# Compact Broad Band Microstrip antenna for L-S-C Band Wireless communication

**Deepa Singh Bundela[1] Syed Uvaid[2]**
[1]PG Scholar's PIES Bhopal,[2]Asst Prof, PIT Bhopal,
[1]deepa.bundela@gmail.com, [2]uvaidullah@gmail.com

**Abstract—***In this paper Compact Broad Band Microstrip antenna for L-S-C Band Wireless communication is presented. In recent application size of antenna, impedance bandwidth, Antenna efficiency and different polarization from single antenna is major issues, we presented antenna which overcome all drawbacks and cable in polarization switching from linear to circular and circular to linear. The proposed design consists of four L-Slot and via hole technique. 65% Compactness is done using via hole and shorting Pin technique. This proposed design applicable for L-Band, S-Band and C-Band application. All results validated in IE3D Simulator.*

**Keywords**—Slotting Technique, via hole, Shorting Pin, Polarization, L-S-C-Band application, Ultra wideband antenna

## I. INTRODUCTION

ULTRAWIDEBAND communication systems have recently received great attention in the wireless world. It is a widely used technology in radar and remote sensing applications. In recent years, ultra wideband (UWB) system has been required for many applications because of its plenty of advantages, such as low complexity and low cost, resistant to severe multipath and jamming, etc. In literature [1], Shih-Kai Lin, et.al. have given an novel leaky-wave slot antenna for broadside circularly polarized (CP) radiation presented, The measured performances of the final prototype were found to exhibit 10-dB return loss bandwidth of 40%[1], antennas have gained increasing attention in many applications, such as satellite communications, radio frequency identification (RFID) reader and the global positioning system (GPS) [2]. In order to increase the capacity or interoperate several systems in the same module, CP antennas of broad bandwidth in axial ratio (AR) and broadside radiation are desirable in various wireless systems. The most often used broadband CP antennas are traditional equiangular spiral antennas [3]. Spiral antennas inherently havebroadband characteristics on the input impedance, the AR, and gain patterns, mainly resulting from the mechanism of leaky-wave radiation. However, the spiral antenna in general is large, with several wavelengths required. Particularly, the antenna feed is complex, where the centre-fed scheme, the vertical joint of balun structure, and the strict magnitude/phase balance are difficult to design and implement and expensive to fabricate. UWB system is defined as any radio system that has a 10-dB bandwidth larger than 25 percent of its centre frequency, or has a 10-dB bandwidth equal to or larger than 1.5 GHz if the centre frequency is greater than 6 GHz [23].

## II. DESIGNING OF PROPOSED ANTENNA

Proposed antenna design is consists using FR-4 material. For ultra wideband impedance matching by proposed geometry we used shorting pin at the center point and via hole at the right side bottom corner, all description of geometry is given in fig 1. In this we successfully achieved broad bandwidth. In fig 1 dimension of patch, dimension of four L-Slot, position of Shorting Pin and Via Hole all arespecified. From this technique we enhanced surface current and reduced 65% size of antenna.

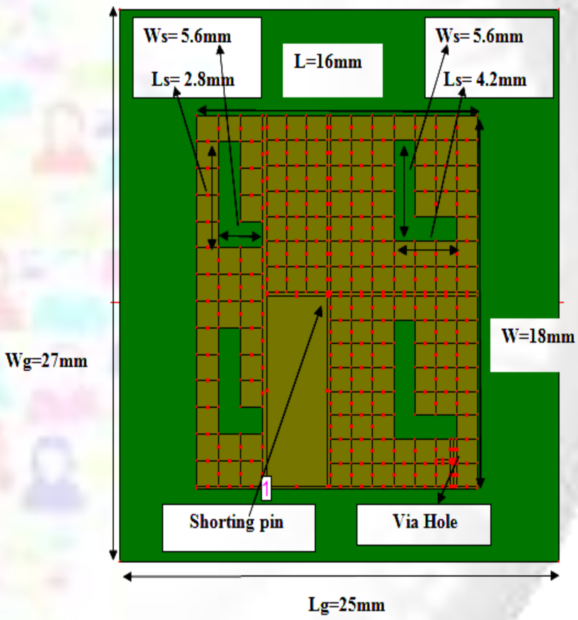


Fig.1: Proposed Design

## III. RESULTS AND DISCUSSION

The results of proposed antenna validated in IE3D Simulator, the performance of antenna in terms of Return losses, Antenna Efficiency, radiating efficiency and radiation characteristics of antenna specified in radiation pattern.

