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Design and Simulation of E Slotted Square Shape Micro-Strip Patch Antenna forRFIDapplication

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Abstract :Communication between human's was first by sound through voice. With the desire for slightly more distance communication came, instruments such as drums, then, visual methods such as signal flags and fire signals were used. These optical communication devices, of course, utilized the visible light portion of the electromagnetic spectrum. It has only very recent in the history of the humankind that the electromagnetic spectrum, outside the visible region, has been employed for communication, through the use of radio. One of humankind's greatest natural resources is the electromagnetic spectrum and the antenna has been contributory in harnessing this resource.A Micro Strip Patch is three layer structures which consist of a radiating patch on one side of a dielectric substrate and has a ground plane on the other sideThispaper provides a detailed study of how to design and simulate coaxial -feed Micro strip Patch Antenna using IE3D software.In this paper we presents a proposeddesign and simulation of E slotted square shape micro strip patch antenna for RFID applicationwhich can be used for wireless communication such as RFID application. The radiating patch is square E slotted. The advantages of this is bandwidth enhancement, smaller in size, simple structure, low in cost and easy to be fabricated.In this paper, method of moments based IE3D software is used to design and simulate aE slotted Square Shape Micro strip Patch Antenna with better return loss, VSWR and enhanced bandwidth.Using proposed antenna design and coaxial feeding at proper position we find the resultant return loss, VSWR and enhance bandwidth. We are using IE3D software for designing and analysis. We have observed that using slotted patch antenna and using coaxial feed at proper location we can get better return loss, VSWR and wide bandwidth.

Keywords- Slotted E shaped Rectangular micro-strip patch antenna, return loss, VSWR, radiation pattern, wide bandwidth.

1. Introduction:-

Antenna is a key building in wireless communication and global positioning system(GPS) since it was first demonstrate in 1886 by Heinrich Hertz and its practical application by Guglielmo Marconi in 1901[1]. Future trend in communication design is towards compact devices. Low cost of fabrication and low profile features attract many researches to investigate the performance of a micro-strip patch antenna in various ways. Micro-strip antenna was first proposed by G.A. Deschamps in 1953. Micro-strip patch antennas are often uses where thickness and conformability to the host surfaces are the key requirements. Since patch antennas can be directly printed onto a circuit board, these are becoming increasingly popular within the mobile phone market. They are low cost, have a low profile and are easily fabricated. One of the key drawbacks of such device is their narrow bandwidth [2]. Micro-strip patch antenna is widely considered to be suitable for many wireless applications, even though it usually has a narrow bandwidth [3]. The bandwidth limitation can be addressed by using thick substrates, cutting slots in the metallic patch, using aperture coupled stacked patch antenna [2]. The stacked patch antenna have multilayer structure consisting of several parasitic radiating elements placed one above the other and above the driven element[4]. However this approach has the inherent disadvantage of increased overall thickness and issues related on aligning various precisely. In this paper we design a rectangular micro-strip patch antenna in which a U shaped and rectangular shaped slots are cut. By cutting a slot in micro-strip patch enhance its bandwidth.

2. Antenna Design:-

The proposed antenna design by cutting aE shape and two rectangular shape slots in square patch as shown in fig. (1). Cutting of theses slots in antenna increases the current path which increases current intensity as a result efficiency is increased. First a square micro-strip patch antenna is designed based on standard design procedure to determine the length (L) and width (W) for resonant frequency. The resonant frequency of micro-strip antenna and the size of the radiation patch can be similar to the following formulas [6].

$$f = \frac{C}{2L\sqrt{\varepsilon}} \quad (1)$$

$$W = \frac{C}{2f}\sqrt{\frac{2}{\varepsilon+1}} \quad (2)$$

$$L = \frac{C}{2f\sqrt{\varepsilon}} - 2\Delta L \quad (3)$$

Where f is the resonant frequency of the antenna, C is the free space velocity of the light, L is the actual length of the current, ε is the effective dielectric constant of the substrate and ΔL is the length of equivalent radiation gap. The dimension of the

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patchare L=25mm and W=25mm. Inside thissquare patch aE shaped and two rectangularshaped slots are cut. The antenna is fabricated on a substrate of dielectric constant 4.4 and thickness h=3.2mm. The coaxial feeding is used for better results.

