IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319 5940

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 4, Issue 12, December 2015

Design of a Modified L Slot CPW Feed Multiband Antenna for Wireless Application

Juin Acharjee[1] and Kaushik Mandal[2]

Assistant Professor, ECE, NSHM Knowledge Campus, Durgapur, West Bengal, India[1]

Associate Professor, ECE, Academy of Technology, Hooghly, India[2]

Abstract: In this paper a new multiband compact CPW feed complementary antenna has been proposed which is suitable for wireless communication. This multiband characteristic is achieved with the help of one L-shaped slot on the radiating patch. By controlling the position and length of the slot multiband position can be varied. The size of the antenna is 27.4×23.6 mm^2 and it is printed on FR4 EPOXY substrate with height of 1.6 mm, dielectric constant 4.4. Simulation result shows the proposed antenna exhibits a good impedance matching over a wide frequency range of 2.41to2.46GHz and 4.79 GHz to 6.67 GHz with a gain of 1.5dBi and 2.6dBi respectively. This proposed antenna produces good performance, and small size.

Keywords: WLAN, CPW Feed, Microstrip Antenna.

I. INTRODUCTION

With advancement of technologies broadband antenna design for wireless communication system is increasing day by day with some innovative features like high gain, multimode operation, light weight and large bandwidth. In mobile application, radar application and various wireless application microstrip antennas are used due to light weight, small size, ease of fabrication or many other features. For using one antenna in different application multiband antenna design becomes a attractive pancake now a days. Many authors have reported different structure of microstrip patch antenna for this multiband operation. CPW fed is widely used to achieve dual band operation [1-3]. Different shaped monopole radiators having shaped Y [4], S [5], T [6], G [7] have been reported and they are often adopted to realize multiband operation. These antennas have several advantages like.Simple structure, wide bandwidth, regular omnidirectional pattern etc. But the only disadvantage is that the size of these antennas is too large for portable wireless devices. To minimize the size different shaped slot are cut into the monopole radiators. Different shaped slots can generate different resonant frequency. There are several feeding techniques like microstrip feed, inset feed, proximity feed, aperture coupled feed, CPW feed for exciting the microstrip patch. In the paper CPW feeding technique is used because this feeding technique gives wideband characteristic compared to other feeding techniques.

In this paper we basically proposed one CPW feed rectangular shaped patch embedded with single L-shaped slot for wireless application. This structure not only gives dual band operation performance but also gives very simple structure and compact size. Details of antenna design and explanation of experimental results are demonstrated in this paper.

II. ANTENNA STRUCTURE

Figure1 (a) and 1(b) shows the geometry of proposed dual band antenna with slot and without slot. For designing this antenna FR4 EPOXY substrate with dielectric constant 4.4, height 1.6 mm and loss tangent 0.02 has been taken. The overall size of the antenna is (27.4×23.6×1.6) mm^3. A 50-ohm feed line of width 3mm is used to excite the antenna. The antenna has been simulated with method of moment based ZELAND IE3D simulator. This proposed antenna has single layer metallic structure on one side and other is without any metallization. Two equal sized ground planes are placed on the same side of radiating patch and theses ground planes are placed 0.35mm distance from CPW Feed line. For designing this antenna FR4 EPOXY substrate with dielectric constant 4.4, height 1.6 mm and loss tangent 0.02 has been taken. The overall size of the antenna is (27.4×23.6×1.6) mm^3. A 50-ohm feed line of width 3mm is used to excite the antenna. The antenna has been simulated with method of moment based ZELAND IE3D simulator. This proposed antenna has single layer metallic structure on one side and other is without any metallization. Two equal sized ground planes are placed on the same side of radiating patch and theses ground planes are placed 0.35mm distance from CPW Feed line.

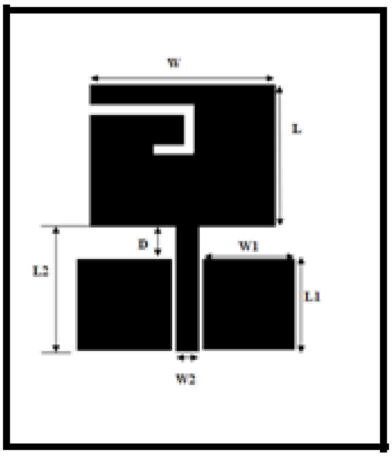


Figure 1(a) Geometry of Proposed antenna

IJARCCE
ISSN (Online) 2278-1021
ISSN (Print) 2319 5940
International Journal of Advanced Research in Computer and Communication Engineering
Vol. 4, Issue 12, December 2015

The optimized geometric parameters are W=17.35mm, L=15 mm, L1=10.2mm, W1=8.30 mm, L2=12.4mm, W2=3mm. The spacing between radiating patch and ground plane D=2.2mm and the gap between strip line and ground plane S= 0.3mm.The length of the modified L-Shaped slot is 23.3mm and width is 0.67mm.