### A. *Return Loss Vs Frequency*

The return loss of antenna with respect to frequency is shown in Fig 2. From Fig 2 we concluded that the return losses obtained up to -17.8dB at centre frequency 3GHz. From this design we achieved impedance matching bandwidth slot from 1.5GHz to 5.8GHz. From this analysis we concluded that proposed design achieved 25% impedance bandwidth for L-Band (1.5GHz to 2GHz), 67% impedance bandwidth for S-Band (2.01GHz to 4GHz) and 34% of C-Band (4.01GHz to 5.8GHz). This design is applicable for L-Band S-Band and C-Band application.

The antenna and radiating efficiency depicts in Fig 3. From the fig 3 we obtained 92% antenna and radiating efficiency at centre frequency 3GHz. The antenna and radiating efficiency vary from 70% to 92%.

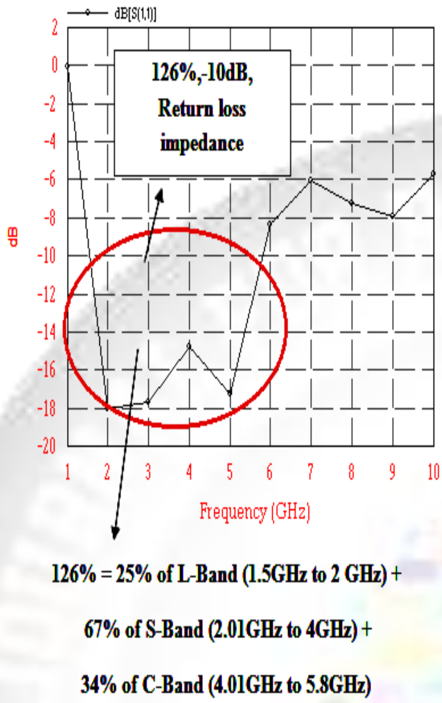


Fig.1: Return Loss Vs Frequency

*B. Efficiency Vs Frequency*

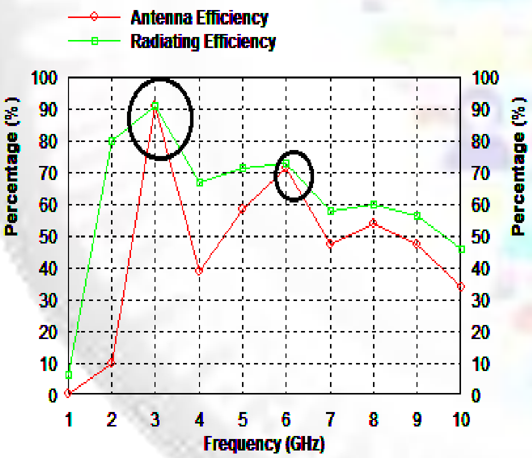


Fig.3: Antenna and Radiating Efficiency Vs Frequency

*C. Axial Ratio Vs Frequency*

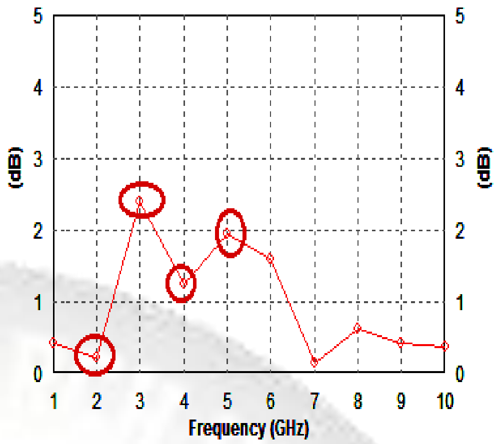


Fig.4: Axial Ratio Vs Frequency

Fig 4 depicts Axial Ratio with respect to frequency, from this analysis we concluded that our proposed design provided linear and circular polarisation, for L-Band the value of axial ratio is less than 1dB, so that antenna is circular polarized while for S-Band the value of axial ratio is 2.5dB, so that antenna is linear polarized and the value of axial ration is more than 1dB, for entire C-Band therefore antenna in C-Band is linear polarized. Hence switching in polarization is achieved using this geometry due to orthogonal arrangement of shorting pin and via hole. Therefore this design is applicable for linear and circular polarization.

