Printed CPW-Fed Wideband Rhombus Slot Antenna for WiMAX applications

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1. Introduction

In recent years, wireless communications have progressed very rapidly. In order to provide with large bandwidth for any wireless application, wideband antenna design has become very important. In the reported literature [1-2], some of CPW-fed and microstrip-line-fed wide-slot antennas have been proposed for the wideband operation. The impedance bandwidths of the wide-slot designs [1-2] can reach about 15~88%. However, they are still not enough for wireless applications. For other reports in [3-5], some of slot antennas for WiMAX applications are proposed. However, the wideband technique used in these designs makes the antenna design more complicated.

In this paper, a CPW-fed rhombus slot antenna is proposed for WiMAX applications. Good impedance matching for a wideband operation can be obtained. Within this wide operating impedance bandwidth, the same polarization plane and broadside radiation patterns can be excited.

2. Antenna design and experimental results

Figure 1 depicts the geometry of the proposed CPW-fed printed slot antenna. This antenna consists of a rhombus wide-slot printed on a FR4 substrate with the thickness of 1.6 mm and the relative permittivity of 4.4. The antenna size used in this design is with a size of 41.6 $\times$ 46.6 mm^2. And the 50-Ω CPW feed line has the tuning stub of with the length of Ls in mm and with the width of 6.3 mm. As Ls = 27 mm, the wideband operation for WiMAX applications can be obtained in the design.

Figure 2 shows that measured and simulated results of return loss. It is seen that the measured impedance bandwidth can agree with the simulated one which was performed by using the software package from ANSOFT High Frequency Structure Simulation. In Fig. 2, it is seen that with the case of Ls = 27 mm the proposed antenna demonstrates a wideband bandwidth of 3870 MHz (determined from 10 dB return loss) which is about 93 %. Fig. 3(a), 3(b), and 3(c) show measured radiation patterns in WiMAX (2305~5825 MHz) band by E- and H-plane. The WiMAX band includes 2.3~2.7, 3.4~3.6, and 5.2~5.8 GHz sub-bands according to the IEEE 802.16 standard. It is shown that the radiation patterns obtained are stable throughout the WiMAX band. Figure 4(a), 4(b), and 4(c) show the measured peak antenna gains within the wide operating bandwidth in each of WiMAX sub-bands. The gain variations are observed to be less than 3dBi in each of 2.3~2.7, 3.4~3.6 and 5.2~5.8 GHz sub-bands.

3. Conclusions

In this paper, a wideband printed CPW-fed rhombus slot antenna has been demonstrated. Experimental results show that a wideband operation for WiMAX applications can be obtained. From theoretical simulation and experimental results, the proposed antenna has the impedance bandwidth of 3870 MHz which is about 93% with respect to the center frequency at 4145 MHz. In addition, the radiation patterns have been measured and presented by E- and H-planes. It is seen that they are similar to those of a conventional wide-slot antenna. From measured results, antenna gain variation can be less than 3 dBi within the wide impedance bandwidth of the WiMAX band.

