UWB Antenna with CPW-fed Monopole

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1. Introduction

Ultra-wideband (UWB) antenna technology has recently applied for wireless communication. According to the FCC definition of UWB, fractional bandwidth measured at -10dB points $(f_H - f_L)/f_C > 20\%$ or total bandwidth >500MHz [1]. And the requirements of antenna have these properties for ultra-wideband: 2-Dimensonal, compact size, omni directional patterns, wide impedance bandwidth, and so on [2]. Therefore, to choice suitable antenna for ultra-wideband applications will be important.

Traditional monopole antenna is the fundamental mobile antenna and has the simplest structure. The radiation patterns of monopole antenna would be the same as a dipole antenna when it has the infinite ground plane. However, to obtain wide bandwidth, monopole antennas have recently been shown to be presented in these papers [3]-[5]. In this paper, a CPW-fed planar UWB monopole antenna consists of taped structure of ground plane and modified load. By adjusting taped type of load and taped structure of ground plane, we can obtain wideband performance on return loss of antenna. Details of the antenna design and both simulation and experimental results are investigated and discussed.

2. Antenna Design

The configuration of the proposed antenna is shown in Fig.1. The FR4 substrate material is used for this antenna. The thickness of substrate is 0.8mm and relative permittivity ε_r is 4.4. The left and right sides of proposed antenna is symmetrical structure. For CPW, the spacing between the center conductor of width W_f and the taped ground is g_1. By using the CPW as feeding, it is used to excite the monopole antenna. The spacing between the monopole antenna and edge of taped ground plane is g_2. The parameters of taped ground plane are $w_1, w_2, w_3, w_4, h_1, h_2, h_3$, respectively. The parameters of modified load are h_4, h_5, w_5, respectively. All optimum parameters of proposed antenna are also shown in Fig. 1. By selecting optimum parameters of proposed antenna, it is found that return loss of proposed antenna has good impedance matching. Especially, the parameters of both taped ground plane and modified type of load will influence obviously the impedance bandwidth of proposed antenna.

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3. Simulation and Measurement Results

To discuss effects of parameters variation of proposed antenna on performance of return losses, the proposed antenna is calculated with the simulator of HFSS and IE3D. The comparison of return loss between simulation and measurement versus frequency are shown in Fig. 2. During simulating, it is found that parameters of both taped ground plane and modified type of load are playing important roles on performance of return loss. By adjusting the parameters of proposed antenna, the bandwidth will be enhanced. From the measured result, the return loss of proposed antenna is form 3GHz to 14.1GHz or fractional bandwidth is 130%. It is conformed to operating frequency bands of ultra-wideband. The simulated and measured radiation patterns of proposed antenna at 3.1GHz, 7.1GHz, and 10.6GHz are shown in Fig. 3 and Fig. 4, respectively. The radiation patterns are plotted in the H-plane (X-Z plane) and E-plane (Y-Z plane); those of the proposed antenna are monopole-like. The radiation azimuthal planes are omnidirectional patterns and suitable for ultra-wideband applications. Within the operating frequencies bands (3.1GHz to 10.6GHz), the measured gain of proposed antenna is 1.15 dBi to 4.48 dBi and is presented in Fig. 5. The simulation results for bandwidth and radiation patterns are good in agreement with the measured data.

4. Conclusions

In this paper, design of a CPW-fed UWB monopole antenna for UWB applications is proposed. The maximum size of proposed antenna is 42.8mm by 38.08mm. By selecting optimum parameters of proposed antenna, the measured return loss of proposed antenna is from 3GHz to 14.1GHz or fractional bandwidth is 130%. The measured radiation azimuthal planes at X-Z plane are omni-directional pattern and suited for UWB application. The gain of proposed antenna is form 1.15 dBi to 4.48 dBi within 3.1GHz to 10.6GHz. The proposed antenna should be useful for wideband communication such as UWB systems.

