www.ijecs.in
International Journal Of Engineering And Computer Science ISSN:2319-7242
Volume 3 Issue 1 January, 2014 Page No.3784-3788

COMPARATIVE ANALYSIS of LINEARLY POLARIZED PATCH ANTENNA for WI-FI and WLAN APPLICATIONS

Meghna Kucheria[1] Vijendra Maurya[2] Parikshit Vasisht[3], Taruna Sharma[4] Dr. Neela Chattoraj[5],

[1]Mtech Student
[2] Assistant Prof(E&TC) GITS Udaipur
[3] Assistant proffesor in APEEJAY STYA UNIVERSITY, Sohna
[4]Ph.D student in Y.M.C.A.U.S.T , Faridabad
[5] Assosiate Professor - Bit mesra Ranchi

[1]meghna.kota@gmail.com
[2]mail-maurya.vijendra@gmail.com
[3]parikshit.vasisht@asu.apeejay.edu
[4]parashar.taruna@gmail.com
[5]nchattoraj@bitmesra.ac.in

Abstract- This paper presents novel compact, single feed, rectangular linearly polarized, Microstrip antenna for WI-FI and WLAN application, point to point and multipoint wireless communication. The proposed antennas fed by 50Ω impedance thin microstrip designed in both CST MWS and HFSS software. Proposed design shows tremendous return losses at frequencies of 4 GHz and 5GHz. 5 GHz band offers a clean radio environment for Wi-Fi without nuisance from virtually all non-Wi-Fi interference sources. The software used for the simulation is the CST Microwave Studio and HFSS which are an analytical tool that provides an accurate 3D EM simulation results for high frequency design. This work presents the comparison of two antenna analysis software and at the same time with the fabricated antenna.

1. INTRODUCTION

Microstrip antennas are attractive due to their light weight, conformability, low cost and ease of fabrication [1-3].These antennas can be integrated with printed strip -line feed networks and active devices. In its most fundamental form, a Microstrip patch antenna consists of a radiating patch on one side of a dielectric substrate which has a ground plane on the other side. For a rectangular patch, the length of the patch is usually $0.3333\lambda_0 < L < 0.5\ \lambda_0$, where λ_0 is the free space wavelength. The patch is selected to be very thin such that $t << \lambda_0$(where t is patch thickness).The height h of the dielectric substrate is usually $0.003 \leq h \leq 0.05\ \lambda_0$. The dielectric constant of the substrate(ε_r) is typically in the range $2.2 \leq \varepsilon_r \leq 12$[6].

Microstrip antenna radiates primarily because of the fringing fields between the patch edge and the ground plane. For good antenna performance, a thick dielectric substrate having a low dielectric constant is desirable since this provides better efficiency, larger bandwidth and better radiation [6].However such a configuration leads to a larger antenna size. In order to design a compact Microstrip patch antenna, substrate with higher dielectric constants must be used which are less efficient and results in narrower bandwidth [5].

Proposed antenna used Microstrip line feed technique. The purpose of inset cut in the patch is to match the impedance of the feed line to the patch without the need for additional matching element. This is achieved by properly controlling the inset position [4].Patch antenna is analysed using transmission line model .Hence this is an easy scheme, since it provides ease of fabrication and simplicity in modelling as well as impedance matching. Linearly polarized single feed Microstrip antenna are widely employed in cordless phones which do not use the 2.4 GHz band, Using the 5GHz band, DECT 6.0 (1.9 GHz), 5.8 GHz or 900 MHz phones, commonly available today, do not use the 2.4 GHz band and thus do not interfere. VoIP/Wi-Fi phones share the Wi-Fi base stations and participate in the Wi-Fi contention protocols.

