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PERFORMANCE EVALUATION OF MICROSTRIP PATCH ANTENNA FOR X- BAND APPLICTIONS

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ABSTRACT

In this paper, a design of Microstrip Patch Antenna for X- Band applications is proposed. The input impedance of the antenna is 50Ω. The Proposed antenna resonates at9.00 GHz, 9.85 GHz, 10.71 GHz having return loss valuesof-30.90 dB, -14.52 dB and -11.78 dB respectively. The total bandwidth of the proposed patch antenna is2.16GHz. The antenna is fed by a coaxial probe feed. The Rogers RT/ Duroid 5880 (tm) is used as a substrate with dimensions of 30mm x 30mm in X and Y directions and having a thickness of 1.6mm. The results are simulated by using Ansoft HFSS software. Also gain, directivity and bandwidth of the proposed antenna are studied.

Keywords: Microstrip, Bandwidth, Gain, X- Band

I. INTRODUCTION

Today's wireless communication systems demand wider bandwidth, multiband or dual band and low profile antennas for different applications. An antenna is an important element of the wireless system. Antenna is an electrical device that transmits the electromagnetic waves into the space by converting the electric power given at the input into the radio waves at the transmitter side and at the receiver side the antenna intercepts these radio waves and converts them back into the electrical power. There are so many systems that uses antenna such as remote controlled television, cellular phones, satellite communications, spacecraft, radars, wireless phones and wireless computer networks. Increase in the satellite communication and use of antennas in the aircraft and spacecraft has also increased the demands a low profile antenna that can provide reliable communication [1-5].Wireless operations, such as long distance communications, are impossible or impractical to achieve with the use of wires. With the advancement of the technology, now the electromagnetic spectrum, outside the visible region, has been employed for communication, through the use of radio. The proposed antenna resonates at multiplefrequencies of 9.0 GHz, 9.85 GHz and 10.71 GHz and the total bandwidth achieved is 2.16 GHz.

II. ANTENNA DESIGN

In this proposed design of antenna the substrate is of Rogers RT/ Duroid 5880 (tm) whose relative permittivity is 2.2, the dimensions of the substrate is 30mm x 30mm in X and Y directions and having a thickness of 1.6mm.The dimensions of the rectangular patch is 18mm x 20mm, the coaxial feed is used with inner and outer dimension of 0.5mm and 2.2mm respectively. The input impedance of the antenna is 50Ω,two rectangular slots

are cut in order to get better results. The proposed design is simulated using Ansoft HFSS Software. Fig.1 and Fig.2 represents the top and side view of the proposed antenna.

