L-Slotted With DGS Coaxial Feed Patch Antenna

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Abstract -- In this paper, a L–shaped microstrip patch antenna with parametric study of the antenna parameters is presented. The proposed antenna is simulated in Ansoft's High Frequency Structure Simulator (HFSS) V11.1.To design the proposed antenna 5.72-5.85GHz frequency band is chosen because this frequency band is being developed for various commercial and noncommercial applications. This frequency band is referred as C-band.

Indexed Terms: L-Shaped, Coaxial feed, HFSS,WLAN and WiMAX

I. INTRODUCTION

In this paper, a coaxial fed L–shaped microstrip patch antenna is presented. The FR4 epoxy dielectric material of relative permittivity 4.4 and loss tangent of 0.019. With the thickness of 1.6mm is used as a substrate of the antenna. The proposed antenna is excited by microstrip coaxial probe feeding technique and probe is located at (--1.8mm, 0mm,-3 mm).

A rectangular shape slot of the dimension of (20.23 mm x 0.5 mm). mm is removed from right edge of the base shape (simple rectangular) to make a L–shaped patch antenna shown in Fig.2. The antenna is simulated upon completion of the design and various results are obtained. The return loss plot for simple base shape, L -shape. Table1 shows the results of return loss plots for the steps in development of the antenna design. Where f_l, f_h and f_r are frequency at lower return loss, frequency at higher return loss, and resonant frequency respectively. From the table, it can be seen that, the bandwidth percentage of base shape is 3.98%, but in final step it has increased to 4.21%.Which covers the frequency band from 5.64GHz to 5.70GHz with return loss -44.13dB. The resonating frequency and return loss are also increased as moved from base shape to L – shaped patch antenna.

II. ANTENNA DESIGN

The development of micro strip antenna technology started in the 1970s. By the early 1980s basic micro strip antenna elements were fairly well established in terms of design and modeling.

The side view of the proposed antenna structure has been shown in Fig.1 .The broad banding technique of slotting technique is used to improve bandwidth. In the first step a simple rectangular micro strip patch antenna has been taken. Size of the antenna is calculated from the basic patch antenna equation (C.A.Balanis,2007) and appropriate changes have been done to make an I shape patch antenna. Coaxial feeding is chosen for the excitation of the proposed antenna.

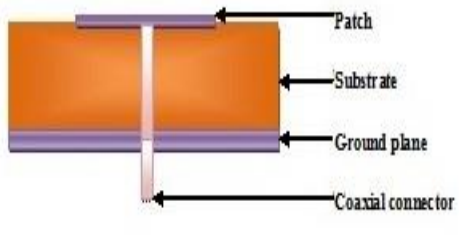

Fig.1. side view proposed antenna structure

In the first step a simple rectangular microstrip patch antenna has been taken as shown in the Fig.1. Size of the antenna is calculated from the basic patch antenna equations [1] and appropriate changes have been done for the desired result. Coaxial feeding is chosen for the excitation of the proposed antenna. A rectangular shape slot of the dimension of (20.23 mm x 0.5 mm). is removed from right edge of the base shape (simple rectangular) to make a L–shaped patch antenna shown in Fig.2

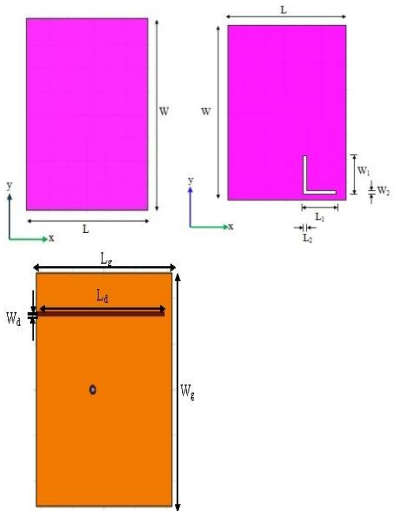

Fig.2 Development of "L" from Base rectangular shape & DGS

Table 1 Results Of Return Loss Plots For Development Of The Design

Antenna Design	f_l (GHz)	f_h (GHz)	f_r (GHz)	Return Loss(dB)	Bandwidth %
Base Shape	5.00	5.21	5.10	-32.66	3.98
L-Shape	4.96	5.10	5.0	-32.47	3.65
DGS	5.64	5.88	5.7	-44.13	4.21