II. ANTENNA GEOMETRY AND DESIGN

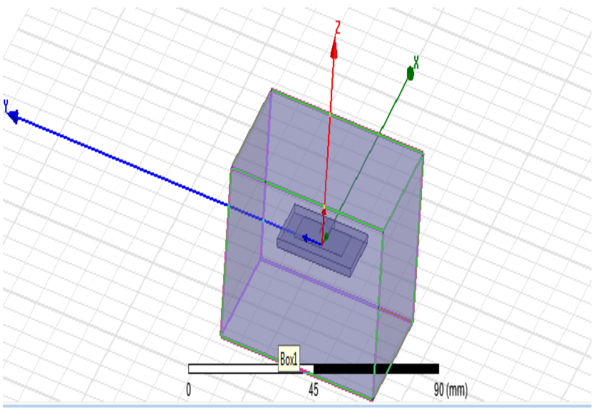

Fig.1 Geometry of the antenna (W=23.36mm, L=27.86 mm, h=1.6,

Geometry of the proposed antenna is illustrated in Fig.1. As shown initially, the dimensions of the slot are 34x34x0.508 mm^3. The inset recess dimensions are calculated [1] and length of the recess is Fig. 2 shows the surface current distribution of the proposed antenna for centre frequency of 5 GHz.

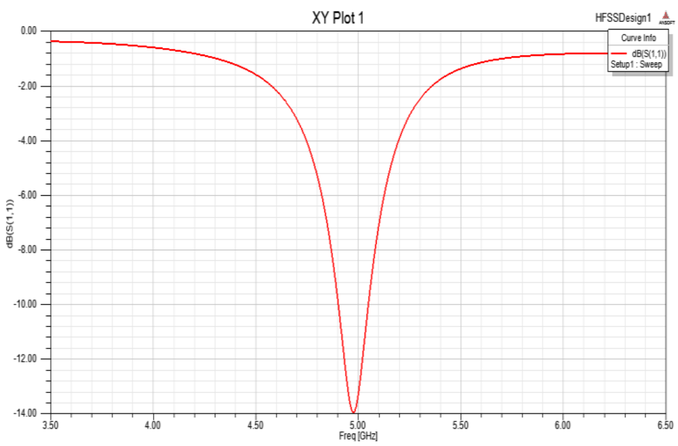

Fig 2 S11 parameters /Return loss of patch antenna at 5 GHz

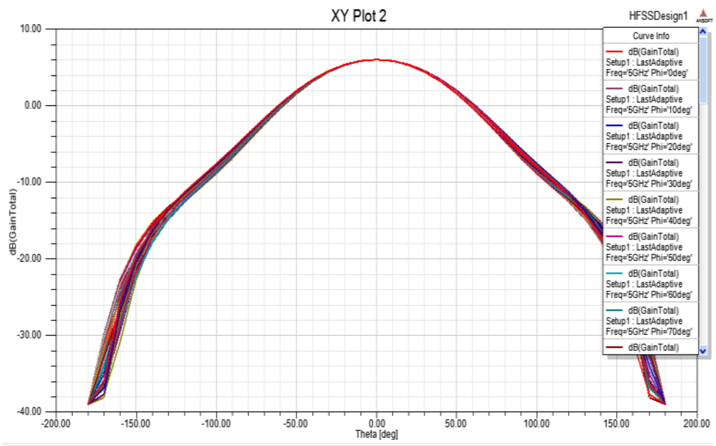

Fig 3 gain v/s frequency plot of patch antenna at 5GHz

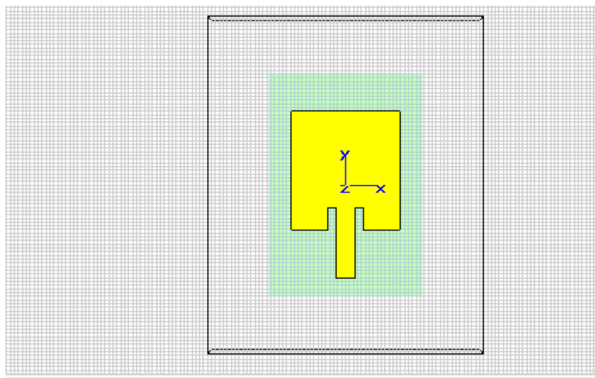

Fig.4 Geometry of the antenna (W=28mm, L=32 mm, h=1.6)

As shown in fig .4 the microstrip patch has the dimensions of Width= 28mm, length =32 mm and height of substrate is 1.6 made up of FR4 epoxy substrate having dielectric constant of 4.4.Fig. 5 shows the return loss graph of the same and Fig. 6 shows the bandwidth of the antenna.it shows a band width of 1.5%.