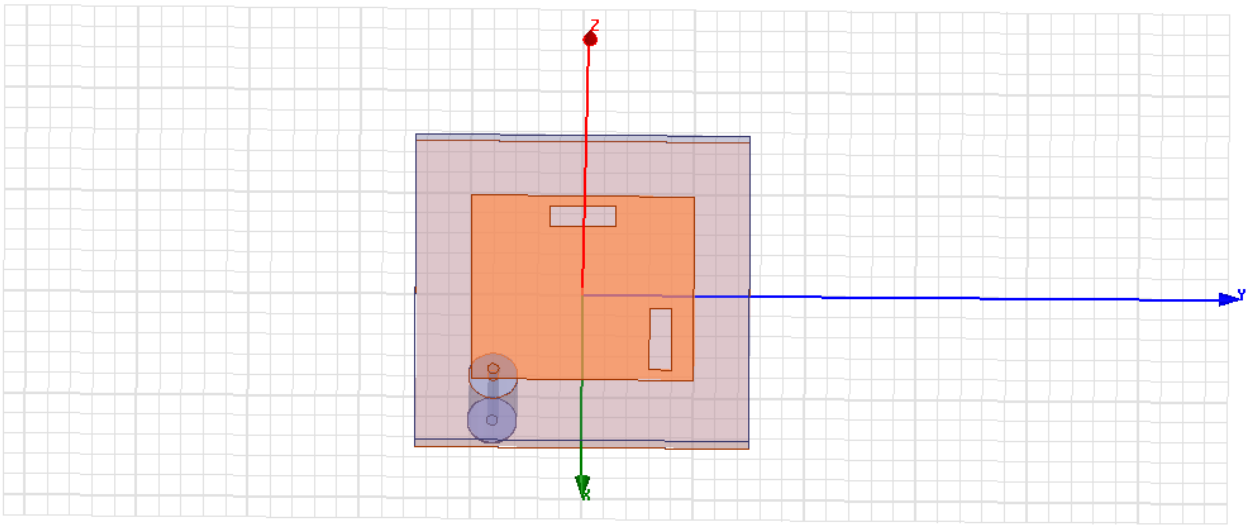

Fig.1: Top view of Proposed Antenna

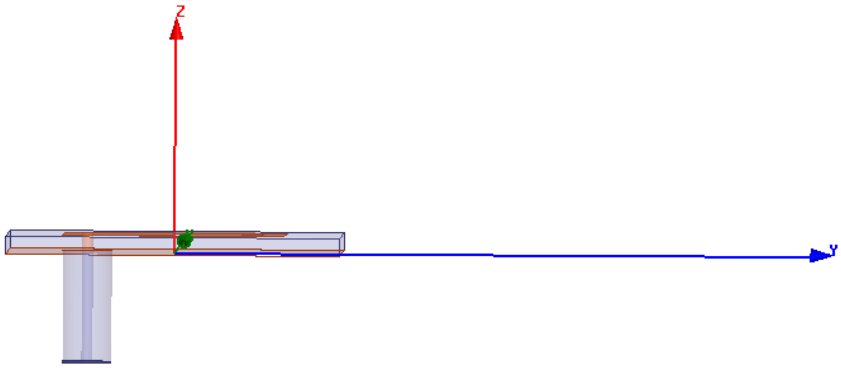

Fig.2: Side view of Proposed Antenna

II. SIMULATED RESULTS AND DISCUSSION

The simulated results of the proposed antenna are presented as figures given below:

2.1 Return Loss and Antenna Bandwidth

Fig.3shows S_{11} parameters (return loss) for the proposed antenna thatresonatesat9.00 GHz, 9.85 GHz, 10.71 GHz having valueof-30.90 dB, -14.52 dB and -11.78 dB. The bandwidth of the antenna can be said to be those range of frequenciesoverwhichthe returnlossisgreaterthan-8dB (correspondstoaVSWRof3).Thus,thebandwidthof antennacanbecalculated fromreturnloss versusfrequencyplot. The total bandwidth of the proposed patch antenna is2.16GHz.

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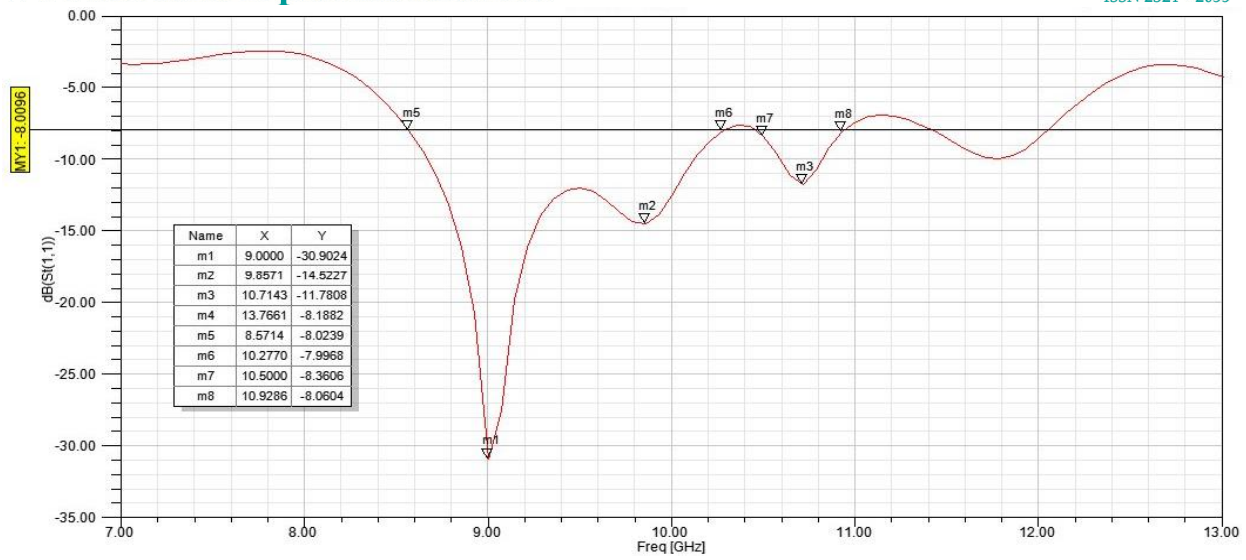

