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Design and Analysis of Mircostrip Patch Antenna Array for WLAN

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***Abstract*--In the last decade, huge development in the field of wireless local area network (WLAN).The performance depend on the shape and size of the antenna. The future aim of wireless communication is to provide data with high speed data range even in harsh geographical areas. Here aim is to design an cascade patch antenna array with maximizing the antenna gain and minimizing the radiation loss using high frequency structure simulator(HFSS).we will use epoxy F4(4.4) as substrate due to its suitable mechanical and insulating properties. Resonant frequency used will be 2.4 GHz and height will be 1.6 mm.**

Keywords-**Microstrip Patch antenna, Substrate, Dielectric constant, Resonating frequency**

I. INTRODUCTION

Microstrip patch antenna are increasingly use for commercial purpose. It is easy to fabricate comfortable on curved path of the devices. Hence it is easy to integrate them with microwave integrated circuits (MICs)[1-5]. They are light weight, small size and therefore end up with small device. It can be of various shape rectangular, circular, elliptical etc. We choose the shape which is nest suitable for the device application. The resonant frequency 2.4GHz is reserved band according to the Federal Communication system (FCC).The antenna comprised of three main parts ground, substrate and patch at the top. The ground plane is bottom most layer with negligible thickness. Substrate used will be epoxy F4(4.4) for its suitable mechanical and insulating properties height of the substrate is 1.6mm.At top there is a metal patch with dimensions length(L) and width(W).A similar another patch antenna will be made and cascaded with another,in this way antenna array antenna will be formed. A series feed cascaded antenna array will give high gain and shows efficient working[6-12].

Both the antenna have a distance, d. The variation in ‘d’ will result in variation in gain .our aim is to maximize the gain and minimize the loss for different iterations of ‘d’ .The matching impedance is 50 Ohm. So we will analyze the reflection coefficient, radiation pattern that occur internally.

Design of series feed antenna array-In this array antenna two single patch antenna are cascaded and Let the distance between them is “d”. The parameters of the antenna are computed on resonant frequency 2.4GHz.

II. ANTENNA CONFIGURATION AND DESIGN

In this we will discuss about patch antenna simulated by High Frequency Structure Simulator (HFSS) Software**.**

A microstrip patch antenna is designed and simulated here. The aim is to design the antenna with proper feed. In this we use microstrip feeding technique is used.

Geometrical specification of single patch antenna [2]-

$$W = \frac{1}{2fr\sqrt{\mu_\circ \varepsilon_\circ}} \sqrt{\frac{2}{\varepsilon_{reff+1}}}$$

$$\varepsilon_{reff} = \frac{\varepsilon_r + 1}{2} + \frac{\varepsilon_r - 1}{2}$$

$$L = \frac{1}{2f_r\sqrt{\varepsilon_{reff}}\sqrt{\mu_\circ \varepsilon_\circ}} - 2\Delta_l$$

$$\frac{\Delta_l}{h} = 0.412\frac{(\varepsilon_{reff} + 0.3)(\frac{W}{h} + 0.264)}{(\varepsilon_{reff} - 0.258)(\frac{W}{h} + 0.8)}$$

With the help of these formulas we design the substrate having dimension 38.10x29.43x 1.6

The substrate used will be epoxy F4 with $\varepsilon_r = 4.4$ with 1.6mm thickness

Here, W is the width of the patch. ε_r is the dielectric constant. μ_0 is permeability. ε_0 is the permittivity. ε_{reff} is the effective dielectric constant. The length of the patch is ‘L’.The resonant frequency is f_r. The performance parameters are:

1. **Directivity**

In antenna, the ratio of radiation intensity in a direction to that of radiation intensity averaged in all direction [1].

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$$D = \frac{4\pi U}{P_{rad}}$$

2. Gain

It is the ratio of the intensity in a direction to the radiation intensity that will be obtained if the power accepted were radiated isotropically.

$$G = 4\pi \frac{Radiation\ intensity}{Total\ input\ power}$$

3. Bandwidth

The BW is defined as range of frequency in the performance in the antenna. It can be on either side of the central frequency. There are two types of bandwidth narrow and broad.

$$B.W = f_h - f_l$$

4. Return loss

Return loss is the reflection of the signal power from insertion of a device. It is expressed in dB.

$$R.L = 10\ Log\ \frac{P_r}{P_i}$$

Design of series feed antenna array:

Symbol	Quantity	Values (in mm)
W	Width	38.10
L	Length	29.43
h	Thickness of the substrate	1.6
g	Gap between patch and feed line	0.3
L_f	Length of the feed	20.95
y	Inset Depth	10.38
W_f	Width of the feed	2.6
a, b	Effective length and Width	5