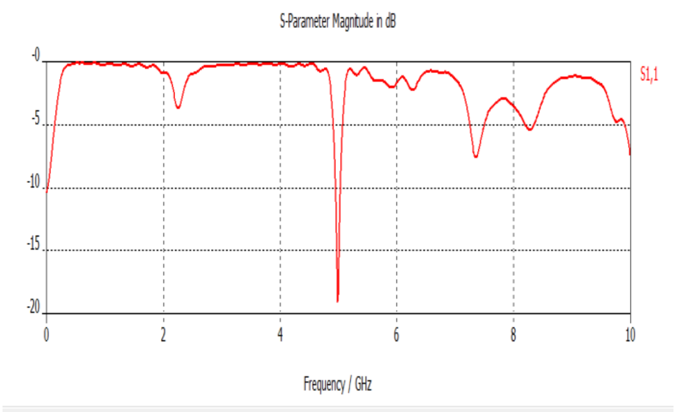

Fig 5 S11 parameters /Return loss of patch antenna at 5 GHz

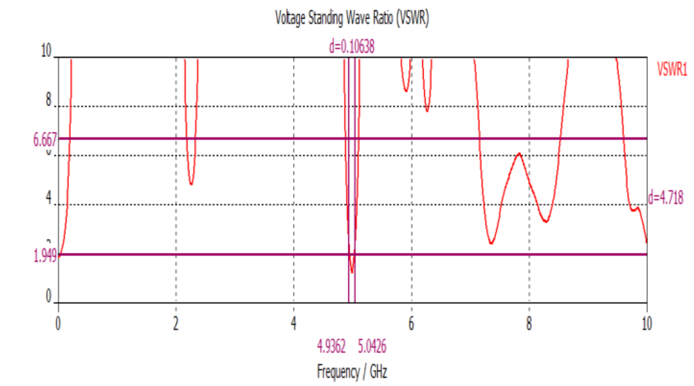

Fig 6. VSWR v/s FREQUENCY curve.

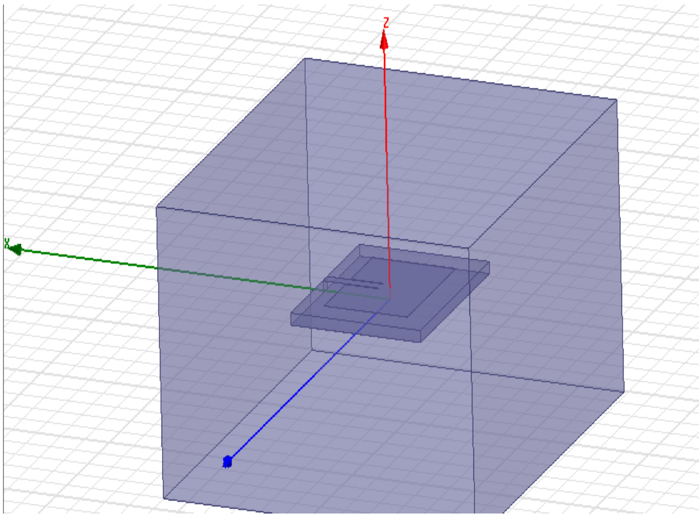

Fig.7 Geometry of the antenna (W=22.8mm, L=17.1 mm, h=1.6)

