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Development and Study on L Slot Microstrip Patch Antenna for GSM/ZIGBEE Applications

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ABSTRACT: A new shape planar antenna topology of L-slot probe feed microstrip Patches is introduced. The antenna is designed to work at higher operating mode which exhibit localization property of the electric field close to the antenna's boundary. Such higher eigenmode results in higher directivity. Antenna is solved in terms of the cavity model using FEM and results are refined by full-wave simulator.

KEYWORDS: L-Slot patchantenna, GSM, ZIGBEE, Directivity, returnloss, radiationpattern, FEM.

1. INTRODUCTION

Microstrip patch antennas are very popular in many fields as they are low-profile, low weight, robust and cheap. In last year's new techniques employing fractal geometry are studied and developed [1]. One of them is the fractal zing of antenna's boundary where new qualitative effect as the higher mode localization appears. Next, resonant frequencies are slightly decreasing as the fractal dimension of the boundary increases. Microstrip antennas attract the attention of designers because of its attractive specifications like low profile, conformal nature, low weight and ease of fabrication. Due to these advantages these antennas are used and developed in wireless and aerospace applications [2-3]. From the previous works there are many designs for different multiband frequencies depending on the application that the antenna need to be used in. This design is suitable for use in wireless applications especially in mobile phone applications such as jamming of mobile phone. These new frequencies include global system mobile (GSM) 0.9, 1.8 GHz and ISM band which is used for Bluetooth and wireless local area network bands applications.

In this paper a simple design of micro strip patch antenna at 60GHz applications is proposed. Micro strip patch uses conductive strips or patches formed on the top surface of a thin dielectric substrate separating them from a conductive layer on the bottom surface of the substrate and constituting a ground for the antenna [4]. A patch is typically wider than a strip and its shape and dimensions are important features of the antenna

II. DESIGN CONSIDERATIONS

A micro strip antenna in its simplest form consists of a sandwich of two parallel conducting layers separated by a single thin dielectric substrate. The lower conductor functions as a ground plane and the upper conductor functions as radiator [5]. The simplest patch antenna uses a half wavelength long patch and a larger ground plane. Larger ground plane gives better performance but of course makes the antenna bigger. Among different shapes of microstrip patch elements such as rectangular, square, dipole, triangular, circular and elliptical for better radiation characteristics we use rectangular micro strip patch antenna. The resonant length of the antenna determines the resonant frequency [6]. The patch is in fact electrically a bit larger than its physical dimensions due to the fringing fields. The deviation between electrical and physical size is mainly dependent on the PCB thickness and dielectric constant. The patch that introduced

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here has been made of conducting material copper. The design parameters define the operation and performance of the patch
antenna [7]. In this paper the patch dimensions taken along X-axis and Y-axis is 0.15 cm and the substrate dimensions taken along X-axis and Yaxis is 1 cm respectively. The substrate thickness is 0.03 cm. The feed location along X and Y axis are 0 and 0.05 respectively. The coaxial inner and outer radius is 0.004 and 0.014 respectively and coaxial feed length is 0.04 cm. For good performance, a substrate having a low dielectric constant is desirable since this provides better efficiency, larger bandwidth and better radiation. The design also checks for maximum power transfer by matching the feed line impedance to the impedance of the patch antenna [8]. The different feeding techniques used for impedance matching are micro strip line, coaxial probe, Proximity coupling and aperture coupling. Micro strip line: In this Impedance matching is easier. And feed can be fabricated on some
substrate as single layer to provide planner structure. But disadvantage is we must use transformer to match impedance and it excites cross polarization. Coaxial probe: Probe location is used for impedance matching. Ease of insetting and low radiations is advantages of probe feeding. Proximity coupling: Proximity coupling offers some opportunity to reduce feed line radiation while maintaining a relatively thick substrate for the radiating patch [9-11]. The input impedance of antenna is affected by the overlap of the patch and the feed line, and by the substrates. However due to multilayer fabrication the antenna thickness increases. Aperture coupling: No spurious radiation escapes to corrupt the side lobes or polarization of the antenna. However due to multilayer fabrication antenna, thickness increases [12-13]. Among this coaxial probe is used for impedance matching, as it is ease of insetting and low radiation and also used with plated for multi layer circuits. Micro strip antennas are versatile in the sense that they can be designed to produce a wide variety of patterns and polarizations, depending on the mode excited and the particular shape of the patch used [14]. The required design is shown below in Figure1.