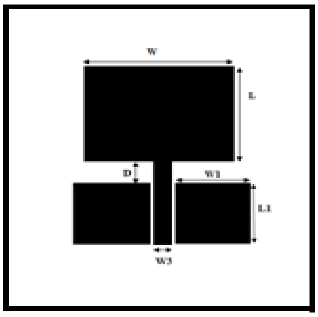


Figure 1(b) Geometry of Proposed antenna without slot

III. RESULT AND DISCUSSION

The simulated reflection coefficient (S_{11}) for the reference (without slot) and the proposed antenna are shown in Fig. 2 and Fig. 3 respectively. The reference provides a single operating band where as the proposed antenna provides dual operating band 2.41-2.46 GHz and 4.79-6.67 GHz.

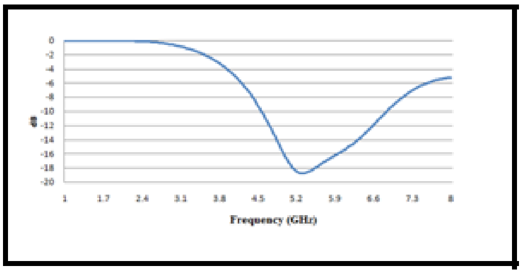


Figure 3: Simulated S_{11} characteristic of reference antenna

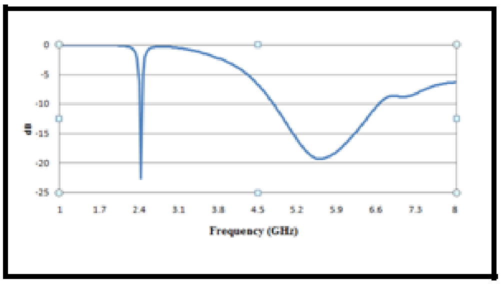


Figure 3: Simulated S_{11} characteristic of proposed antenna

Effect of slot width variation on performance of the Proposed Antenna:

Slot width variation changes the performance of the antenna. When the width of the slot is 0.87mm, 0.97mm, 1.07mm and 1.17mm respectively the first band and second band of the proposed antenna shifted to the right side. Moreover when the width of the slot is 0.97mm impedance matching at the first band is more. The effect of slot width variation is shown in Fig. 4. Similarly when slot of the antenna is decreased the first band and second band shifted to the left side which is shown in figure 6. But when the slot width is 0.3mm then first band of the proposed antenna vanish. So after different optimization we get the optimized slot width and that is 0.37mm for which we get the result which covers the WLAN band.

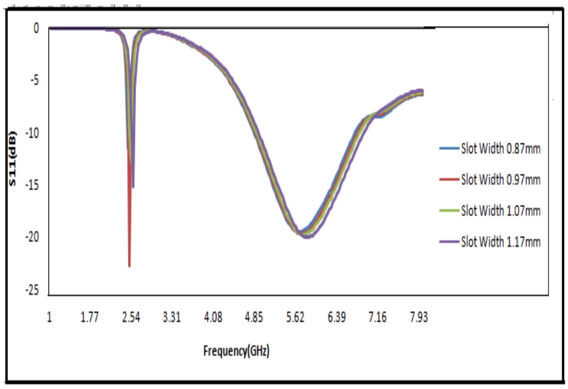


Figure 4: Effect of slot width variation on operating bands

To further study the electromagnetic mechanism of the proposed antenna surface current distributions are presented in Fig. 5 for different operating frequency that means for 2.4 GHz and 5.6 GHz. From the current distribution pattern it is clearly shown that current distributions are different for two different frequency bands. For 2.4 GHz frequency band most of the surface currents are concentrated near the modified L-Shaped slot to generate the lower resonance mode. For 5.6 GHz frequency band most of the surface currents are concentrated along the monopole to generate the upper resonance mode.