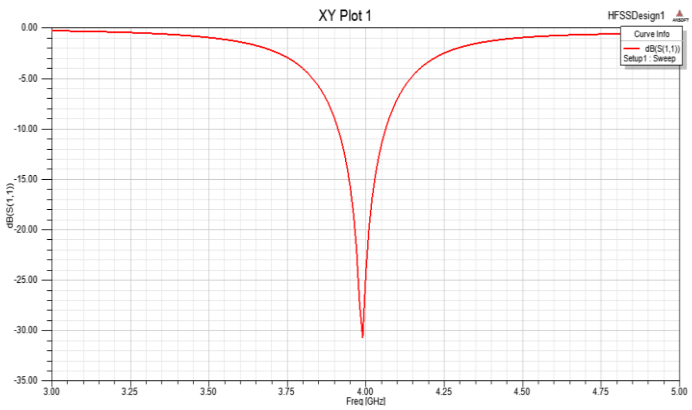

Fig 8 S11 parameters /Return loss of patch antenna at 5Ghz

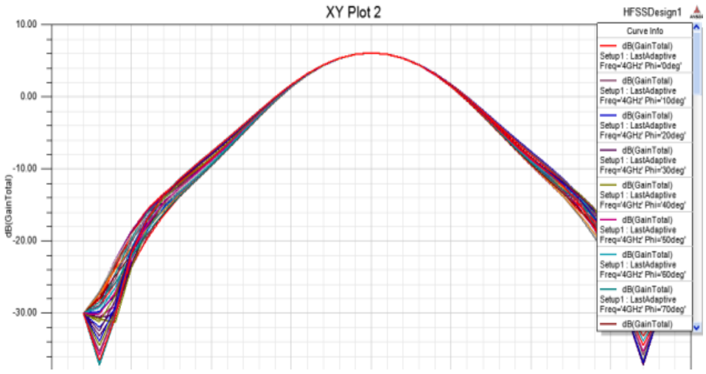

Fig 9 gain v/s frequency plot of patch antenna at 5GHz

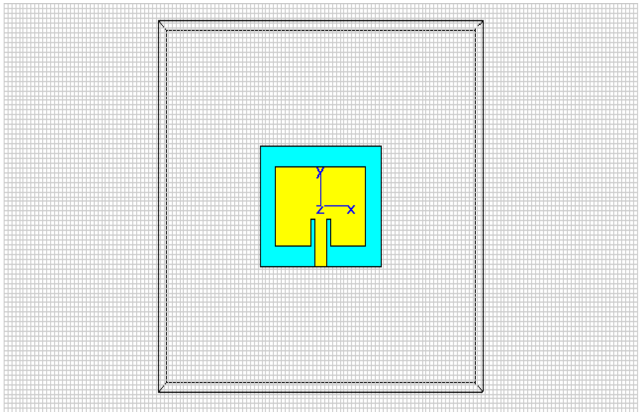

Fig.10 Geometry of the antenna (W=22.8mm, L=17.1 mm, h=1.6)