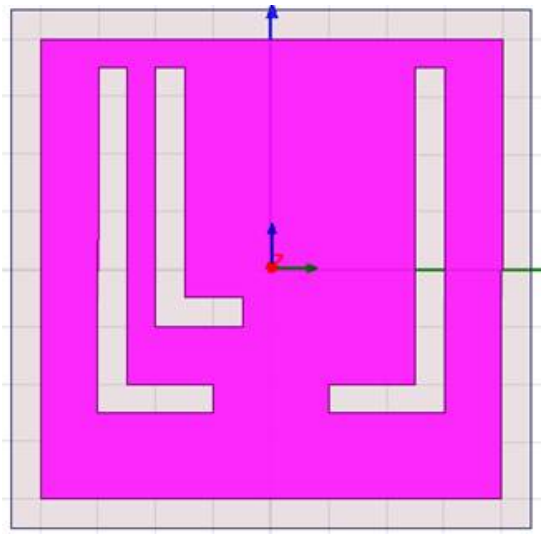

Figure.1 L slot planner antenna

III. RESULTS AND DISCUSSIONS

The Return loss of the proposed antenna shown in figure-2.it describes the amount of power deliver to the radiating element. It shows resonant frequency 0.856MHg with -21.57dB returloss. This frequency used in GSM applications. The 3D-polar plot of the antenna gain is also shown in figure-3.

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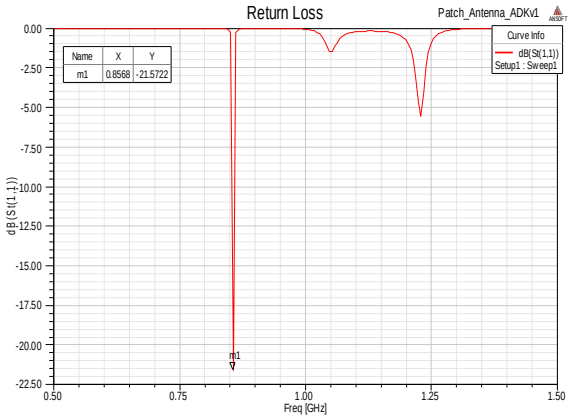

Figure.2 Return loss Curve

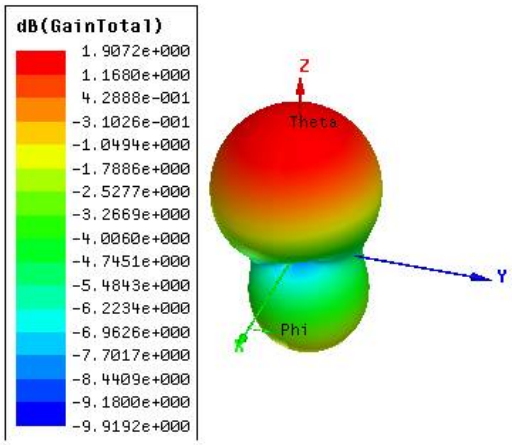

Figure.3 3D Gain plot

The 2D gain of the proposed antenna is shown in figure-4 and Figure 5 represents the 3D radiation pattern of the proposed antenna.