*D. Radiation Pattern*

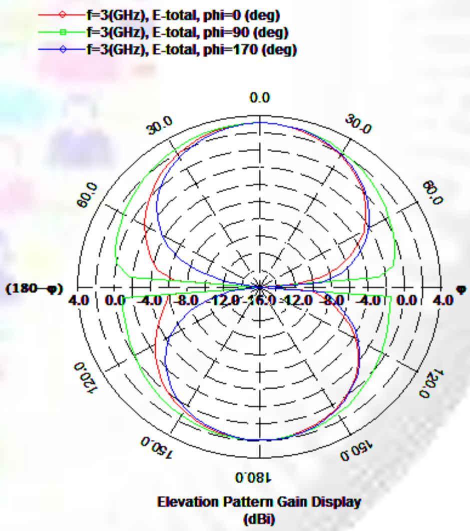


Fig.5: Elevation Pattern at 3GHz

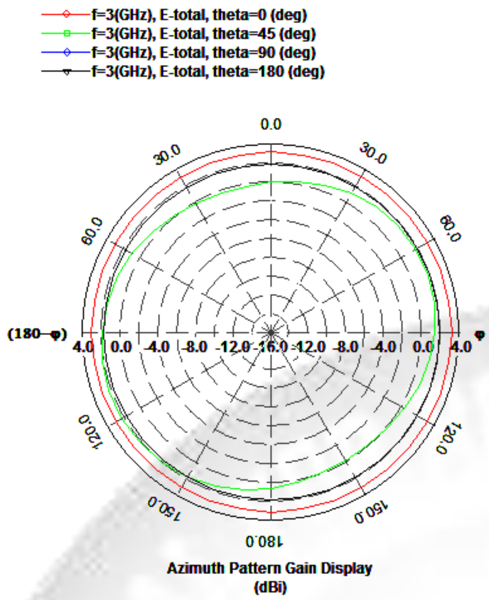


Fig.6: Azimuth Pattern at 3GHz

| Antenna Parameters | Obtained results |
|---|---|
| Input Power | 0.009979 (W) |
| Radiated Power | 0.00905786 (W) |
| Radiation Efficiency | 90.7692% |
| Directivity | 3.5891 dBi |
| -10dB,Return loss bandwidth | 126% |
| Return loss | Up to -18dB, |
| VSWR | Up to 1.285 |

Table1: Result Summary

## IV. CONCLUSION

In this paper, a Compact Broad Band Microstrip antenna for L-S-C Band Wireless communication has been presented. We concluded that shorting pin, via hole and four L-Slots are successful demonstrated ultra wide band antenna, that proposed design achieved 25% impedance bandwidth for L-Band (1.5GHz to 2GHz), 67% impedance bandwidth for S-Band (2.01GHz to 4GHz) and 34% of C-Band (4.01GHz to 5.8GHz). This design is applicable for L-Band S-Band and C-Band application. The antenna is fed through the coaxial probe of an SMA connector. Achieved antenna and radiating efficiency up to 92%, antenna exist circular polarization for L-Band and linear polarization for S-Band and C-Band All simulation results shown in Table-1, all results validated in IE3D Simulator, this design applicable for L-Band, S-Band and C-Band wireless communication. By using shorting pin and via hole surface current of geometry is more towards lower frequency therefore achieved 65% reduction in size and area of antenna.

## REFERENCE

[1] Shih-Kai Lin, et.al "A Compact Outer-Fed Leaky-Wave Antenna Using Exponentially Tapered Slots for Broadside Circularly Polarized Radiation" IEEE Transactions On Antennas And Propagation, Vol. 60, No. 6, June 2012

[2] Nasimuddin, Z. N. Chen, and X. Qing, "Asymmetric-circular shaped slotted microstrip antennas for circular polarization and RFID applications,"IEEE Trans. Antennas Propag., vol. 58, no. 12, pp. 3821–3828,Dec. 2010.

