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A Compact Dual Band E-Shape Microstrip Antenna for Wireless Application

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***Abstract*—** A novel dual band small size E-shaped patch microstrip antenna for wireless communication is presented. This E-shaped microstrip antenna offers dual band characteristics. Low profile, light weight, and broad bandwidth are the principle characteristics for antenna designed for wireless applications. The design concept and performance of the proposed compact dual wide band antenna is simulated by using IE3D software.

Keywords- *Rectangular MSA, E-shape, Wireless Application.*

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1. INTRODUCTION

Antennas for portable cellular phones are required to be small in size and light in weight. Microstrip antennas have attracted widespread interest due to their small size, light weight, low profile and low cost [1-2]as well as to the fact that they are simple to manufacture, suited to planar and non planar surfaces, easily integrated with circuits and conformability to mounting hosts which makes them excellent candidates for satisfying this design consideration.

Recently, many novel planar antenna designs to satisfy the requirements of mobile cellular communication systems have been developed. These systems include global system for mobile communication, digital communication system, personal communication system, and the universal mobile telecommunication system [3-7]. Planar antennas are also very attractive for applications in communication devices for global poisoning system, and wireless local area network (WLAN) systems in the 2.4 bands. In many applications, operation in two or more discrete bands is desired. The trend in the development of wireless personal communication systems has been in the pursuit of a single system that can accommodate the needs of all users. In such cases, a patch antenna capable of operating in multi-band is highly desirable. The design of compact multiple band microstrip antennas for wireless applications has recently received much attention [8-14].

In this paper, a dual-band E-shaped microstrip antenna for wireless communications is designed. Many parametric studies has been carried out to understand the effects of various dimensional parameters and to optimize the performance of the final design.

II ANTENNA DESIGN

In this paper we have analyzed the rectangular microstrip patch antenna by most popular method transmission line model and then analyzed proposed antenna as same model equation (1-4). The presented rectangular antenna geometry is shown in

figure1. The E-shape has been cut along the patch width in such a way that it lies at a symmetrical distance from both length edges of the patch [15-21]. In figure1 W is the width and L is the length and h is the thickness of Rectangular microstrip patch antenna. Now we have taken small value of substrate thickness is 1.6 mm of proposed antenna.

$$W = \frac{c}{2f\sqrt{(\varepsilon_r + 1)/2}} \quad (1)$$

$$\varepsilon_{reff} = \frac{(\varepsilon_r + 1)}{2} + \frac{(\varepsilon_r - 1)}{2}\left[1 + 12\frac{h}{W}\right]^{-\frac{1}{2}} \quad (2)$$

$$\frac{\Delta l}{h} = 0.412\frac{\left(\varepsilon_{reff} + 0.300\right)\left(\frac{W}{h} + 0.264\right)}{\left(\varepsilon_{reff} - 0.258\right)\left(\frac{W}{h} + 0.813\right)} \quad (3)$$

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Since the length of the patch has been extended by Δl on each side; the effective length of the patch is now

$$L = \frac{1}{2 fr \sqrt{\varepsilon_{reff}} \sqrt{\mu_o \varepsilon_o}} - 2\Delta l \quad (4)$$

Where,
c = Velocity of Light
ε_r = is dielectric constant of the substrate
f = antenna working frequency
W = width of the patch
L = Length of the patch
h = height of substrate
Δl = normalized extension of the length of the patch

