RECTANGULAR MICROSTRIP PATCH ANTENNA FOR ULTRA WIDE BAND APPLICATION

G.NANDA KISHORE[1], L.NAGESWARA RAO[2]
MTech Scholar[1], Assistant Professor[2]
Department of ECE, CVR College of Engineering, Hyderabad, INDIA[1,2].

ABSTRACT: - The given paper presents a compact microstrip fed rectangular monopole antenna for ultra wideband communication. The basic antenna consists of rectangular shaped slot on ground plane, which achieved UWB frequency band operation.The proposed antenna is designed using low cost is used for simulation and optimization with stable radiation patterns. The designed antenna has efficiency and provides an excellent bandwidth which satisfied UWB requirement for VSWR. The UWB antenna is simple in structure. Large Impedance bandwidth is achieved using wide rectangular shaped slot on ground plane. Stable radiation patterns are obtained by HFSS software It is observed that radiation patterns are nearly omni directional in H-plane and bidirectional in E-plane for UWB frequency band. Efficiency of antenna is for entire operating band. Hence the given antenna is best choice for personal wireless communication.

Keywords: - Ultra wide band, Open ended slot, Microstrip slot antenna

I. INTRODUCTION

Recently, ultra wideband technology has received great attention in various fields for the short range, low power consumption, compactness, low-cost, excellent immunity to multipath interference and reduced hardware complexity. The Federal Communications Commission (FCC) of the United State officially released the regulation for Ultra wideband (UWB) technology. In this regulation, the spectrum from 3.1 GHz to 10.6 GHz is allocated to the unlicensed indoor UWB communication systems. Therefore, one of the main issues in UWB communication system is the design of a compact antenna which provides wideband characteristics over the whole UWB range of frequencies. One of the major design considerations of a practical UWB antenna is the co-existence with existing narrowband communication systems. For instance, the 5-GHz band wireless local area network (WLAN) operates at the band. Based on the above requirements, many antenna configurations including planar monopole, dipole and slot antenna have been developed so far. In these antennas, a variety of shapes and bandwidth enhancement techniques has been studied. Several shapes such as diamond, ring, bow-tie, elliptical and square shapes have been proposed to satisfy UWB specifications. In these antennas, several bandwidth enhancement techniques are used to have a continuous UWB bandwidth. Many CPW-fed slot antenna configurations have also been proposed and developed. It includes wide rectangular slot, a bow-tie slot and some other broadband designs such as using a patch element loaded in a circular slot and a diamond patch in a rectangular slot. To achieve frequency rejected characteristic, different techniques are used including an embedded inverted U-shape, an embedded two slit on a circular monopole, adjusting a V-shaped thin slot length on the bow-tie shape slot antenna and an embedded U-shape on a beveling rectangular patch. A compact CPW-fed ultra-wideband antenna with band notched characteristic has also been studied. In this study, a tuning stub is inserted in the middle of the fork-like patch to achieve the band rejection characteristic. Another compact antenna study has a C-shaped slot to obtain the band-rejection operation of the antenna . A slot-type split-ring resonator (STSRR) is inserted into the center line of the CPW to notch the wireless local area network (WLAN) frequency band. Nowadays, it is often required to design an antenna which can be used for multifunctional systems such as 2.4 GHz and UWB systems.

II. LITERATURE SURVEY

Bandwidth enhancement and size reduction of microstrip slot antennas

Reduced size microstrip monopole slot antennas with different slot shapes-straight, L and inverted T, and placed on a small ground plane, are investigated. The ground plane size is 50 mm/spl times/80 mm, which is about the size of a typical PC Wireless card. Detailed simulation and experimental investigations are conducted to understand their behavior and optimize for broadband operation. It is shown that, the variation in the slot shape, from straight to L and T shapes, helps in generating additional resonances, which when coupled to the original resonances of the slot, further increases impedance bandwidths. The bent shapes of the L and T slots reduce their height and provide more space on the ground plane for electronics. A mirror image dual L-slot antenna, placed at two adjacent corners of the ground plane, is also investigated and optimized for the polarization diversity. They provide an impedance bandwidth of 87%, with near orthogonal radiation characteristics.

The measured impedance bandwidths (S/sub 11/=-10 dB) of up to 60%, 84%, and 80% are achieved for these straight, L and inverted T slots respectively, by suitably selecting their design parameters. The simulation results are in good agreement with the experimental data considering several practical issues.