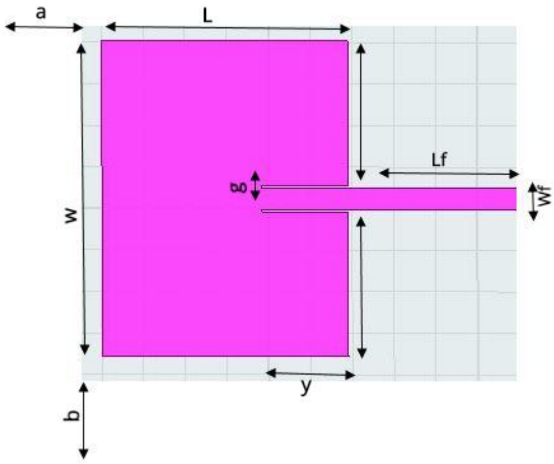

Fig.1. Single patch

Thickness, Wf, of the feed is kept 2.57mm and inset depth, y, is 10.38 mm to match the input impedance. The 'g' gap between feed line and the patch is 0.3 mm.

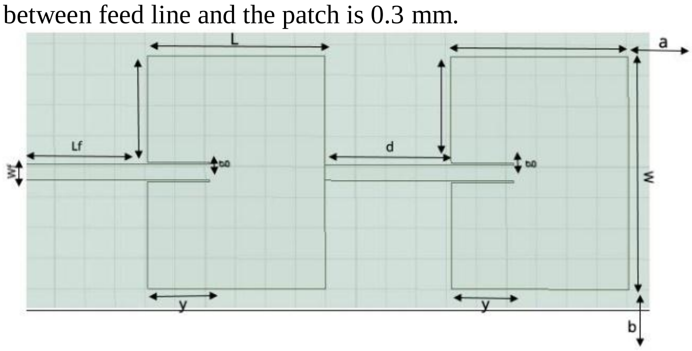

Fig.2 Antenna array

The series-feed microstrip patch antenna designed by connecting two designs in array or cascade. (d is the distance between two cascaded stages)

III. RESULTS

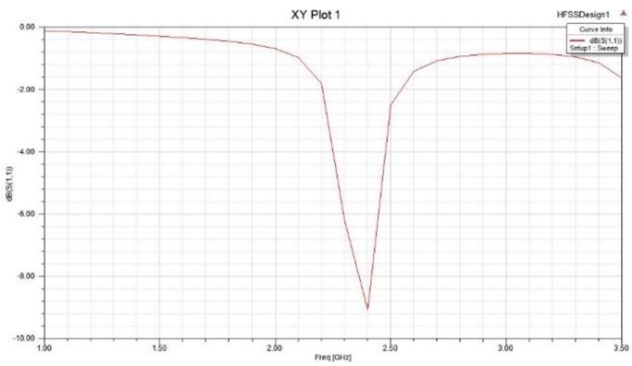

Fig 3 (a) Return Loss of single microstrip patch antenna

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Return loss graph shows minimum loss of -9 dB at frequency 2.4GHz in case of single patch microstrip patch antenna.

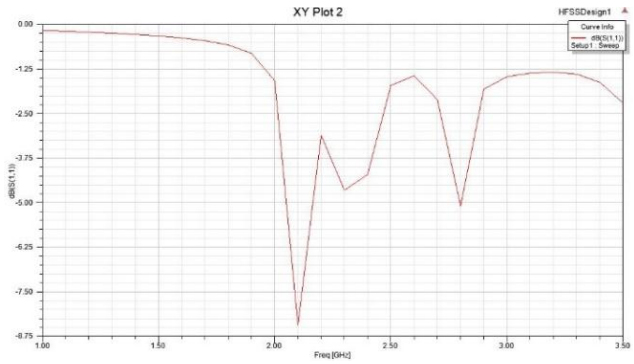

Fig 3(b) Return loss graph of array antenna

Return loss graph in case of array antenna shows in band of frequencies i.e. from 2.1 GHz to 2.4 GHz. At 2.1 GHz the minimum loss is -8.50 dB and at 2.4 GHz the minimum loss is -4.25 db. It shows that the return loss in array antenna as compared to single patch antenna is low.