Fig.3: Simulated ReturnLoss S_{11} (in dB)

2.2 Smith Chart

The Smith Chart plot (Fig.4) represents that how theantenna impedance varies withfrequency.Multiple circles describes that the proposed antenna is a multi-band antenna. Also, from these circles, large bandwidth of the antenna is given. For proper matchingthe locusmustbe largeenoughthatit passes through thecenterofthesmith chart. As,itcanbe seenfromthe figure 2 thatthe circle cuts the resistive part at four different values 0.02, 0.15, 0.34 and 0.55 and it is normalized to 50 ohm for perfect matching.

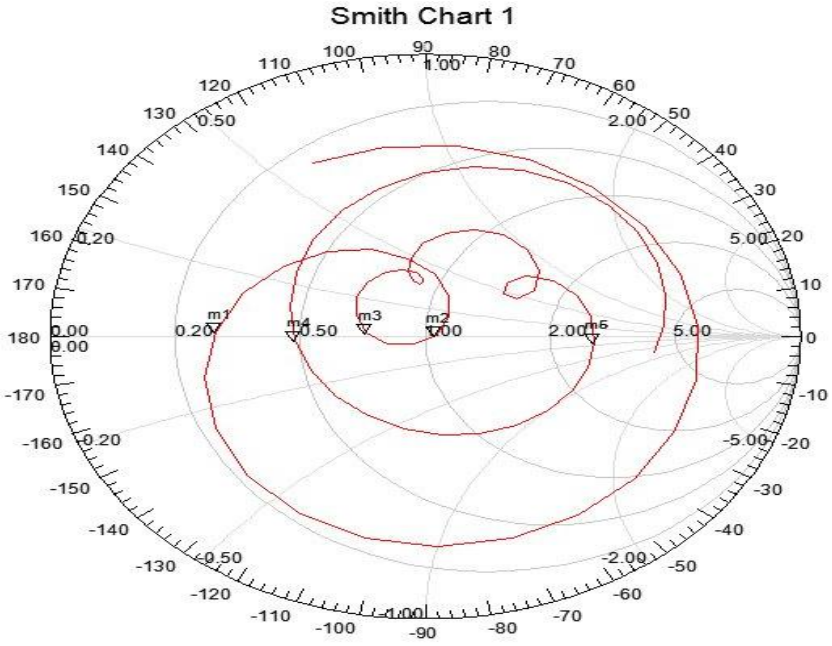

Fig.4: Simulated SmithChart

2.3 Voltage Standing Wave Ratio (VSWR)

Fig.5 indicates the voltage standing wave ratio (VSWR) of the proposed X-band antenna.. It shows 0.49 and 3.3 VSWR at resonant frequencies respectively.