References

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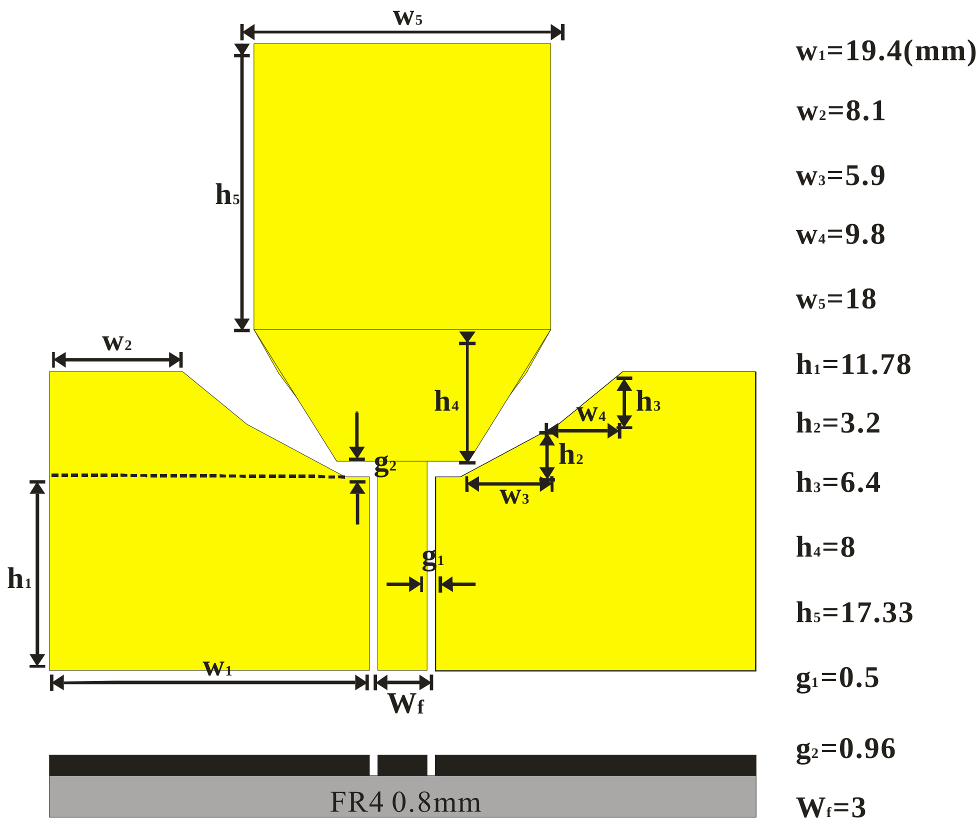


