A Compact Triple-band MIMO Antenna for Wimax/WLAN Application

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Abstract— A compact triple-band inverted-F antenna for WLAN and WiMAX multiple-input-multiple-output (MIMO) system is proposed in the paper. Its main radiation element is evolved from simple inverted-F antenna, works at 2.4 GHz, 3.5 GHz. The parasitic element works at 5.2 GHz, 5.8 GHz, In order to reduce the size of the antenna and improve the effect of the truncated ground plane on impedence match, a slot is added. A four-element array configuration of the proposed antenna for MIMO application is also studied. The siumulation results of reflection coefficient, mutual coupling, and radiation pattern are presented.

1. INTRODUCTION

Multiple-input-multiple-output (MIMO) technology can enhance the data rate and reliability without sacrificing additional spectrum or transmitted power in rich scattering environment, which make it very attractive in the recent years [1]. Various types of MIMO for Wimax/WLAN Application were presented [2–5], As we all know that inverted-F antenna is widely used in mobile terminal for its low cost, compact structure and easy to fabricate [2, 6]. In this paper, a inverted-F MIMO antenna operating at WLAN and WiMAX is presented. Inverted-F antenna is dependent of the ground dimension strongly, especially at lower frequency whose eletrical length is relative large, which often results in bad isolation for MIMO application, In order to reduce the coupling, each element is orthogonal to adjacent elements, Finally, the four-element MIMO antenna occupies $60 \times 60\,\mathrm{mm}^2$, operating at the following frequency bands: 2.36–2.56, 3.45–3.74, 4.95–6.33 GHz.

2. ANTENNA DESIGN

The geometry and configuration of the proposed antenna is illustrated in Fig. 1, which is printed on a FR4 epoxy substrate with a thickness of 0.8mm, a relative permittivity of 4.4, and a loss tangent of 0.02. The antenna is comprised of a main radiation element evolved from simple inverted-F antenna and a paramistic stub, which only occupy the size of $25\times8\mathrm{mm}^2$. Both the ground plane and the radiation element are etched on the same substrate, without vias, making the structure easily fabricated and conveniently excited. The lower resonant mode was excited by stub AB, which

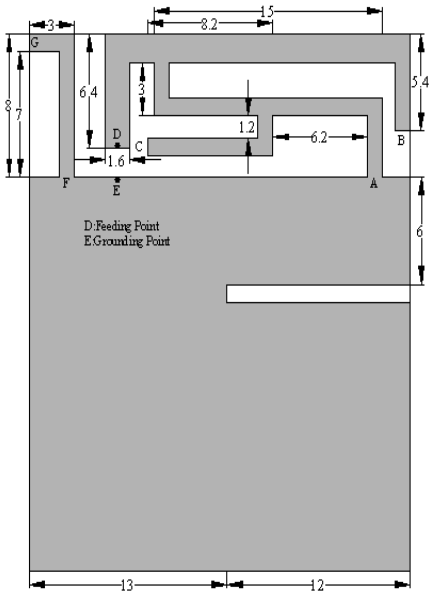

Figure 1: Geometry of the proposed antenna.

is approximately equal to a quarter-wavelength for the frequency of 2.4 GHz ($\lambda \cong c/(f \times \sqrt{\varepsilon_e})$, where ε_e is the effective dielectric constant; the resonance in 3.5 GHz was produced by AC; The paramistic stub FG provided the upper resonance. The single-element simulated result is shown in Fig. 2.

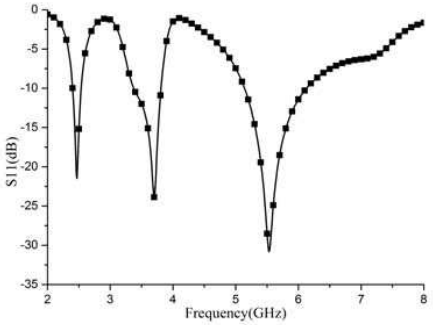

Figure 2: Reflection coefficient of the proposed antenna against frequency.

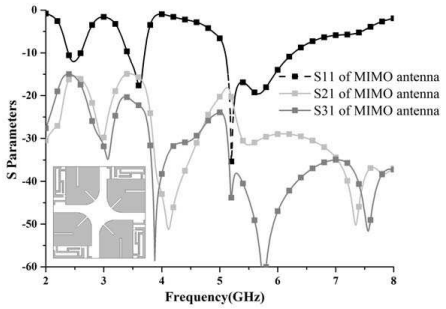

Figure 3: The MIMO antenna proposed.