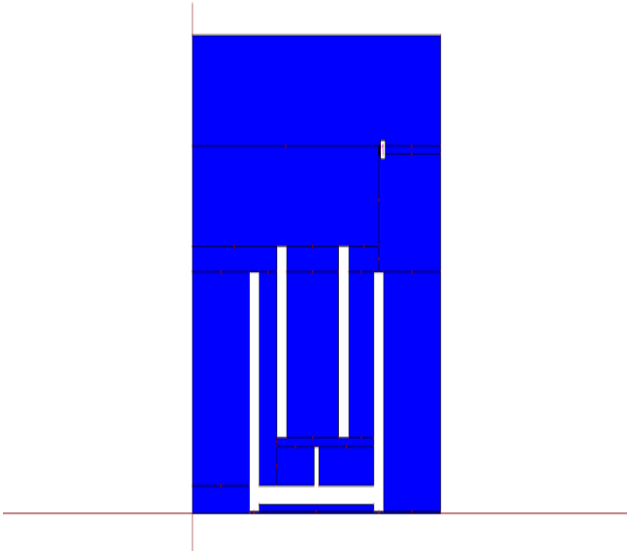

Figure (1): Proposed E slotted Square Shape Micro-strip Patch Antenna

3. Antenna Result:-

The simulation of micro-strip patch antenna is done by using IE3D simulation software. The variation of return loss with frequency of square patch antenna with E shape and two rectangular shaped slots is shown in figure (2). The return loss is defined as the ratio of the Fourier transform of the incident pulse and the reflected signal. It is an important parameter to reckon with [2]. The VSWR graph for aE shape and two rectangular shaped slotted square patch antenna is shown in figure (3).The VSWR indicates the mismatch between the antenna and the transmission line. For perfect matching the VSWR value should be close to unity. The simulation impedance bandwidth for theE shape and two rectangular shaped slot loaded square micro-strip patch antenna as shown in fig. (1) is200 MHz and it is about8.55% for the frequency range of 2.30 GHz to 2.50 GHz and for the frequency range of 2.78 GHz to 2.87 GHz it is 90 MHz and it is about 3.19%. The bandwidth is calculated at the frequency range where the return loss is approximately below the -10dBand the best return loss (S_{11}) is -33.62 dB at 2.34GHzand -27.41 dB at 2.82 GHz. The bandwidth is calculated at the frequency range where the return loss is approximately below the -10dB. The simulated radiation pattern in 2D are shown in figure (4), the Smith chart is shown in figure (5), radiation pattern in 3D is shown in figure (6) and the current distributionfortheProposed E slotted Square Shape Micro-strip Patch Antenna is shown in fig(7).

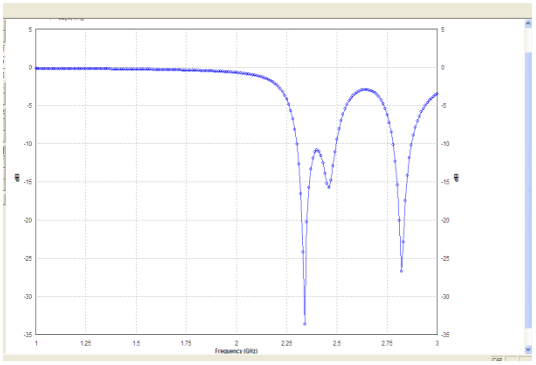

Figure (2): Return loss of the Proposed E slotted Square Shape Micro-strip Patch Antenna

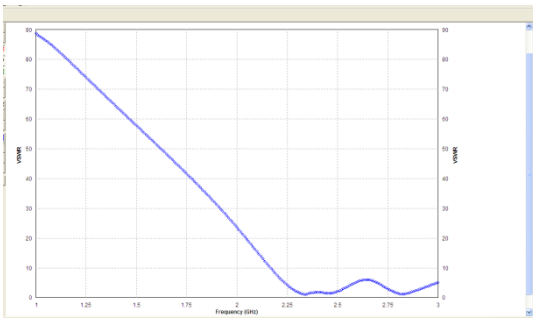

Figure (3); VSWR of the Proposed E slotted Square Shape Micro-strip Patch Antenna

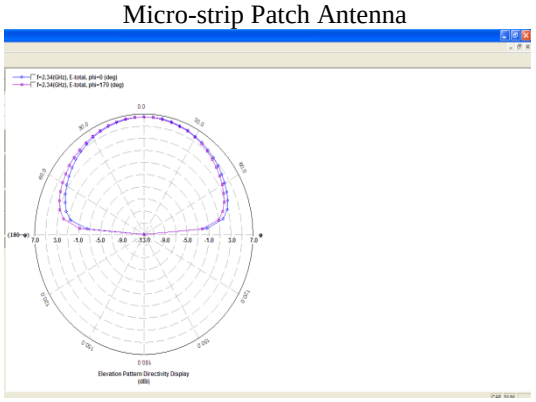

Figure (4): Radiation pattern in 2D of theProposed E slotted Square Shape Micro-strip Patch Antenna

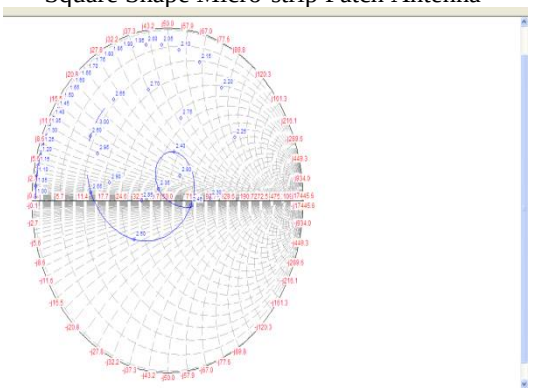

Figure (5): Smith chart of the Proposed E slotted Square Shape Micro-strip Patch Antenna