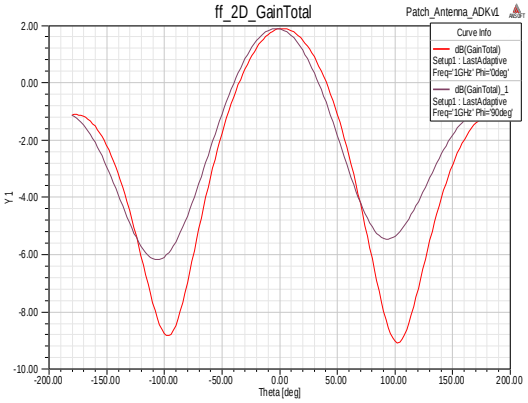

Figure.4 3D Gain plot

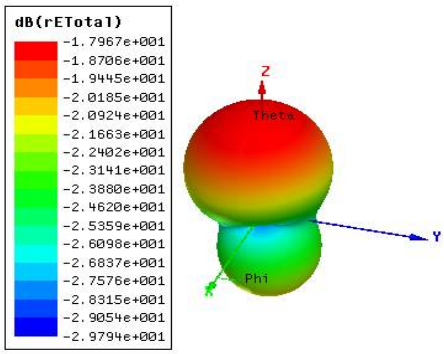

Figure.5 3D radiation pattern

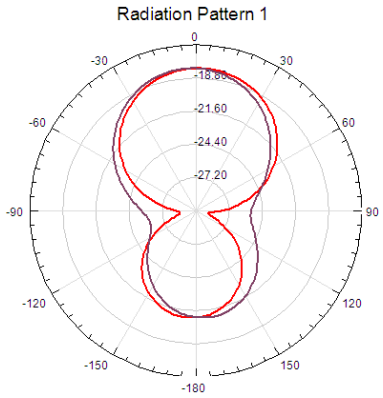

Figure.6 Polar radiation pattern

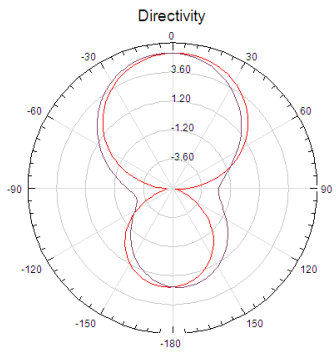

Figure.7 Polar directivity pattern

The Radiation pattern polar plot of the proposed antenna is represented by figure-6 and Figure.7 describes the 3D directivity pattern of the proposed antenna.

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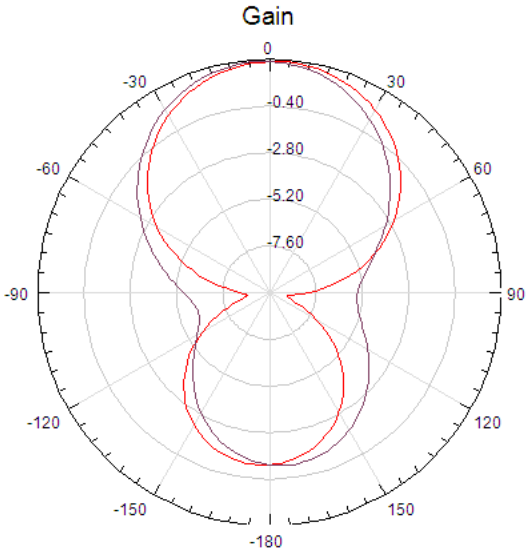

Figure.8 Polar Gain pattern

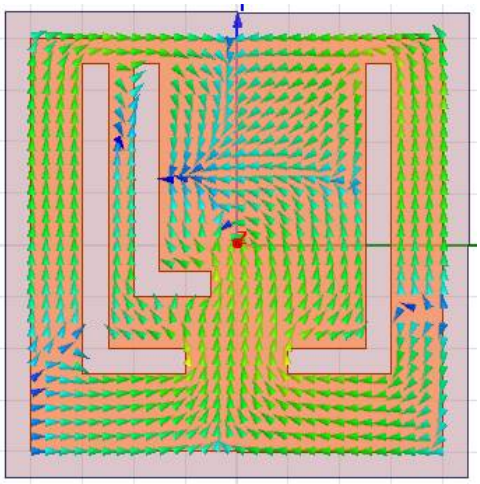

Figure.9 current distribution pattern

Gain Polar plot of the proposed antenna is represented by figure-8 and Figure.9 describes the current distributions of the proposed antenna.