Table.2 Parameters Of The Optimized L–Shapedpatch Antena

Parameters	Dimensions (mm)
L	11.5
W	15.5
L_1	3
W_1	3
L_2	*0.3*
W_2	0.3
Ground	*L x W* = 21.46 x 25.47
Height	1.6
L_d	20.23
W_d	0.5
L_g x W_g	21.46 x 25.47

III. RESULTS

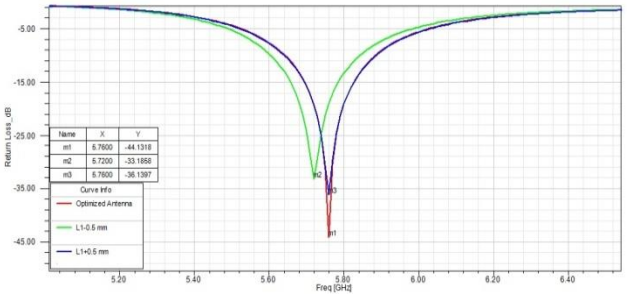

Fig.3Return loss plot for base shape and L–shaped& DGS

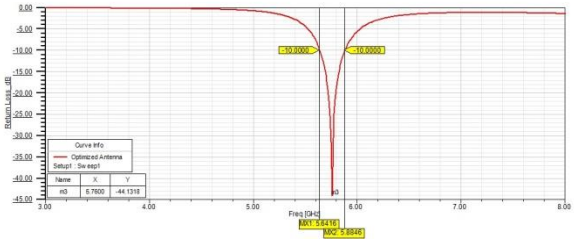

Fig.4 Return loss

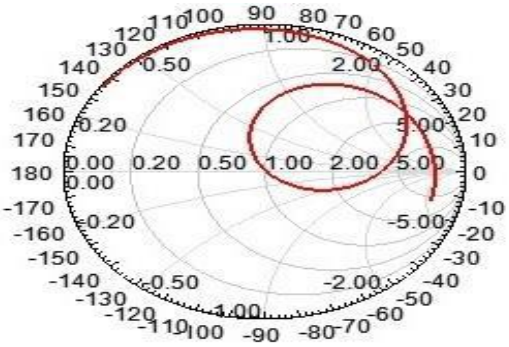

Fig.5 Smith chart of L–shaped patch antenna

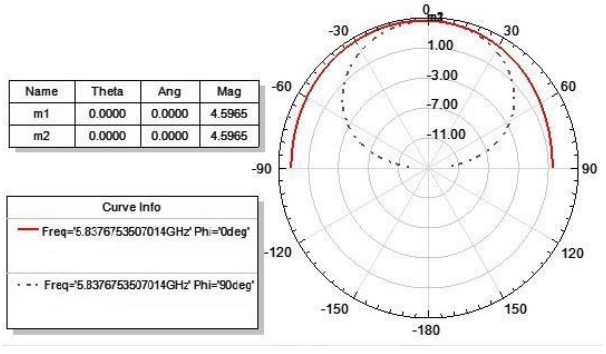

Fig.6 Radiation pattern of L-shaped patch antenna at 5.83

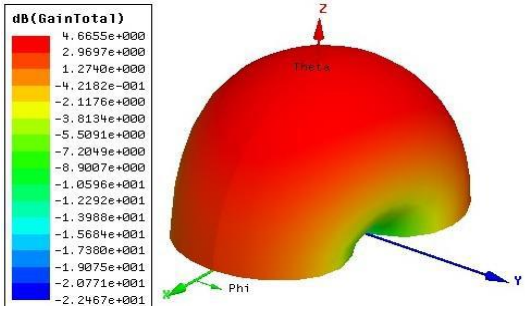

Fig.7. 3D Polar plot of L–shaped patch antenna

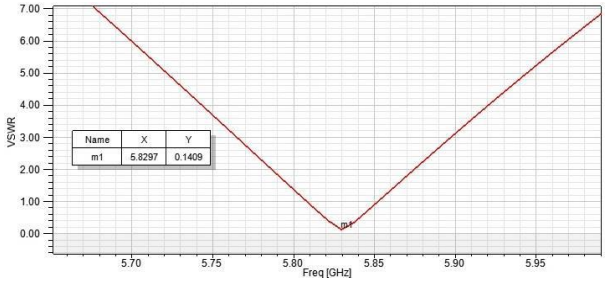

Fig.8 VSWR of L–shaped patch antenna

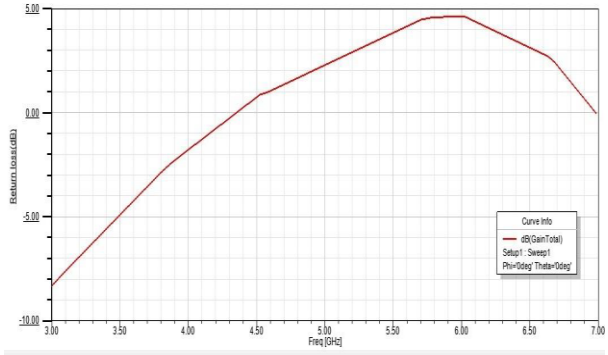

Fig.9 Gain V/s Frequency of L–shaped patch antenna

IV. CONCLUSIONS

The In this paper, a L-shaped patch antenna has been designed with coaxial feeding technique used.

Initially rectangular shape patch is simulated and return loss curve is traced, then a rectangular shape of particular dimension is detached from the base shape such a way that base shape converted into I-shape then. After accomplishment of the design it is retained beneath simulation to get desired result. Here we get better return loss than base shape, and then parametric study of various parameters of the proposed antenna has also been presented. We concluded that return loss increases to some value. The return loss plot of the proposed antenna has been shown that the antenna is resonated from 5.64GHz to 5.70GHz with return loss -44.13dB. So, the proposed antenna can be used for amateur radio and satellite communications. The proposed antenna shows the satisfactory gain in the desired frequency range. In this shape we improved BW% up to 4.21% from 3.98%.