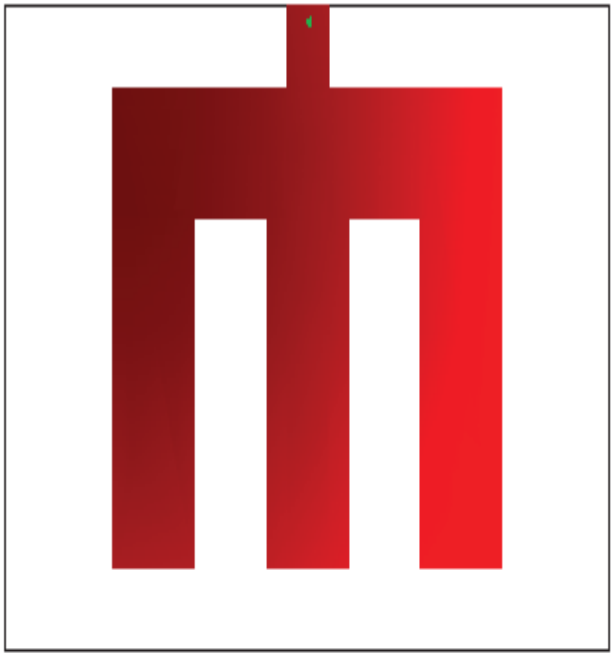

Figure 1.Geometry of E shaped Microstrip Antenna

III DISCUSSION AND RESULTS

Fig 2 shows the plot of return loss Vs frequency. The proposed microstrip antenna gives dual band which is suitable for different wireless communication systems. Fig 3 shows the Smith chart Vs frequency plot of input impedance which should be normally 50Ω used for impedance matching. Fig 4 shows the directivity Vs frequency of Proposed MSA having maximum directivity of about 5 dBi. Fig 5 represents the Gain Vs Frequency of proposed microstrip antenna and Fig 6 shows radiating efficiency of proposed microstrip antenna. The maximum radiation efficiency is about 70%