Analysis of a wide radiating slot in the ground plane of a microstrip line

An analysis of a wide rectangular radiating slot excited by a microstrip line is described. Coupled integral equations are formulated to find the electric current distribution on the feed line and the electric field in the aperture. The solution is based on the method of moments and using the space domain Sommerfeld-type Green's function. The information about the input impedance or reflection coefficient is extracted from the electric current distribution on the microstrip line utilizing the matrix pencil technique. The theoretical analysis is described and data are presented and compared with other theoretical and experimental results.

PCS antenna design: the challenge of miniaturization

PCS (personal communication system) devices have become an important part of everyday life. The pressure to design small, lightweight, and user-friendly mobile-communication devices has increased accordingly, creating the need for optimal antennas for mobile applications. In this paper, we present some basic rules about electrically small antennas, give clues and guidelines about efficient antenna miniaturization, and, finally, show some examples of miniature antennas developed in our laboratory for practical applications.

Design of microstrip antennas fed by four-microstrip-port waveguide transition with slot radiators

Millimeter-wave antennas have been developed for various applications such as broadband highspeed wireless communication systems and automotive radar systems. Microstrip antennas are more advantageous than other millimeter-wave antennas at the viewpoints of low profile and low cost. On the other hand, feeding loss due to transmission loss of microstrip line is significant problem in array feeding. So, microstrip array antennas are suitable for relatively low gain applications such as a subarray of digital beam forming (DBF) systems. A comb-line feeding system is effective at the point of relatively low loss compared with other microstrip patch array antennas (MSA) fed by parallel or ordinary series feeding. A travelling wave array antenna has a significant problem that gain is degraded due to beam shift in frequency changes when the array antenna is fed from one end of the feeding line. A center feeding microstrip comb-line antenna (MSCLA) is one of the solutions to reduce the gain degradation due to frequency change. However, a blank area exists at the center above the microstrip-to-waveguide transition in the aperture radiation distribution, which causes elevation of sidelobe level (SLL). To fill the radiation source in the blank area, the authors designed four-microstrip-port waveguide transition with slot radiators. The authors proposed a center feeding 2 × 2 MSA and a 2-line 6-element MSCLA fed by the transition in this paper. The authors compared the simulated radiation patterns of the antennas fed by the transitions with slot radiators and without slot radiators in the computer analysis.

III. EXISTING SYSTEM

A variety of printed slot antennas are straight slot, wide slot, L-shaped slot, inverted T -slot, U slot, step slot, and fractal shaped slot, these wide slot antennas can achieve a good ultra-wideband characteristic. On the other hand, some slot antennas have limited bandwidth, which was not enough for more applications. A tapered slot is used in the design of an antenna for lower ultra wide-band (UWB) applications, but the band-width is too limited to meet the demands for UWB systems. An inverted-L-shaped open slot antenna, U-shaped slot and a linear tapered slot antenna are presented to enhance the impedance bandwidth.

IV. PROPOSED SYSTEM

In this work, a novel compact open-ended L shape slot antenna is presented. The proposed antenna design provides wide band width with – 10 dB return loss. The details and parameters of the antenna performances are also illustrated.

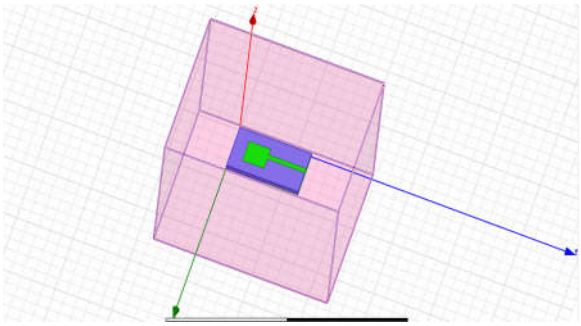
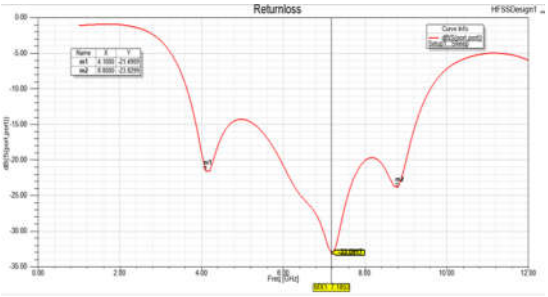