3. INTEGRATION OF FOUR-ELEMENT ANTENNA

With the demand of high-quality and high-capacity data transmission, MIMO antenna become more and more important, so the trail that transform the SISO antenna into MIMO antenna will be studied in the following part. The simulated S parameters of the proposed MIMO antenna consists of four element is shown in the Fig. 3.

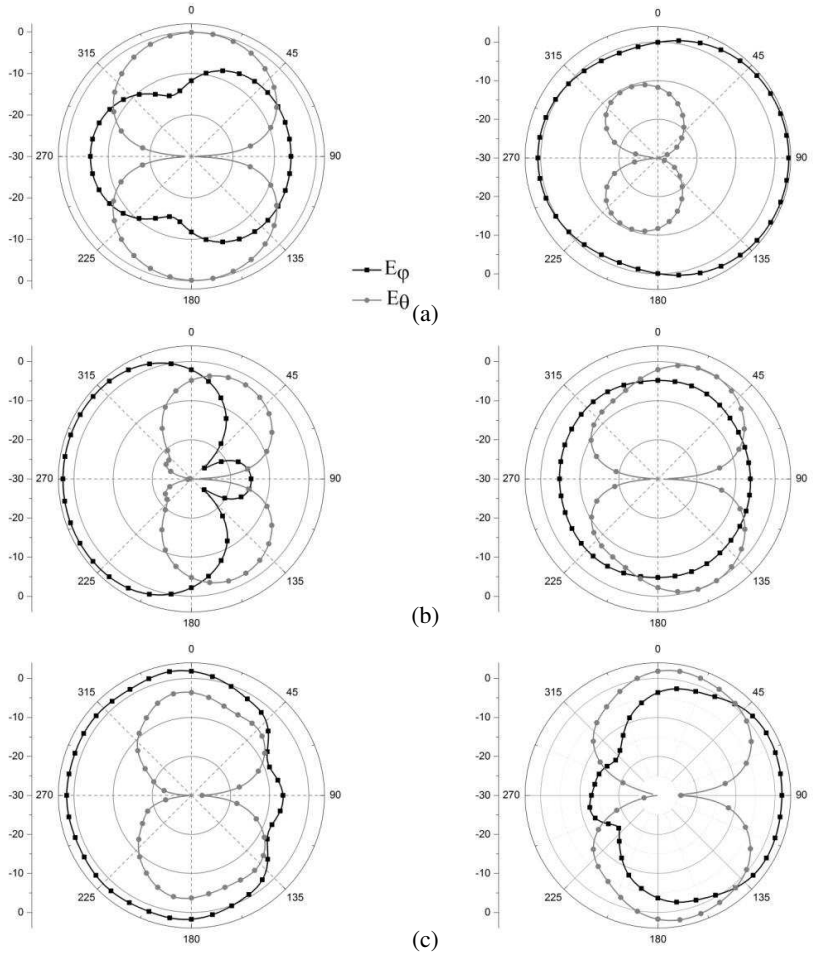

Figure 4: Radiation pattern XOZ_plane (left) and YOZ_plane (right) for (a) 2.44 GHz, (b) 3.61 GHz, (c) 5.5 GHz.

Inverted-F antenna is strong dependent of the ground. The common ground plane must cause strong mutual coupling, then make the diversity performance worse. So each element has its own ground plane, In order to further reduce the coupling, each element is orthogonal to adjacent elements. The slot and circular-corner both improve the isolation. The simulation result shows that the MIMO antenna can cover the 2.4/5.2/5.8 GHz WLAN and 3.5/5.5 GHz Wimax, within the designed frequency range, the isolation can achieved 15 dB. The radiation patterns for *xoz* plane and *yoz* plane are shown in Fig. 4, nearly omnidirectional pattern can be observed in lower frequency.

4. CONCLUSION

A compact triple-band inverted-F antenna for WLAN and WiMAX multiple-input-multiple-output (MIMO) system is proposed in the paper. The four-element MIMO antenna occupies $60\times60\,\mathrm{mm}^2$, operating at the following frequency bands: 2.36–2.56, 3.45–3.74, 4.95–6.33 GHz.

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