Fig. 1 The configuration of proposed antenna

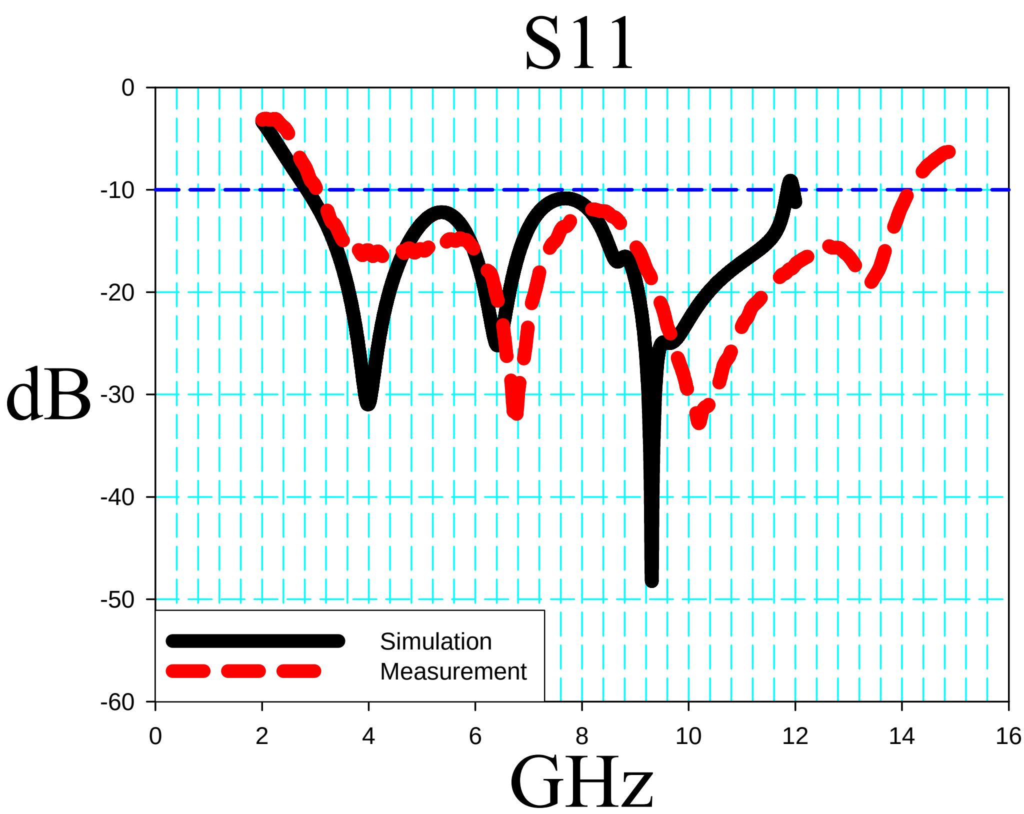
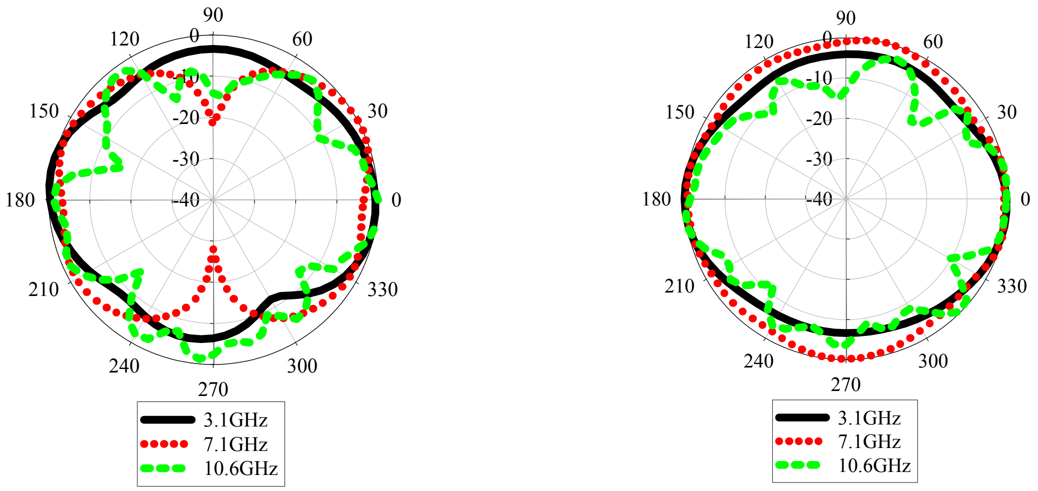
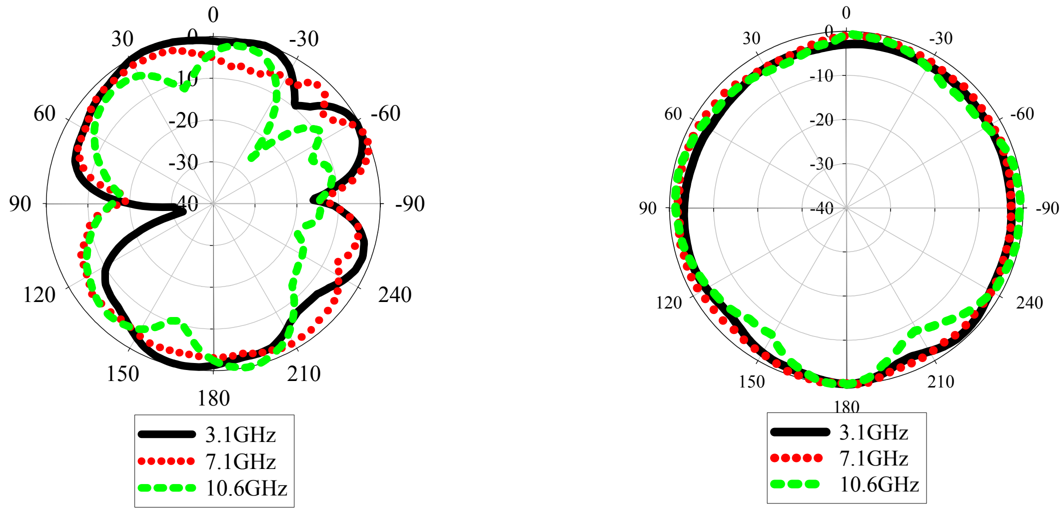


Fig. 2 The comparison of return loss between simulation and measurement results



(a) E-Planes (b) H-Planes

Fig. 3 The simulation radiation patterns of proposed antenna



(a) E-Planes (b) H-Planes

Fig. 4 The measured radiation patterns of proposed antenna

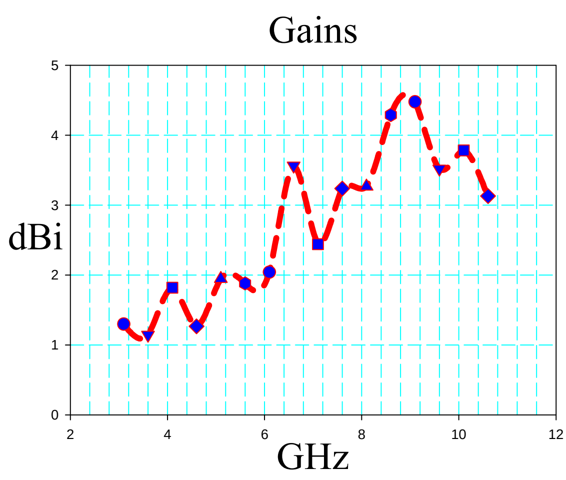


Fig. 5 The measured gains of proposed antenna