Fig: Proposed Antenna Design

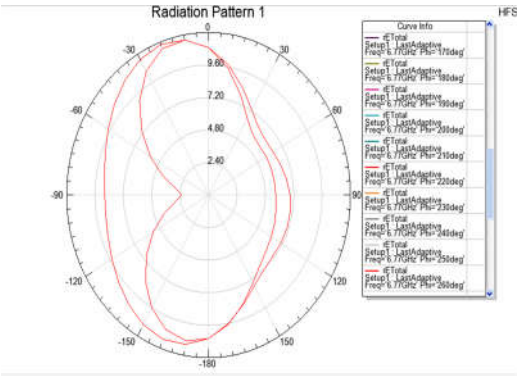
A novel compact open-ended slot antenna with bandwidth enhancement and UWB band application is presented. By using an asymmetrical rectangular

patch with the L-shaped open-slot structure, impedance bandwidth of the designed antenna is improved. Effects of key parameters on the antenna performances are also investigated.

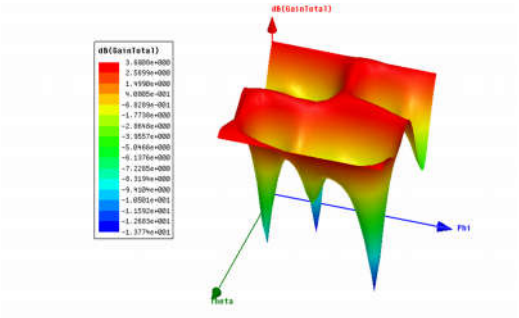
V. RESULT AND DISSCUSSION



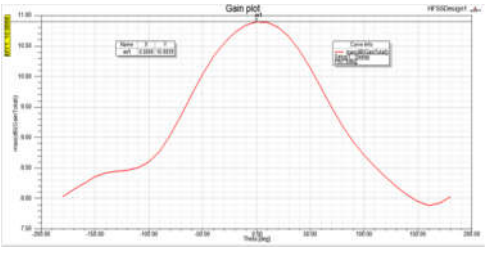
RADIATION PATTERN



GAIN IN 3D



GAIN PLOT



VI. CONCLUSION

A frequency-reconfigurable bow-tie antenna for Bluetooth, WiMAX, and WLAN applications is proposed. By employing p-i-n diodes over the bow-tie arms, the effective electrical length of the antenna can be changed, leading to an electrically tunable operating band. The simulated and measured results are found to be in good agreement, demonstrating that the antenna operates effectively at the desired frequency bands and has stable radiation patterns. The reconfigurable bow-tie antenna has other advantages, such as compact size, stable radiation characteristics across the entire tunable frequency range, and low levels of cross-polarized radiation, which make it a promising candidate for multiradio wireless applications and cognitive radio.

REFERENCES

[1] Microstrip Antenna Design Handbook, Artech House, Norwood, MA, 2001. R. Garg, P. Bhartia, I. Bahl, A. Ittipiboon.

[2] K. Fujimoto and J. James, Mobile Communication Systems. Norwood, MA, USA: Artech House, 1994.

[3] A. K. Skriverik, J. F. Zurcher, O. Staub, and J. R. Mosig, “PCS antenna design: The challenge of miniaturization,” IEEE Antennas Propag. Mag., vol. 43, no. 4, pp. 12–26, Aug. 2001.

[4] M. Kahrizi, T. K. Sarkar, and Z. A. Maricevic, “Analysis of a wide radiating slot in the ground plane of a microstrip line,” IEEE Trans. Microwave Theory Tech., vol. 41, pp. 29–37, 1993.

[5] A. Axelord, M. Kiliuk, and J. Maoz, “Broadband microstrip fed slot radiators,” Microw. J., pp. 81–94, 1989.

[6] J.-Y. Sze and K.-L. Wong, “Bandwidth enhancement of a microstripline-fed printed wide-slot antenna,” IEEE Trans. Antennas Propag., vol. 49, no. 7, pp. 1020–1024, Jul. 2001.

[7] J. P. Kim and W. S. Park, “Network modeling of an inclined and offcenter microstrip-fed slot antenna,” IEEE Trans. Antennas Propag., vol. 46, no. 8, pp. 1182–1188, Aug. 1998.

[8] A. K. Bhattacharyya, Y. M. M. Antar, and A. Ittipiboon, “Full-wave analysis for the equivalent circuit of an inclined slot on a microstrip ground plane,” in Proc. Inst. Elect. Eng., vol. 139, Jun. 1992, pp. 245–250.

[9] S. K. Sharma, N. Jacob, and L. Shafai, “Low profile wide band slot antenna for wireless communications,” in Proc. IEEE Antennas and Propagation Society Int. Symp. Dig., vol. 1, San Antonio, TX, Jun. 2002, pp. 390–393.