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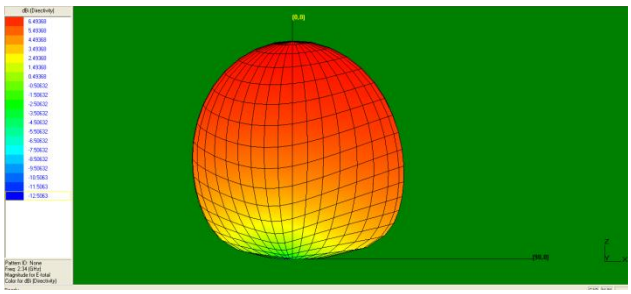

Figure (6): Radiation pattern in 3D of the Proposed E slotted Square Shape Micro-strip Patch Antenna

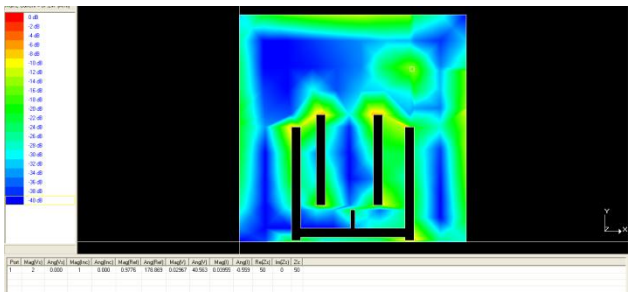

Figure (7): Current distribution of the Proposed E slotted Square Shape Micro-strip Patch Antenna

4. Conclusion:-

It is observed that a coaxial feed, E slotted Square Shape Micro-strip Patch Antenna is presented. The proposed antenna has a compact size of (25 x 25 x3.2) and it can effectively covers the RFID,WiMax and WLAN application and it can also use other wireless communication system.

5. References:-

i. *G.Papitha, V. Thyagarajan and AyshathulFouzia,"Design and Simulation of Stacked Fractal Patch Antenna using IE3D" . International Conference on Computing and Control Engineering (ICCCE), 12 and 13 April 2012.*

ii. *John D Kraus, Ronald J Marhefka, Ahmed S Khan," Antennas and Wave Propagation". Tata McGraw Hill Education Private Limited New Delhi 2010.*

iii. *R. Garg and P. Bhartia, "Micro-strip Antenna handbook". Boston Artech House 2001*

iv. *R.Q. Lee, K.F. Lee and J.Bobinchak,"Characterstics of a two layer electromagnetically coupled rectangular patch antenna", Electron Lett. Vol. 23 no 20, pp 1070-1072, 1987*

v. *Binu Paul, S. Mridula, C.K. Aanandan and P. Mohan. Microwave and optical technology letters/ vol33, no4, 4 may2002.*

vi. *Constantine A. Balanis"Antenna Theory: Analysis Design" Third edition John Wiley & Sons, Inc 2005*

vii. *Ahmed Khidre, Kai-Fong Lee, Fan Yang, and Atef Z. Elsherbeni "Circular Polarization Reconfigurable Wideband E-Shaped Patch Antenna for Wireless Applications" IEEE TRANSACTIONS ON ANTENNAS AND PROPAGATION, VOL. 61, NO. 2, FEBRUARY 2013*

viii. *Raied A. R. Ibrahim, Mustapha C.E. Yagoub, Riadh W. Y. HabashMICROSTRIP PATCH ANTENNA FOR RFID APPLICATIONS 2009 IEEE*

ix. *MandeepKaur, ManjeetSandhu, Neeraj Mohan and Parvinder S. Sandhu "RFID Technology Principles, Advantages,Limitations& Its Applications" International Journal of Computer and Electrical Engineering, Vol.3, No.1, February, 2011 1793-8163*

x. *Qiang Liu, JunyuShen, Jungang Yin, Member, IEEE, Hongli Liu, and Yuanan Liu, Member, IEEE "Compact 0.92/2.45-GHz Dual-Band Directional Circularly Polarized Microstrip Antenna for Handheld RFID Reader Applications" IEEE TRANSACTIONS ON ANTENNAS AND PROPAGATION, VOL. 63, NO. 9, SEPTEMBER 2015*

xi. *SwarajPanusaMithilesh Kumar "Quad Band H-slot Microstrip Patch Antenna for WiMAX Application" International Journal of Computer Applications (0975 – 8887) Volume 103 – No.12, October 2014*

xii. *AnshulShrivastava , NehaRai, Ankita Rajput "A Wideband U & Rectangular Slotted Rectangular Shaped Micro-strip PatchAntenna for Broadband Application" International Journal of Scientific Engineering and Technology (ISSN : 2277-1581)Volume No.3 Issue No.9, pp : 1167-1169 1 Sep 2014*