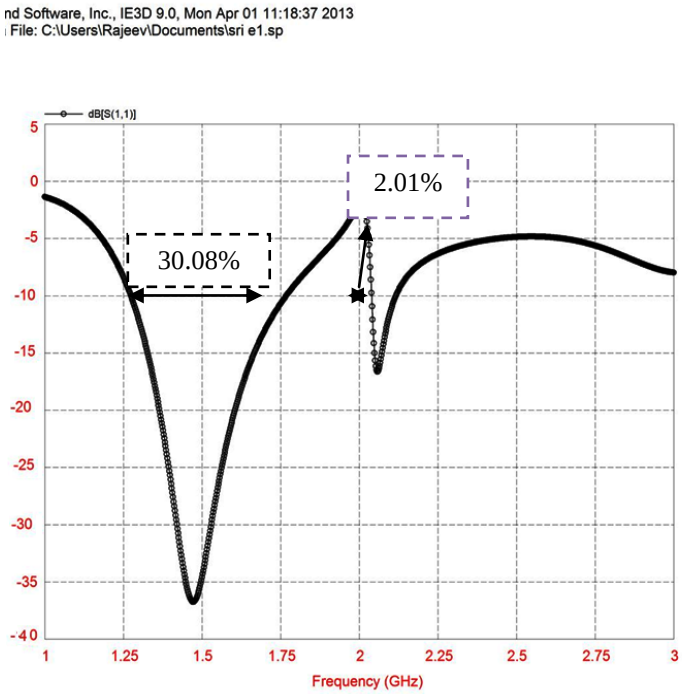

Figure 2. Return lossVs frequency plot of proposed microstrip antenna on IE3D

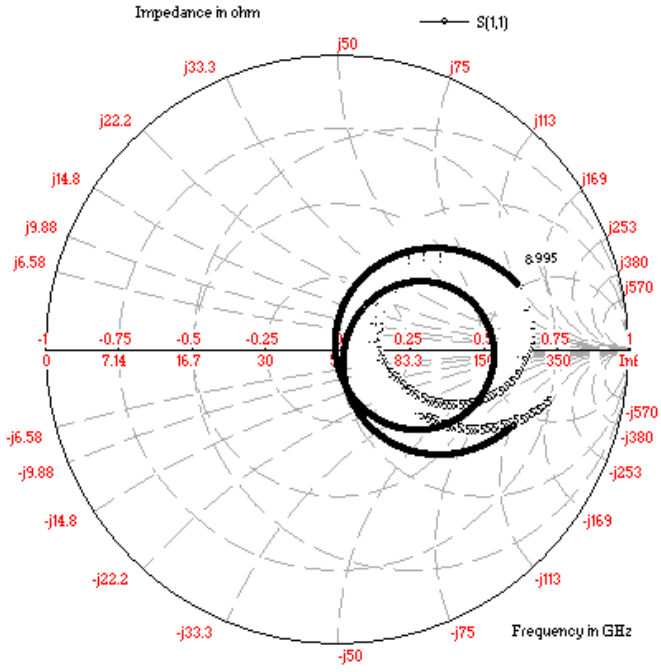

Figure3. Smith chart display of proposed microstrip antenna

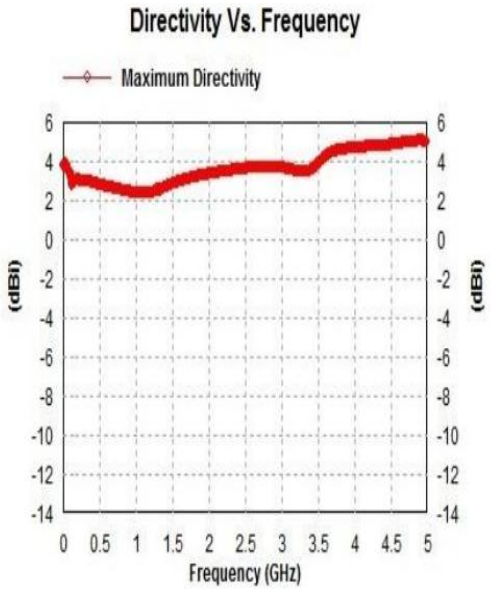

Figure 4.Directivity Vs Frequency of Proposed MSA

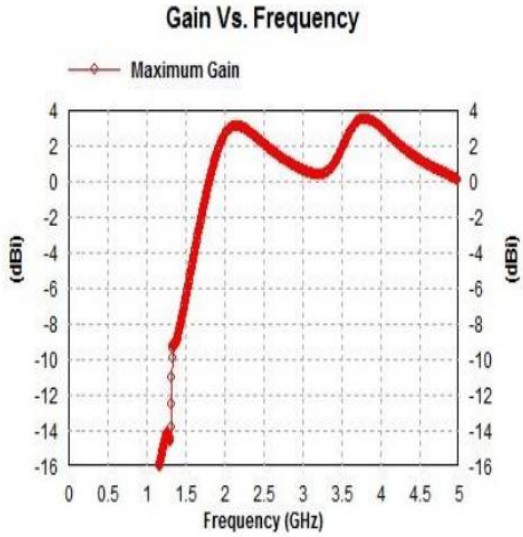

Figure 5.Gain Vs Frequency of proposed Microstrip Antenna

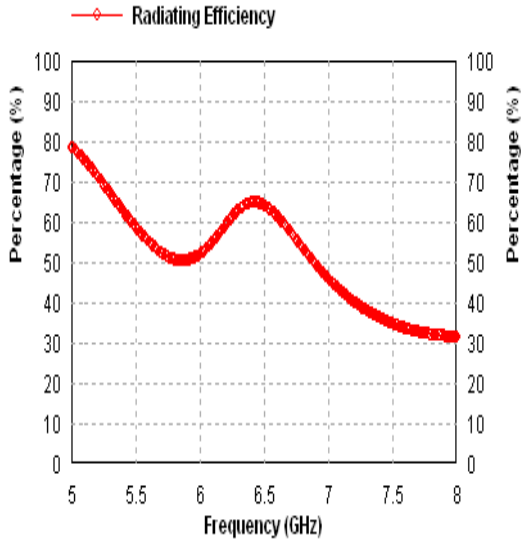

Figure 6. Radiating efficiency of proposed microstrip antenna

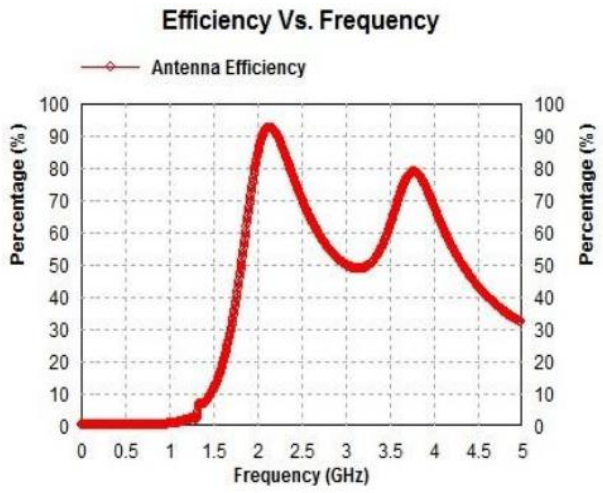

Figure 7. Antenna Efficincy Vs Frequency of proposed microstrip antenna

IV CONCLUSION

A wide band coaxial probe feed microstrip antenna has simulated and designed on glass epoxy substrate having dielectric constant 4.4. Based on the results from the simulations it is clear that the proposed microstrip antenna has dual bandwidth of 30.08% and 2.01% having maximum antenna efficiency of about 70%. The proposed antenna design gives a bandwidth enhancement which is designed on EM simulator software IE3D.

REFRENCE

[1] C. A. Balanis, "Antenna Theory, Analysis and Design" John Wiley & Sons New York 1997

[2] Girish Kumar and K.P. Ray, Broadband Microstrip antennas, Norwood: Artech House 2003.

