Tradeoff Study of Different Kinds of UWB Antennas

Dua-Chyrh Chang, Ming-Yen Liu
Department of Electrical Engineering, Da Yeh University
112 Shan Jeau Road, Da Tsuen Shiang, Changhua, Taiwan 515, R.O.C.
TEL: 04-8511888#2180 FAX: 04-8511666
E-mail:dcchang@mail.dyu.edu.tw

An ultra wideband system is generally defined as having a wide bandwidth. There are some antenna types having such bandwidth. In this paper, there are some different kinds of UWB antenna at Da Yeh University (DYU) will be presented. By using different characteristic of structures, we can obtain good impedance matching for wideband applications. Details of the antenna design and both simulation and experimental results are presented and discussed.

Keywords—Ultra-wideband (UWB) antenna

Introduction

Ultra-wideband systems have recently researched more and more attention in the wireless communications. According to UWB definition of FCC, the UWB is a wide spectrum and low radiated power density [1]. Therefore, the antenna in UWB systems will play an important role. At DYU, different kinds of UWB antenna are designed and investigated for wireless communications or antenna measurement system applications.

Wideband Slot Antenna

The slot antennas are good for wideband operation [2]. By modifying the wideband slot antenna with microstrip feed line [3], we used four corners to stick internal wide slot ground plane and a metal plate to enhance impedance bandwidth. The configuration of proposed antenna is shown in Fig. 1(a). The maximum size of proposed antenna is 35.3mm by 42.8mm. The return loss of proposed antenna is from 2.3GHz to 12GHz and shown in Fig. 1(b). The proposed antenna with compact size and wide bandwidth are suitable for UWB application.

Planar UWB Monopole Antenna

Fig. 2 is a taped monopole antenna and Fig. 3 is U type monopole antenna with

ISBN: 89-86522-79-9 94460©KEES

ground-shaped. To obtain wide bandwidth, monopole antennas have recently been shown to be presented in these papers [4]-[7]. By changing the type of load and modifying the shape of ground plane [4], we can obtain dual bands [5] or wideband [6]-[7] characteristics. Both configurations and return losses are shown in Fig. 2(a), Fig. 3(a) and Fig. 2(b), Fig. 3(b), respectively. Both results also show that the proposed antennas have wideband property and compact size (not exceed 50mm by 50mm).

Antenna with Concentric Annular Rings for wideband operation

Fig. 4(a) is the configuration of UWB antenna with concentric annular rings. By using the characteristics of annular ring [8], the impedance bandwidth and radiation efficiency of proposed antenna is enhanced. The dimension and gap of concentric annular rings can be controlled effectively to the impedance bandwidth. It makes possible significant bandwidth enhancement for proposed antenna. Fig. 4(b) shows that the measured return loss of proposed antenna is from 4GHz to 29.4GHz.

Conclusions

The different kinds of UWB antenna at Da Yeh University had been presented. By changing the monopole types or modifying ground plane, and using characteristics of structure, we can obtain wide bandwidth effectively. The proposed antennas with compact size and good impedance matching are good for wideband applications.

References

[1] Jeffrey Reed, R. Michael Buehrer and Dong S. Ha, “Introduction to UWB: Impulse Radio for Radar and Wireless Communications” MPRG, pp.4.

[2] Horng-Dean Chen, “Broadband CPW-fed square slot antennas with a widened tuning stub,” IEEE Trans. Antennas Propagat. Vol.51, pp. 1982 – 1986, Aug 2003.

[3] Jia-Yi Sze; Kin-Lu Wong, “Bandwidth enhancement of a microstrip-line-fed printed wide-slot antenna,” IEEE Trans. Antennas Propagat. Vol.49, pp. 1020-1024, July 2001.

[4] Taeyoung Yang, William A. Davis, “Planar half-disk antenna structures for ultra-wideband communications” 2004 IEEE Antennas Propagat. Soc. Int. Symp. Vol.3, pp. 2508 – 2511, June 2004.

[5] Horng-Dean Chen, Hong-Twu Chen, “A CPW-fed Dual-Frequency Monopole Antenna” IEEE Trans. Antenna Propagat. Vol. 52, pp. 978-982, April 2004.

[6] D. E. Antonino, F. M. Cabedo, B. M. Ferrando and N. A. Valero, “Wideband Double-Fed Planar Monopole Antennas” Electron Lett., Vol. 39, pp. 1635-1636, 13 Nov. 2003.