[10] , “Investigations on low profile wide band slot antennas for wireless communications,” presented at

the Proc. XXVIIth General Assembly URSI, Maastricht, The Netherlands, Aug. 17–24, 2002.
[11] S. C. K. Ko and R. D. Murch, “A diversity antenna for external mounting on wireless handsets,” IEEE Trans. Antennas Propag., vol. 49, no. 5, pp. 840–842, May 2001.
[12] S. K. Sharma, L. Shafai, and N. Jacob, “Investigations of wide band microstrip slot antenna,” IEEE Trans. Antennas Propag., vol. 52, no. 3, pp. 865–872, Mar. 2004.
[13] ENSEMBLE. version 8.0, Ansoft Corporation.
[14] High Frequency Structure Simulator (HFSS). version 8.0, Ansoft Corporation
[I5] J. R. Verbiest and G. A. E. Vandenbosch, "Low-cost small-size
tapered slot antenna for lower band UWB applications," Electron.
Lett., vo1.42, pp. 670-671, 2006.
[16] WeiXing Liu,YinZeng Yin,WenLong Xu, and ShaoLi Zuo,
"Compact Open-Slot antenna with bandwidth enhancement".IEEE
Antennas and Wireless Propag., vol. 10, pp. 850-853, Jan. 2011.
[17] K.Song, Y.-Z.Yin,S.T.Fan, and B.Chen,"Compact open-ended Lshaped
slot antenna with asymmetrical rectangular patch for UWB
applications",Progress in electromagnetic research C,vol. 19,
pp.235-243,2011.
[18] M. Gopikrishna, O. O. Krishna, C. K. Aanandan, P. Mohanan, and
K.Vasudevan, "Compact linear tapered slot antenna for UWB
applications,"Electron. Lett, vol. 44, no. 20, pp. 1174-1175, Sep.
2008.
[19] M. Gopikrishna, D. D. Krishna, C. K. Aanandan, P. Mohanannd,
and K. Vasudevan, "Design of a microstip fed step slot antenna for
UWB communication," Microw. Opt. Technol. Lett., vol. 51, pp.
1126-1129, Apr. 2009
[20] Behdad and K. Sarabandi, "A wide-band slot antenna design
employing a fictitious short circuit concept," IEEE Trans.
Antennas Propag., vol. 53, no. 1, pp. 475-482, Jan. 2005.[2]
[21] J.-Y. Jan and 1. - W. Su, "Bandwidth enhancement of a printed
wide-slot antenna with a rotated slot," IEEE Trans. Antennas
Propag., vol. 53, no. 6, pp. 2111-2114, Jun. 2005.
[22] S. T. Latif, L. Shafai, and S. K. Sharma, "Bandwidth enhancement
and size reduction of microstrip slot antennas," IEEE Trans.
Antennas Propag., vol. 53, no. 3, pp. 994-1003, Mar. 2005.
CES
[23] R. G. Vaughan and J. B. Andersen, “Antenna diversity in mobile communications,” IEEE Trans. Vehicular Technol., vol. VT-36, pp. 147–172, Nov. 1987.
[24] G. F. Pedersen and J. B. Andersen, “Handset antennas for mobile communications: Integration, diversity and performance,” Rev. Radio Sci. 1996–1999, pp. 119–133, Aug. 1999.
[25] P. B. Wong and D. C. Cox, “Low-complexity diversity combining algorithms and circuit architectures for co-channel interference cancellation and frequency-selective fading mitigation,” IEEE Trans. Commun., vol. 44, pp. 879–885, Sept. 1996.
[26] C. Braun, M. Nilsson, and R. D. Murch, “Measurement of the interference rejection capability of smart antenna on mobile telephones,” in Proc. Vehicular Technology Conf., May 16–19, 1999.
[27] G. J. Foschini, “Layered space-time architecture for wireless communication in a fading environment when using multi-element antennas,” Bell Labs Tech. J., vol. 1, no. 2, pp. 41–59, 1996.
[28] M. A. Jensen and Y. Rahmat-Samii, “Performance analysis of antennas for hand-held transceivers using FDTD,” IEEE Trans. Antennas Propagat., vol. 42, pp. 1106–1113, Aug. 1994.
[29] K. Itoh and D. K. Cheng, “A slot-unipole energy-density mobile antenna,” IEEE Trans. Vehicular Technol., vol. VT-21, pp. 59–62, May 1972.
[30] C. A. Balanis, Antenna Theory: Analysis and Design. New York: Wiley, 1997.