[3] Vinod Kumar Singh, Zakir Ali, Shahanaz Ayub, "*Bandwidth Optimization of Compact Microstrip Antenna for PCS/DCS/Bluetooth Application*" Central European Journal of Engineering (ISSN: 1896-1541), Springer, Volume 4, Issue 3, pp-281-286, September 2014.

[4] Vinod K. Singh, Zakir Ali, Ashutosh Kumar Singh, Shahanaz Ayub **"***Dual Band Triangular Slotted Stacked Microstrip Antenna for Wireless Applications***"** Central European Journal of Engineering (ISSN: 1896-1541), Springer, Volume 3, Issue2, pp-221-225, June 2013.

[5] Vinod Kumar Singh , Zakir Ali, Shahanaz Ayub, Ashutosh Kumar Singh ¨*A Compact wide band Microstrip Antenna for GPS/DCS/PCS/WLAN Applications*" Intelligent Computing, Networking, and Informatics, Springer, pp: 183–204 October-2013.

[6] Wu, Y.-J., B.-H. Sun, J.-F. Li, and Q.-Z. Liu, "*Triple-band omni-directional antenna for WLAN applications,"* Progress In Electromagnetics Research, PIER 76, 477-484, 2007.

[7] M.A.S.Alkanhal "*Composite compact tripple-band microstrip antennas*" Progress In Electromagnetics Research,PIER 93,221-236,2009.

[8] Vinod K. Singh, Zakir Ali, D.K.Srivastav "*Design of compact tripple band microstrip antenna for wireless communication*"IJECE(ISSN 0974-2166),India, Vol 3 (1), pp 323-330,Dec 2010.

[9] Alkanhal,M.and A.F.Sheta "A novel dual-band reconfigurable square-ring microstrip antenna," Progress In Electromagnetics Research,PIER 70,337-349,2007.

[10] Vinod K. Singh**,** Zakir Ali, "*Dual Band U- shaped microstrip antenna for wireless Communication"* International Journal of Engineering Science Technology, India, Vol 2 (6), pp 1623-1628, June,2010.

[11] Ansari, J. A., P. Singh, S. K. Dubey, R. U. Khan, and B. R. Vishvakarma, "H-shaped stacked patch antenna for dual band operation," *Progress In Electromagnetics Research B*, Vol. 5, 291-302, 2008.

[12] Elsadek, H. and D. Nashaat, "Ultra miniaturized E-shaped dual band PIFA on cheap foam and FR4 substrates," *Journal of Electromagnetic Waves and Applications*, Vol. 20, No. 3, 291-300, 2006.

[13] Nasimuddin Z.N. Chen "*Aperture coupled asymmetrical c-shaped slot microstrip antenna for circular polarization*"**,** IET Microw Antennas Propag. , Vol. 3, Iss. 3, pp. 372–378, 2009.

[14] Shivnarayan & Babu R Vishvakarma "*Analysis of notch-loaded patch for dual-band operation*", Indian Journal of Radio & Space Physics. Vol.35, pp.435-442.

[15] S**.** K Satpathy, Vijay Srinivasan, K P Ray and G Kumar, "*Compact microstrip antennas for personal mobile communication*", IEEE proc. pp. 245-248, 1998.

[16] Vinod K. Singh, Zakir Ali "*Design and comparison of a rectangular-slot-loaded and C-slot-loaded microstrip patch antenna"* International Journal of Computer Science and Network Security,(ISSN 1738-7906) , Korea, Vol10 (4), pp 247-249, April, 2010.

[17] Pandey V. K. & Vishvakarma B R, "Theoretical analysis of linear array antenna of stacked patches, indian j radio & space physics", 2005.

[18] K. R. Carver and J. W. Mink, "*Microstrip antenna technology*", IEEE Trans. Antenna Propag. Vol. AP- 29, pp.1-24, 1981.

[19] Vinod K. Singh, Zakir Ali, "*Dual Band U- shaped microstrip antenna for wireless Communication*" International Journal of Engineering Science Technology, India, VOL 2 (6), pp 1623-1628, June,2010.

[20] Rajeev Shankar Pathak, Vinod Kumar Singh, Shahanaz Ayub, "*Dual Band Microstrip Antenna for GPS/ WLAN/ WiMAX Applications*", IJETED, ISSN: 2249-6149, Issue 2, Vol. 7, November 2012.

[21] Deepak, Vinod Kumar Singh, and Rajeev S. Pathak "A study on inverted T shaped micro strip antenna at different frequencies" International Journal of Engineering and Computer Science ISSN: 2319-7242 Volume 2. Issue 11 Pages No. 3180-3183, Nov.2013.