[3] W. I. Son, W. G. Lim, M. Q. Lee, S. B. Min, and J. W. Yu, "Design of compact quadruple inverted-F antenna with circular polarizationfor GPS receiver," IEEE Trans. Antennas Propag., vol. 58, no. 5,pp. 1503–1510, May 2010.

[4] J. D. Dyson, "The equiangular spiral antenna," IRE Trans. AntennasPropag., vol. 7, pp. 181–187, Apr. 1959.

[5] R. S. Elliott, Antenna Theory and Design, Revised Edition. New York: Wiley Interscience, 2003.

[6] D. M. Pozar, "Microstrip antennas," Proc. IEEE, vol. 80, no. 1, pp.79–91, Jan. 1992.

[7] J. Q. Howell, "Microstrip antennas," IEEE Trans. Antennas Propag.,vol. 23, no. 1, pp. 90–93, Jun. 1975.

[8] A. G. Derneryd, "Linearly polarizedmicrostrip antennas," IEEE Trans.AntennasPropag., vol. 24, no. 6, pp. 846–851, Nov. 1976.

[9] W. S. Chen, C. K. Wu, and K. L. Wong, "Novel compact circularly polarized square microstrip antenna," IEEE Trans. Antennas Propag.,vol. 49, no. 3, pp. 340–342, Mar. 2001.

[10] A. A. Abdelaziz and D. M. Nashaat, "Compact GPS microstrip patch antenna," presented at the Military Communications Conf., Oct. 2007.

[11] J. Huang, "A technique for an array to generate circular polarization using linearly polarized elements," IEEE Trans. Antennas Propag, vol.34, no. 9, pp. 1113–1124, Sep. 1986.

[12] P. S. Hall, "Application of sequential feeding to wide bandwidth, circularly polarised microstrip patch arrays," Proc. Inst. Elect. Eng. Microw.AntennasPropag., vol. 136, no. 5, pp. 390–398, Oct. 1989.

[13] L. Bian, Y. X. Guo, L. C. Ong, and X. Q. Shi, "Wideband circularlypolarized patch antenna," IEEE Trans. Antennas Propag, vol. 54, no.9, pp. 2682–2686, Sep. 2006.

[14] S. L. S.Yang, R. Chair, A. A. Kishk, K. F. Lee, and K.M. Luk, "Study on sequential feeding networks for subarrays of circularly polarizedelliptical dielectric resonator antenna," IEEE Trans. Antennas Propag. vol. 55, no. 2, pp. 321–333, Feb. 2007.

[15] H. Iwasaki, "A circularly polarized small-size microstrip antenna with a cross slot," IEEE Trans. Antennas Propag., vol. 44, no. 10, pp.1399–1401, Oct. 1996.

[16] Y. F. Lin, H. M. Chen, and S. C. Lin, "A new coupling mechanism for circularly polarized annular-ring patch antenna," IEEE Trans. AntennasPropag., vol. 56, no. 1, pp. 11–16, Jan. 2008.

[17] R. L. Li, V. F. Fusco, and H. Nakano, "Circularly polarized open-loop antenna," IEEE Trans. Antennas Propag., vol. 51, no.9, pp. 2475–2477, Sep. 2003.

[18] Y. Li, Q. Xue, E. K.-N. Yung, and Y. Long, "Circularly-polarised microstrip leaky-wave antenna," Electron. Lett. vol. 43, no. 14, Jul. 2007.

[19] J. L. G. Tornero, "Analysis and design of conformal tapered leaky wave antennas," IEEE Antennas Wireless Propag. Lett., vol. 10, pp.

[20] C. L. Bennett and G. F. Ross, "Electromagnetics and its applications,"Proc. IEEE, vol. 66, no. 3, pp. 299–318, Mar. 1978.1068–1071, 2011.

[21] K. F. Hung and Y. C. Lin, "Novel broadband circularly polarized cavity-backed aperture antenna with traveling wave excitation," IEEETrans. Antennas Propag., vol. 58, no. 1, pp. 35–42, Jun. 2010.