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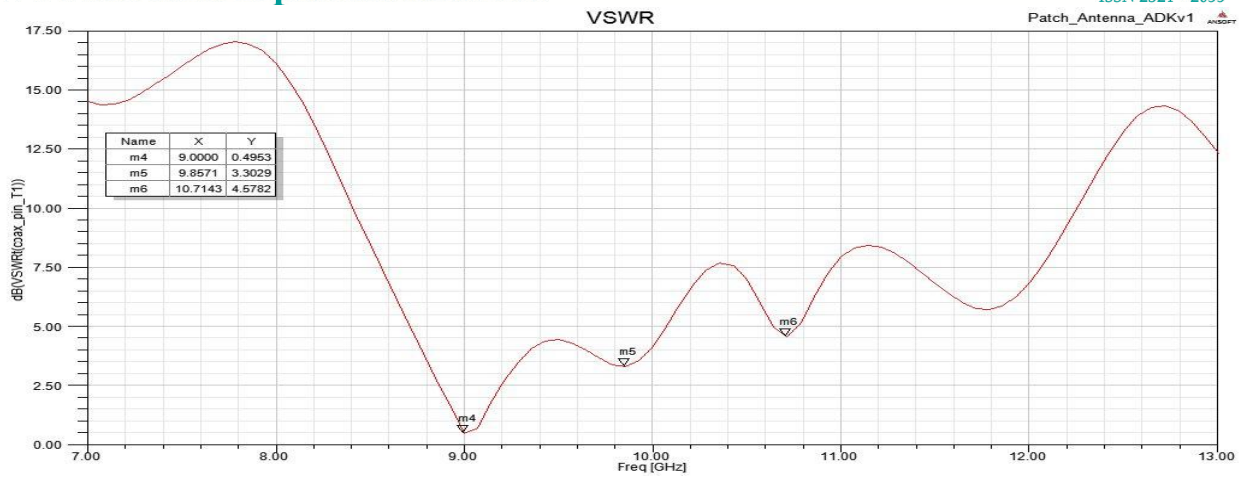

Fig.5: Simulated VSWR Plot

2.4 Gain

TheGainplot(Fig.6)givesthe average peakgain=7.71dB.Thegainoftheantenna in a particular direction is more as compared to isotropic antenna radiating in all directionswhichisvery usefulforvarious applicationsinX-Bandproviding abetter performance.

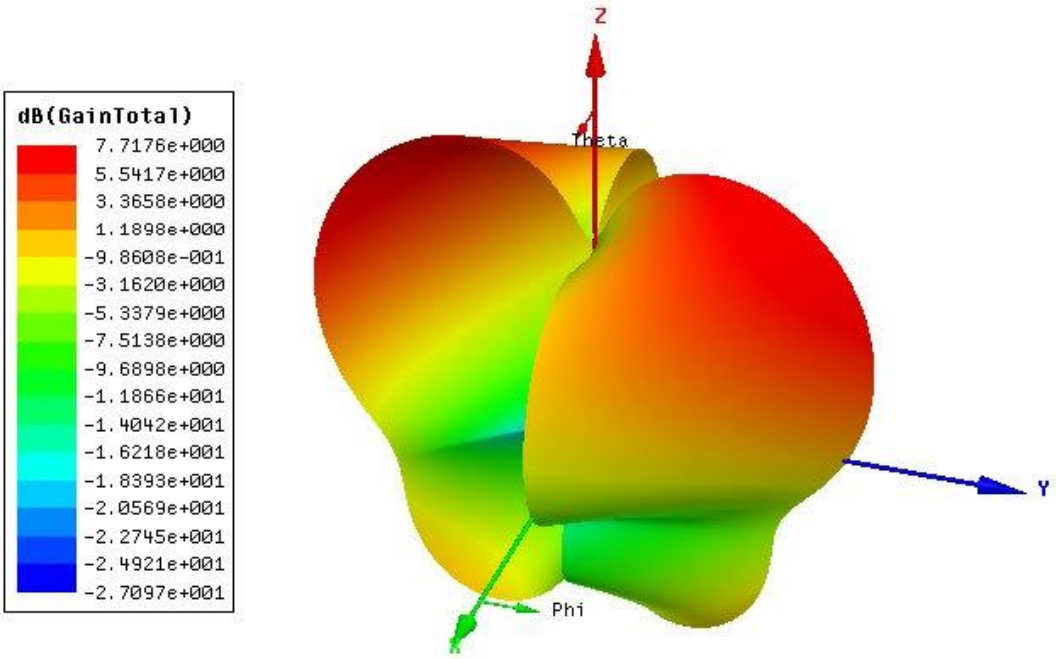

Fig.6: Overall GainoftheProposed Antenna (3D view)