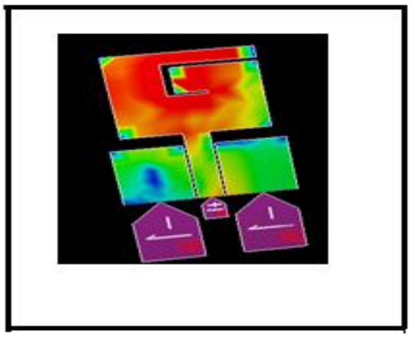


Figure 5 (a): Current distribution pattern at 2.4 GHz

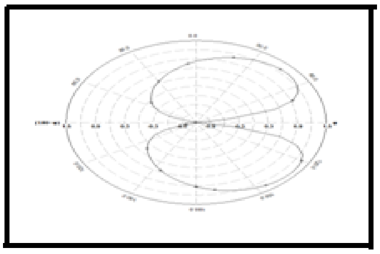
Figure 5 (b): Current distribution pattern at 5.6 GHz

IJARCCE

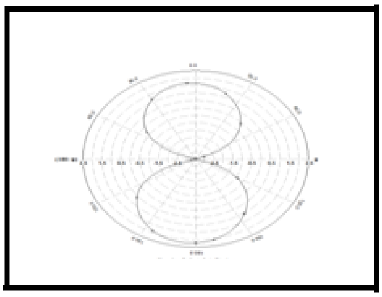
ISSN (Online) 2278-1021
ISSN (Print) 2319 5940

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 4, Issue 12, December 2015

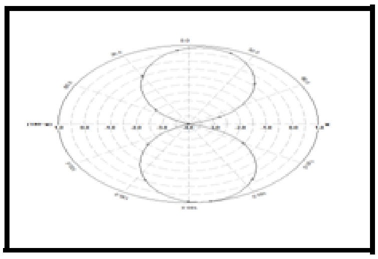
Radiation pattern for two different resonating frequencies are shown in Fig. 6.



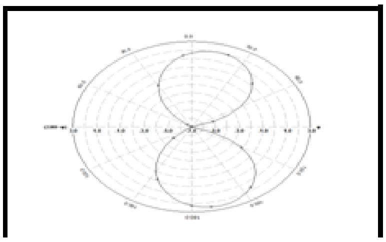
(a)



(b)



(c)



(d)

Figure 6: Radiation pattern of proposed antenna at 2.4 GHz (a) E-Pane (c) H-Plane and 5.6 GHz (b) E-Plane (d) H-Plane

IV. CONCLUSION

In this work a CPW feed rectangular patch antenna with modified L-shaped slot is carried out. This proposed antenna exhibits a good impedance matching from 2.41-2.46 GHz, 4.79-6.67 GHz. These two bands are used for wireless application. This proposed antenna has the advantage of being compact size, light weight, simple structure, easy design, good bandwidth and stable radiation pattern.

REFERENCES

[1]. W. Hu, Y.-Z. Yin, S.-T. Fan, J.-Y. Deng, and M. Zhang, "COMPACT CPW-Fed Square Slot Antenna for Dual-Band Operation", Progress in Electromagnetics Research Letters, Vol. 20, pp.165-173, 2011.

[2].Y.-Y. Cui, Y.-Q.Sun, H.-C.Yang, and C.-L.Ruan**,** "A New Triple-Band CPW-Fed Monopole Antenna for WLAN and Wi-MAX Applications", Progress in Electromagnetics Research M, Vol. 2, pp.141–151, 2008.

[3]. Subhajit Sinha, Biswarup Rana, Chandan Kumar Ghosh, and S. K. Parui, "A CPW-Fed Microstrip Antenna for WLAN Application", Procedia Technology, Vol. 4, pp. 417 – 420, 2012.

[4]. Liu, Z.-Y., Y.-Z. Yin, L.-H.Wen, W.-C.Xiao, Y. Wang, andS.-L.Zuo, "A Y-shaped tri-band monopole antenna with a parasitic M-strip for PCS and WLAN applications," Journal of Electromagnetic Waves and Applications, Vol. 24, No. 8-9, pp.1219-1227, 2010.

[5]. Liu, W. C., W. R. Chen, and C. M. Wu, "Printed double S-shaped monopole antenna for wideband and multiband operation of wireless communication," IEEE Proceedings Microwaves Antennas and Propagation, Vol. 151, pp. 473-476, 2004.

[6]. Kuo, Y. L. and K. L Wong, "Printed double-T monopole antenna for 2.4/5.2 GHz dual-band WLAN operations," IEEE Transactions on Antennas and Propagation, Vol. 51, pp. 2187-2191, 2003.

[7] Liu, W. C., "Optimal design of dual band CPW-fed G-shaped monopole antenna for WLAN application," Progress in Electromagnetics Research, Vol.74, pp.21-38, 2007.