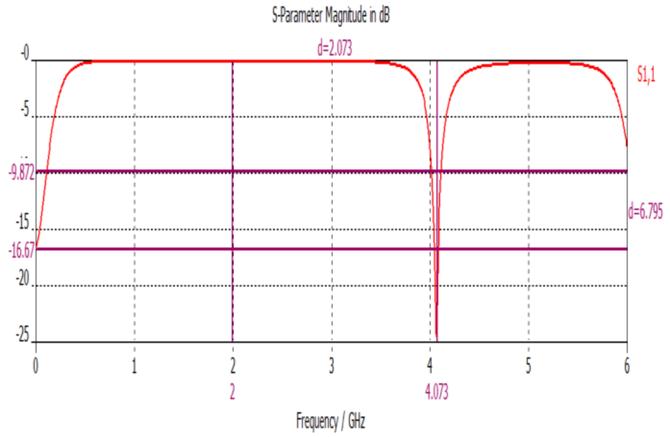

Fig 11 S11 parameters /Return loss of patch antenna at 5 GHz

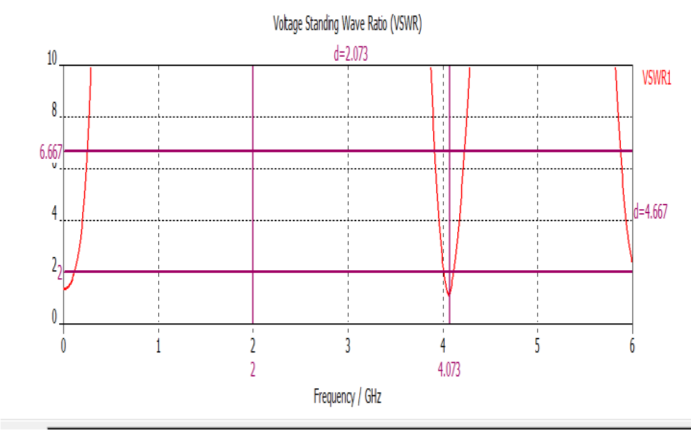

Fig 12. VSWR v/s FREQUENCY curve.

III. RESULTS AND DISCUSSION

Proposed antenna is simulated by taking ε_r=4.4.Antenna is resonating at 4.9895 and 4.99 when It is designed for 5 GHz frequency. By taking S11≤- 10 db and VSWR= 2:1 the bandwidth calculated for resonating frequency comes out to be ≥ 1.5%. Another antenna is simulated by taking ε_r=4.4 designed for 4 GHz. Antenna is resonating at 4.065 and 3.99 when It is designed for 4 GHz frequency. By taking S11≤-10 db and VSWR= 2:1 the bandwidth calculated for resonating frequency comes out to be ≥ 2.33%. Data is tabulated in Table 1,which indicates all the frequencies and their corresponding achieved frequencies along with dimensions and the feed type available.

s.no.	Software used	Center frequency Designed for	Actual achieved frequency	%Bandwidth	Gain (in dB)	S11 parameter	Shape of patch	Feed type	Dimensions of patch
1.	Cst MWS	5 GHz	4.9895	1.5%	4.615	-20	Rectangle	Inset feed	28x32x0.01
2.	Hfss	5 GHz	4.99		6	-14	Rectangle	Inset feed	23.36x27.86x0.01
3.	Cst MWS	4 GHz	4.065	2.33%	5.897	-25	Rectangle	Inset feed	22.8xx17.1x0.01
4.	Hfss	4 GHz	3.99		6	-32	Rectangle	Inset feed	22.8x17x.0.01

Table 1. Parametric comparison of various simulated and fabricated antenna

IV. CONCLUSION

We can say that these designed antennas, which are showing marvellous 1.1 VSWR and very good S11 parameter i.e. the return losses, can make their use in the industry as the viable options at the presently established antennas. Optimization can still be performed in the case of Dielectric resonating antenna but at the present time also ISM bands (The ISM bands are defined by the [ITU-R] in 5.138, 5.150, and 5.280 of the Radio Regulations) is covered in the present design it can be used as ISM antenna at these frequencies

References

[1] K. F. Lee, Ed., Advances in Microstrip and Printed Antennas, John Wiley, 1997

[2] D. M. Pozar and D. H. Schaubert, Microstrip Antennas: The Analysis and Microstrip Antennas and Arrays, IEEE Press, 1995.

[3] Chen, W.-L. and G.-M. Wang, \Small size edge-fed Sierpinski carpet microstrip patch antenna," *Progress In Electromagnetics Research C*, Vol. 3, 195{202, 2008.

[4.] K. Wong and W. Hsu, "A broadband patch antenna with wide slits," in IEEE Antennas and Propagation International Symposium, vol. 3, (Salt Lake City, Utah),pp. 1414– 1417, IEEE, July 2010

,[5] R. Garg, P. Bhartia, I. Bahl, and A. Ittipiboon, Microstrip Antenna Design Handbook, Artech House, 2000

[6]. Balanis, C. A., *Antenna Theory: Analysis and Design*, 811{862