2.5 Radiation Pattern

From polar plot view of radiation pattern as shown in Fig.7, it can be seen that at resonant frequencies radiation pattern obtained is Omni directional.

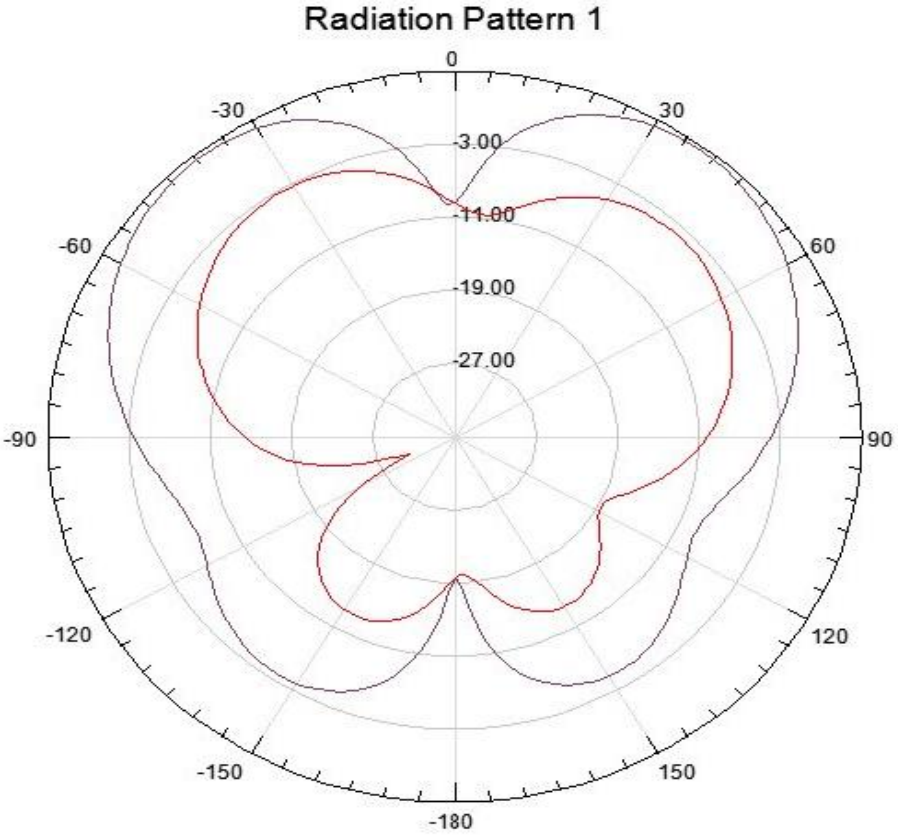

Fig. 7: Radiation Pattern of the designed Antenna (2D view) for phi= 0^0 & 90^0

III. CONCLUSION AND FUTURE SCOPE

Microstrip patch antennas are being used in several applications since last few decades and they have been very popular due to their features like low profile, less weight, conformal design, low cost, ease of fabrication and ease of integration into communication systems. In this paper a Microstrip patch antennais designed for X- band applications. The design of the antenna is properly analyzed and its different parameters like gain, radiation pattern, VSWR and return loss are studied. The proposed antenna can be used for multiple frequencies, the number of frequency bands can be increased by proper slotting and adjusting the design parameters.

