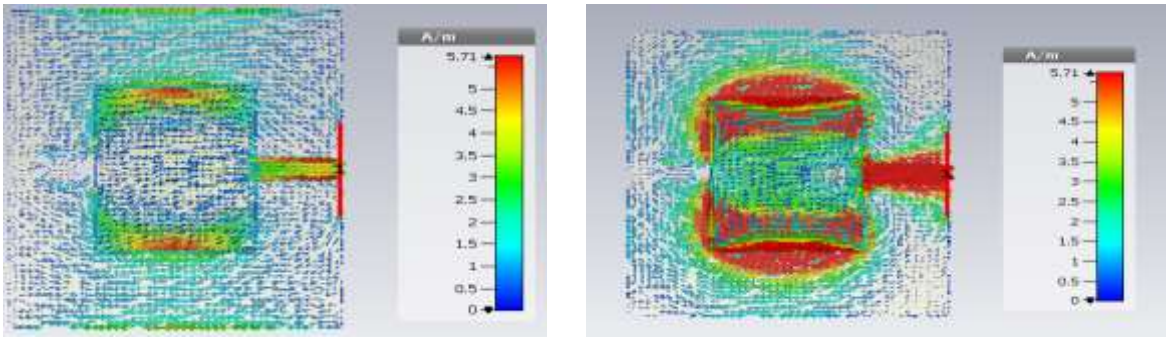
ii) ***VSWR:***



b) *VSWR*

iii) ***Current distributions:***

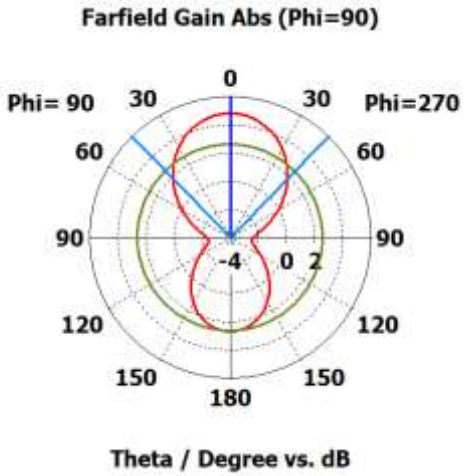
The surface current distribution for the designed antenna at 3.5GHz and 3.7 GHz is shown in figure 3, shows maximum current distribution at the edges as well as feed line position is observed from the current distributions.



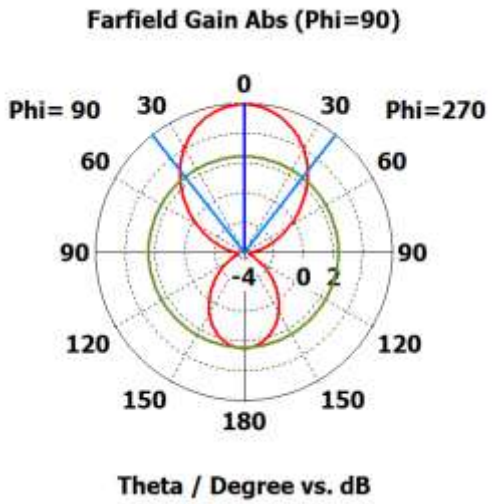
a) 3.5 GHz *b) 3.7 GHz*

c) Current Distributions

iv) *Gain:*



a) 3.5 GHz



b) 3.7 GHz

d) Antenna far-field gain

Fig. 2: Performance parameters of proposed antenna

The maximum gain for the proposed antenna from simulation results is observed to be 4.88 dB 3.5GHz and at 3.7 GHz it is about 5.98 dB as shown in above figure.

V. *Conclusion:*

In this work, initially a single, dual ormulti-layer antenna is designed *with dielectric Rogers RT5880(lossy). A*H-shape patch is designed on front end and DGS shape on back endis proposed to improve the parameters of gain and bandwidth. The designed antenna bandwidth ranges from 3.3 GHz to 4.2GHz and this antenna has the return loss of -16db. The stack patch antenna which is designed is mostly used for n77, n78 sub 6GHz band 5G applications.

VI. *References:*

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