[7] S. Y. Suh, W. L. Stutzman and W. A. Davis, “A New Ultrawideband Printed Monopole antenna: The Planar Inverted Cone Antenna (PICA)” IEEE Trans. Antennas Propagat. Vol. 52, May. 2004.

[8] Shun Yun Lin and Kin Lu Wong, “Enhanced Performances of A Compact Conical-Pattern Annular-Ring Patch Antenna Using A Slotted Ground Plane” IEEE APMC, Vol. 3, pp. 1036-1039, Dec. 2001.

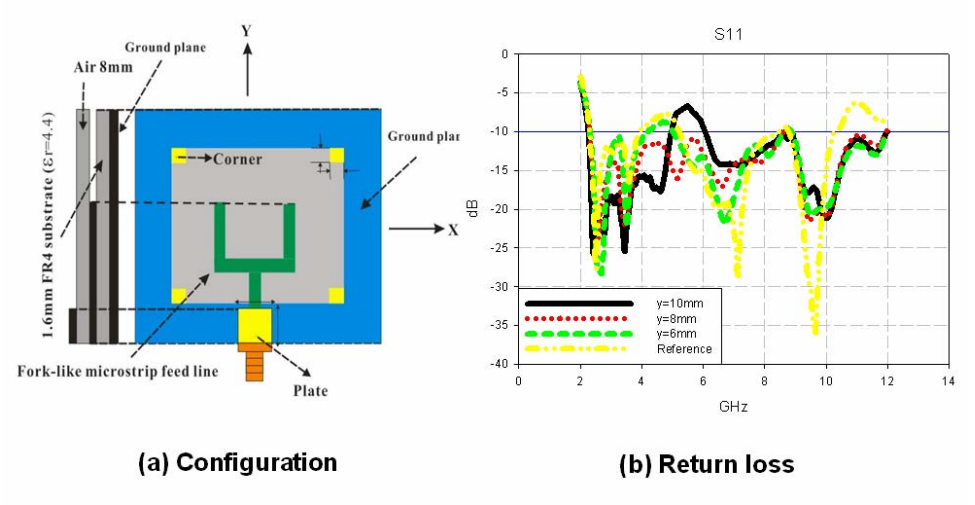

Fig. 1 Modify Wideband Slot Antenna with Fork-like Microstrip Feed Line

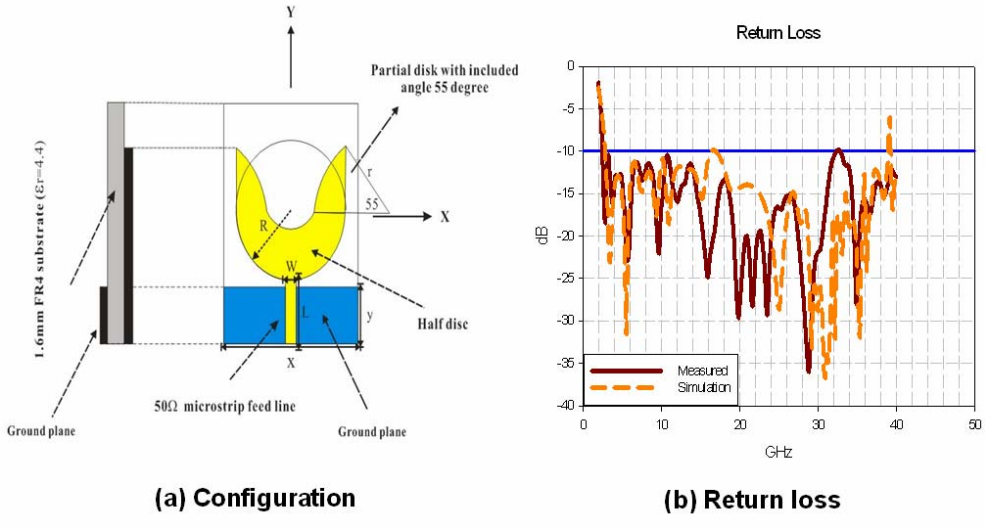

Fig. 2 A Planar UWB Monopole Antenna

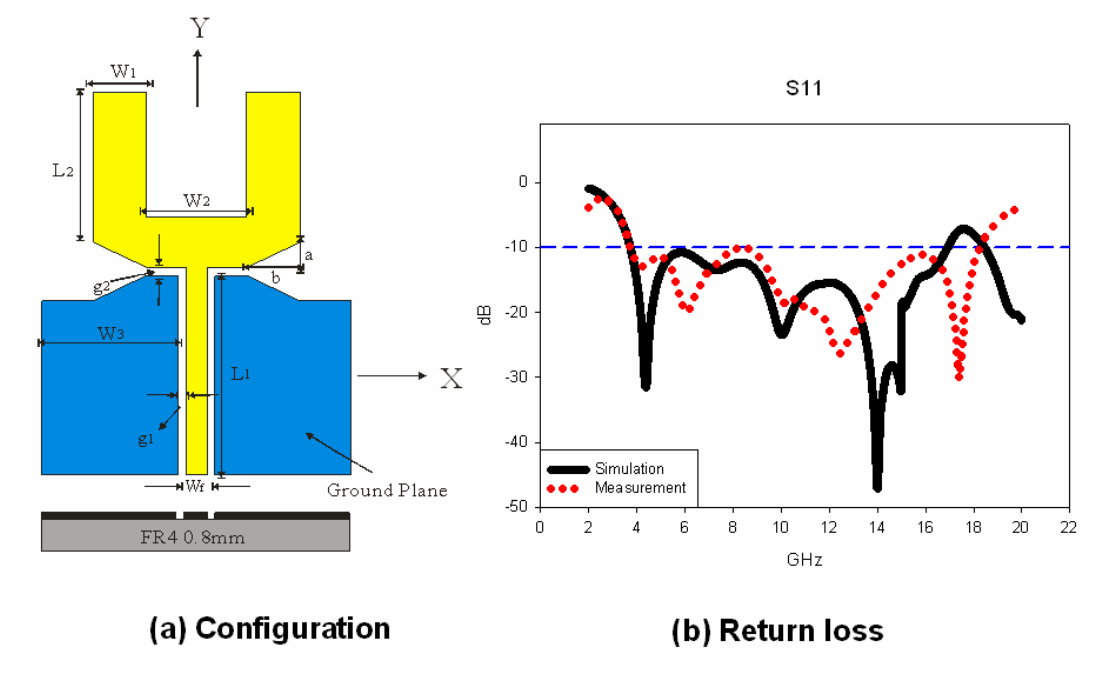

Fig. 3 A CPW-fed U Type UWB Monopole Antenna

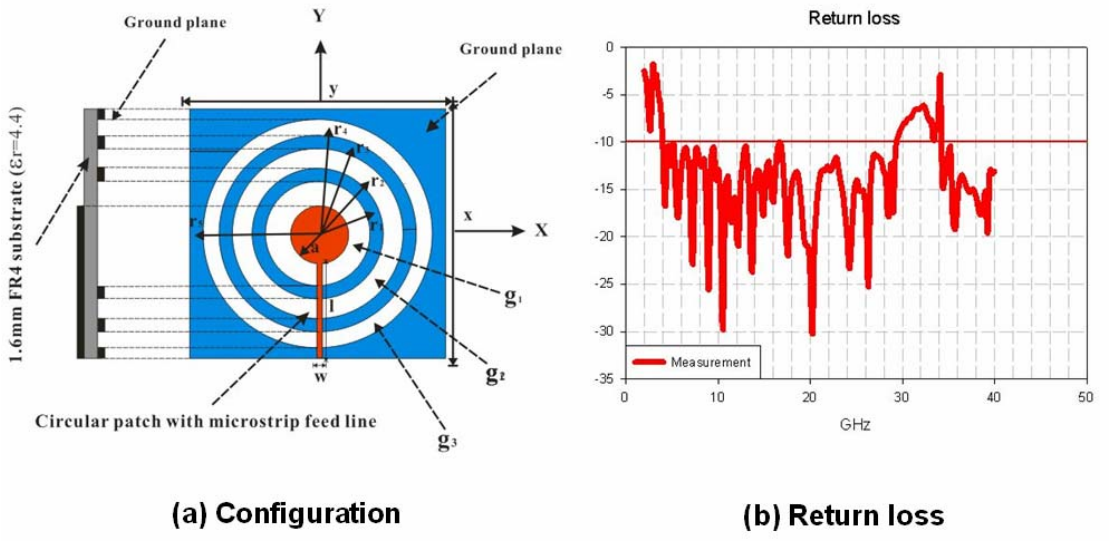

Fig. 4 Antenna with Concentric Annular Rings for wideband operation