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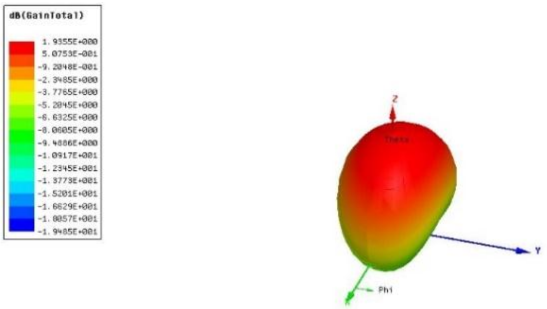

Fig 4 (a)Gain of single microstrip patch antenna

While finding the gain of antenna in case of single patch antenna is 1.93 dB.The gain pattern shown in Fig. 4 (a) and Fig. 4 (b) shows the gain pattern in 3 Dimensions.

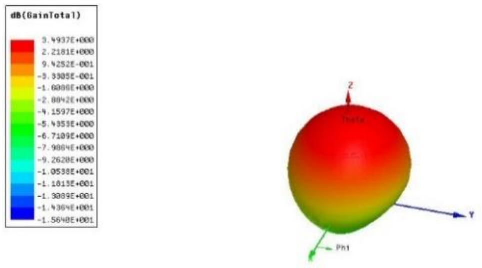

Fig 4 (b) Gain of array antenna

In fig 4(b) the array antenna made by cascading the two single patches is 3.49dB which is greater than the single patch antenna

Parameter	Single Patch Antenna	Antenna Array(Series Feed)
Gain	1.93 dB	3.49 dB
Return Loss	-9 dB at 2.4 GHz Frequency	-8.50 at 2.1 GHz Frequency -4.25 at 2.4 GHz Frequency

IV. CONCLUSION

A design and after that simulation has done for the antennas which has been designed with the parameters 48.02x55.39x1.60 mm^3 for the single antenna and 48.02x105.78x1.60mm^3 for the cascade antenna. It is observed that the designed array antenna has showed increment in gain 3.49 dB as compared to single patch antenna 1.93 db. This increase in the gain is obtained in compensation with return loss. This array antenna operates at dual frequencies which make it suitable to provide data with high speed data range even in harsh geographical areas. For 4G (VoLTE, long term evolution band 3), 5^{th} Generation and other WLAN applications.

V. REFERENCES

1 C. A. Balanis, (2005).Antenna Theory, Analysis and Design, John Wiley and Sons,
2 P. D. M.,(1995). Microstrip Antenna, IEEE Press.
3 M. Sathish, (2017) .Design, Analysis and Gain Enhancement of a Series-Fed Microstrip Patch Antenna Array for Wireless Applications. Journal of Chemical and Pharmaceutical Sciences,(pp.123=128)

4 P. S. Bikash Ranjan Behera,(2016).Rectangular Microstrip Patch Antenna for Wireless Fidelity Application, in IEEE International Conference on Recent Trendsin Electronics Information Communication Technology.(pp.345-350)
5 Chakraborty U(2014).Compact dual-band microstrip antenna for IEEE 802.11a WLAN application," IEEE Antennas and Wireless Propagation Letters,(pp. 407-410)
6 Y. K. S.H(2012).Design of 4 Elements Rectangular Microstrip Patch Antenna with High Gain for 2.4 GHz Applications.Modern Applied Science.(pp.4-10).
7 Lee C.J(2011).Small Antennas Based on Composite Right/Left Handed Structures, Concept, Design and Applications.IEEE Antennas and Propagation Magazine.(pp. 34-50).
8 C Kumar and R Goyal (2018.)Performance analysis of hybrid optical amplifiers for super dense wavelength division multiplexing system in the scenario of reduced channel spacing, Mapan .(pp.159-164).
9 C Kumar and R Goyal(2018). L-Band Flat-Gain Raman with Erbium-Doped Fluoride Hybrid Optical Amplifier for Superdense Wavelength Division Multiplexing System, Journal of Russian Laser Research.(pp.263-266).
10 C Kumar and R Goyal (2018).Performance evaluation of hybrid optical amplifiers for super dense wavelength division multiplexing system with 25 GHz channel spacing, Journal of Nanoelectronics and Optoelectronics.(pp.275-280).
11 C Kumar and R Goyal(2018).A novel flattened gain C-band cascaded hybrid optical Raman and thulium-doped fluoride fiber amplifier for super dense wavelength division multiplexing system, Optica Applicata.(pp.2-10).
12 C Kumar and R Goyal (2019).Performance Evaluation of RAMAN-Erbium-Doped Fiber Amplifier-RAMAN Hybrid Optical Amplifier in the Context of High Spectral Efficiency, Journal of Nanoelectronics and Optoelectronics.(pp.663-668)

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