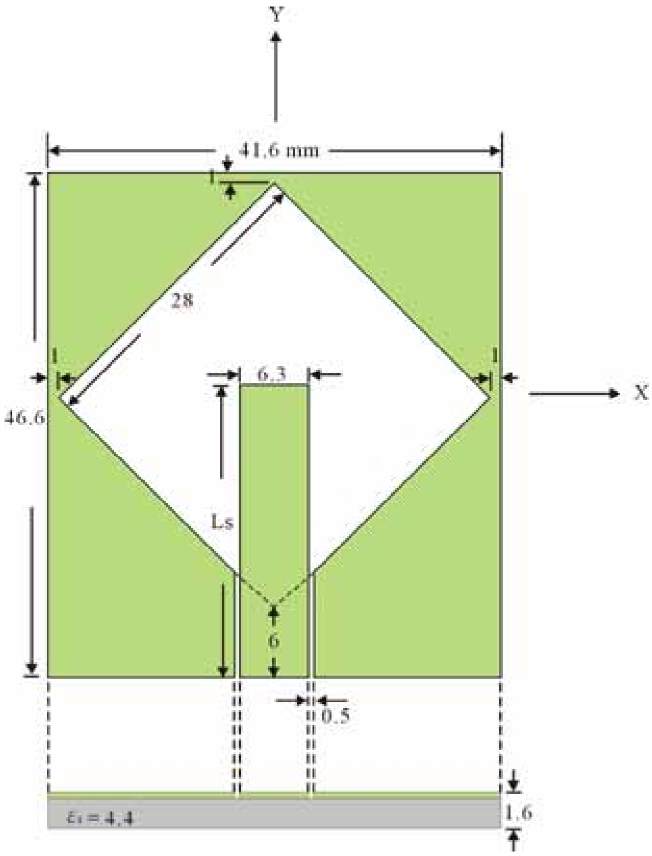


Fig. 1: Geometry and dimensions of the proposed CPW-fed rhombus slot antenna

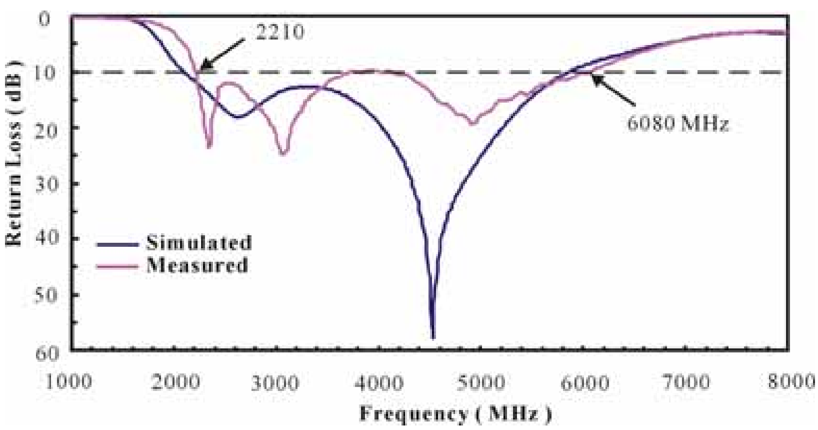


Fig. 2: Measured and Simulated return loss against frequency as Ls = 27 mm in Fig. 1

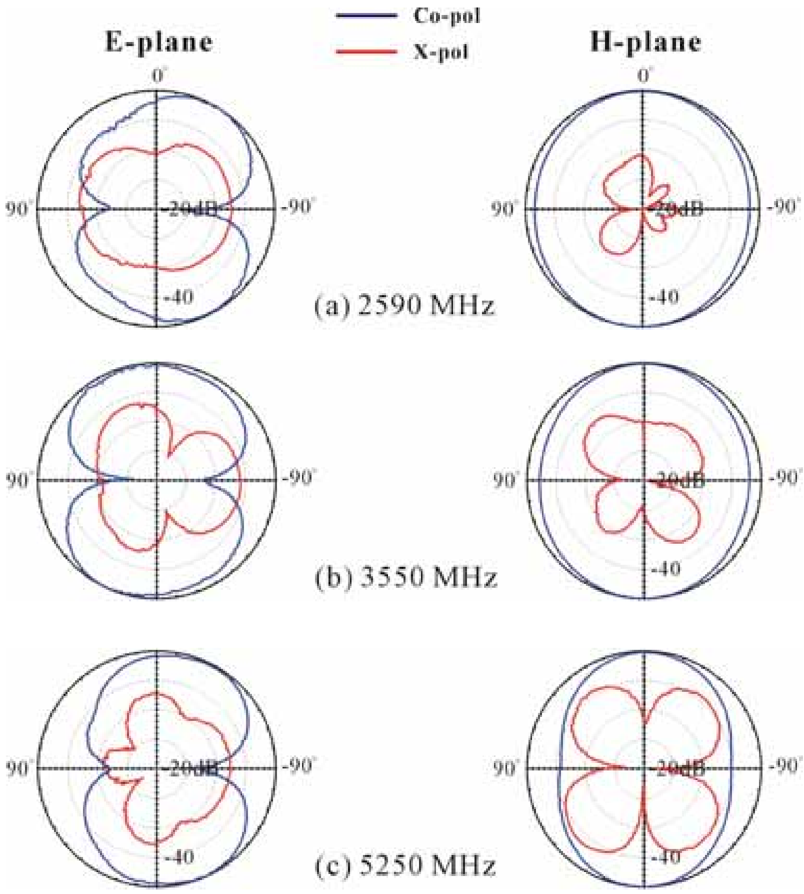
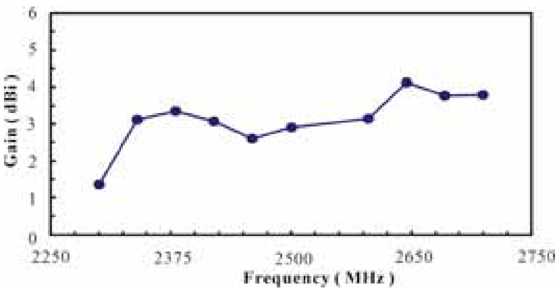
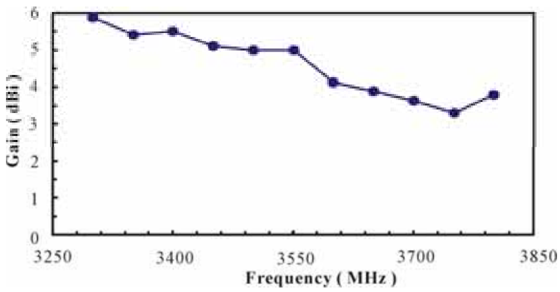


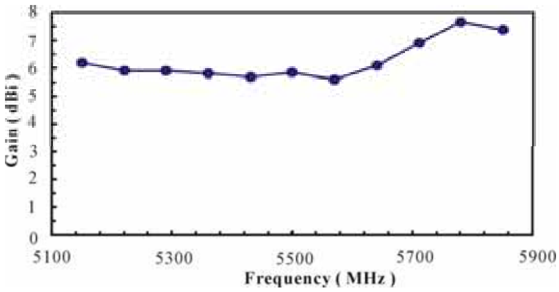
Fig. 3: Measured E- and H-plane radiation patterns as Ls = 27 mm in Fig. 1



(a) WiMAX sub-band at 2.3~2.7 GHz



(b) WiMAX sub-band at 3.4~3.6 GHz



(c) WiMAX sub-band at 5.2~5.8 GHz

Fig. 4: Measured peak antenna gain frequency as Ls = 27 mm in Fig. 1

Acknowledgments

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