REFERENCES

[1] Deschamps, G.A., "Microstrip Microwave Antennas", Third symposium on the USAF Antenna Research and development program, University of IIlinois, Moticello, IIIinois, pp.18-22, October 1953.

[2] Amandeep Bath, Abhishek Thakur, Jitender Sharma, Prof. Basudeo Prasad, "Design of a rectangular Patch Antenna", International Journal of Electrical and Electronics Engineering (IJEEE), Vol. 1, Issue 1, pp. 1-6, February 2014.

[3] Jia-Yi Sze and Wie-Shan Chang, "Dual-band square slot antenna with embedded crossed strips for wireless local area network applications," IEEE Letter on Microwave and Optical Technology, Vol. 51, pp. 435–439, 2009.

[4] Constantine A. Balanis, "Antenna theory analysis and design", 2nd edition, John Wiley and Sons, 2009.

[5] Singh, C.; Gangwar, R.P.S., "Design and analysis of a compact low cost patch antenna for different wireless operations," Emerging Trends in Networks and Computer Communications (ETNCC), 2011 International Conference on , vol., no., pp.18-22, 22-24 April 2011.

[6] Srilakshmi, A.; Koteswararao, N.V.; Srinivasarao, D., "X band printed Microstrip compact antenna with slots in ground plane and patch," Recent Advances in Intelligent Computational Systems (RAICS), 2011 IEEE , vol., no., pp.851-855, 22-24 Sept. 2011.

[7] Musale, P.; Khobragade, S.V.; Anitha, V.R., "Capacitive feeding for slotted Microstrip patch," General Assembly and Scientific Symposium, 2011 XXXth URSI , vol., no., pp.1-4, 13-20 Aug. 2011.

[8] Patel, H.; Patel, S.K.; Bhalani, J.; Kosta, Y., "Design of meandered H-shaped square Microstrip patch antenna," Engineering (NUiCONE), 2012 Nirma University International Conference on, vol., no., pp.1-4, 6-8,Dec. 2012.

[9] Kushwaha, R.S.; Srivastava, D.K.; Saini, J.P.; Dhupkariya, S., "Bandwidth Enhancement for Microstrip Patch Antenna with Microstrip Line Feed," Computer and Communication Technology (ICCCT), 2012 Third International Conference on , vol., no., pp.183-185, 23-25 Nov. 2012.

[10] K.S. Alimgeer, Nihala Khalid, S. A. Khan, S. A. Malik, “Designs of Controllable Dual Band Planar Monopole Patch Antennas”, International Journal of Future Generation Communication and Networking Vol. 5, No. 2, June, 2012.

[11] Sharma, R.; Kumar, M., "Dual band Microstrip antenna for C- and X band wireless applications," Multimedia, Signal Processing and Communication Technologies (IMPACT), 2013 International Conference on , vol., no., pp.154-158, 23- 25 Nov. 2013.

[12] Awad, N.M.; Abdelazeez, M.K., "Circular patch UWB antenna with ground-slot," Antennas and Propagation Society International Symposium (APSURSI), 2013 IEEE, vol., no., pp.442, 443, 7-13 July 2013. [20] Kohli, S.; Dhillon, S.S.; Marwaha, A., "Design and Optimization of Multiband Fractal Microstrip Patch Antenna for Wireless Applications," Computational Intelligence and Communication Networks (CICN), 2013 5th International Conference on, vol., no., pp.32-36, 27-29 Sept. 2013.

[13] Samsuzzaman, M.; Misran, N.; Mandeep, J.S.; Islam, M.T., "An inverted S-shaped multi-frequency patch antenna for X band applications," Informatics, Electronics & Vision (ICIEV), 2013 International Conference on , vol., no., pp.1,4, 17-18 May 2013.

[14] Islam, M.M.; Islam, M.T.; Faruque, M.R.I.; Hueyshin, W., "Design of an X-band Microstrip patch antenna with enhanced bandwidth," International Conference on Advances in Electrical Engineering (ICAEE), pp.313-317, 19-21 Dec. 2013.