REFERENCES

[1] C. A. Balanis, "Antenna Theory: Analysis and Design", ISBN: 978-81-256-2422-8, New York: John Wiley & Sons, 2007.

[2] R.Garg, P. Bhatia, I. Bahl and A. Ittipiboon, "Microstrip Antenna design handbook", ISBN 0-89006-513-6, Artech House London, 2001.

[3] R.J Chitra, M. Yoganathan and V. Nagarajan, "Co-axial Fed Microstrip Patch Antenna Array for WiMaX and WLAN Application", IEEE International Conference on Communications and Signal Processing, Page:-1159 – 1164, April 2013.

[4] Y. GeEsselle and K.P Bird, "Broadband E-shaped Patch Antennas for 5-6GHz Wireless Computer Networks", IEEE Antennas and Propagation Society International Symposium, vol.2. Page(s): 942 – 945, Publication Year: 2003.

[5] Vishal Kalara, Ruchika Manchanda Effect of change of substrate on I shape patch antenna using slots and stub for wireless applications" International Journal for Research in Applied Science & Engineering Technology (IJRASET) Volume 4 Issue VII, July 2016 PP(199-203))

[6] Dr. Soni Changlani, Shivani Chourasia, Poja gupta Design and Analysis of I-Shaped Microstrip Patch Antenna For Low Frequency" IJIRST –International Journal for Innovative Research in Science & Technology| Volume 1 | Issue 6 | November 2014 ISSN (online): 2349-6010 PP (320-324

[7] Hassan M. Elkamchouchi , Rateba A. Salem "Microstrip Patch Antenna with Double I Slot for Wide Band Applications" SSRG International Journal of Electronics and Communication Engineering (SSRG-IJECE) – Volume 3 Issue 3–March 2016(26-28)

[8] P. Moghe and P.K Singhsal, "A Wideband Electromagnetic-Coupled Single-Layer L-

shaped Microstrip Patch Antenna", IEEE International Conference on System Emerging Trends in Electronic and Photonic Device, Page(s): 307-309,Year 2009.