IV. CONCLUSIONS

In this paper, a new antenna design for dual GSM and single ISM (Bluetooth and wireless local area networks) band frequency was achieved by insert in h-slot in the patch antennas. This antenna is designed to work with mobile phone systems or jammer system applications. The simulation results obtained from the CST software showed that the gain and return losses were good for these bands compared with others shape reported in the literature.

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REFERENCES

[1]. R. L. Haupt, "Antenna design with a mixed integer genetic algorithm," *IEEE Trans. Antennas Propag.*, vol. 55, no. 3, pp. 577–582, Mar. 2007.
[2]. Y. Chen and C. F. Wang, "Electrically loaded Yagi-Uda antenna optimizations using characteristic modes and differential evolution," *J. Electromagn. Waves Appl.*, vol. 26, pp. 1018–1028, 2012.
[3]. Y. Chen and C. F. Wang, "Synthesis of reactively controlled antenna arrays using characteristic modes and de algorithm," *IEEE Antennas Wireless Propag. Lett.*, vol. 11, pp. 385–388, 2012.
[4]. W. Wu and Y. P. Zhang, "Analysis of ultra-wideband printed planar quasi-monopole antennas using the theory of characteristic modes," *IEEE Antennas Propag. Mag.*, vol. 52, no. 6, pp. 67–77, Dec. 2010.
[5]. M. Cabedo-Fabres, E. Antonino-Daviu, A. Valero-Nogueira, and M. F. Bataller, "The theory of characteristic modes revisited: A contribution to the design of antennas for modern applications," *IEEE Antennas Propag. Mag.*, vol. 49, no. 5, pp. 52–68, Oct. 2007.
[6]. K. F. Tong and T. P. Wong, "Circularly polarized U-slot antenna," *IEEE Trans. Antennas Propag.*, vol. 55, no. 8, pp. 2382–2385, Aug. 2007.
[7]. A. Khidre, K. F. Lee, F. Yang, and A. Eisherbeni, "Wideband circularly polarized E-shaped patch antenna for wireless applications," *IEEE Antennas Propag. Mag.*, vol. 52, no. 5, pp. 219–229, Oct. 2010.
[8]. R. F. Harrington and J. R. Mautz, "Theory of characteristic modes for conducting bodies," *IEEE Trans. Antennas Propag.*, vol. AP-19, no. 5, pp. 622–628, Sep. 1971.
[9]. F. Yang, X. X. Zhang, X. Ye, and Y. Rahmat-Samii, "Wide-band E-shaped patch antennas for wireless communications," *IEEE*
[10]. S.-L. S. Yang, A. A. Kishk, and K.-F. Lee, "Frequency Reconfigurable U-slot microstrip patch antenna," *IEEE Antenna Wireless Propa. Lett.*, vol. 7, pp. 127-129, 2008.

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[11]. J.-W. Baik, S. Pyo, T.-H. Lee, and Y.-S. Kim, "Switchable printed yagi-uda antenna with pattern reconfigurable," *ETRI Journal*, vol. 31, no. 3, pp. 318-320, June 2009.
[12]. B. Kim, B. Pan, S. Nikolaou, Y.-S. Kim, J. Papapolymerou, and M. Tentzeris, "A novel single-feed circular microstrip antenna with reconfigurable polarization capability," *IEEE Trans. Antennas Propag.*, vol. 56, no. 3, pp. 630-638, Mar. 2008.
[13]. C. A. Balanis, *Antenna Theory*, New Jersey: J. Wiley & Sons, 2005
[14]. J. Domingo, J. Bonache, F. Martin, R. M. Sillero, F. Falcone, T. Lopetegi, M. A. G. Laso, J. G. -Garcia, I. Gil, M. F. Portillo, and M. Sorollar, "Equivalent-circuit models for split-ring resonators and complementary split ring resonators coupled to planar transmission lines," *IEEE Trans. Microw. Theory & Tech.*, vol. 53, no. 4, pp. 1451-2402, Dec. 2000.