Compact WiMAX MIMO Antenna Design for Laptop Applications

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Abstract – In this paper, we proposes a compact of design MIMO antenna design for laptop computers. This design has an advantage of compact size and good isolation. Total size of the antennas are 70 × 8 × 0.8 mm^3, and the size of the ground plane are 205 × 267 mm^3. Meander strip connected to the ground is for isolation enhancement, it successfully reduce the total size. Proposes antenna use in WiMAX 2.3 GHz to 2.7 GHz、3.4 GHz to 3.7GHz and high band 5.25GHz to 5.85GHz. In these bands, S12 are all below -15dB; even S12 at high band are under -20dB. Other detail of the design and results will be discussed in this paper.

***Index Terms* — LTE, WIMAX, MIMO, Laptop, Antenna.**

I. INTRODUCTION

In these years, wireless communication is need for life. Laptop, tablet, and some other portable device are used everywhere. Common communication bands includes GSM850 (824-894 MHz), GSM900 (890-960 MHz), GSM1800 (1710-1880 MHz), UMTS (1920-2170 MHz). People are looking for faster and reliable way, therefore LTE and WiMAX for the fourth generation standard has been proposed [1]. LTE operating bands include LTE700 (698-787 MHz), LTE2300 (2305-2400 MHz), LTE2500 (2500-2690 MHz); WiMAX operating bands include 2.3 GHz band, 3.4 GHz band and high-band 5 GHz band. MIMO (Multi-input Multi-output) configuration is proposed as the need of high data-rate and throughput of communication. MIMO provides high-speed data transmission and high channel capacity [2-3]. In the other way, the isolations problem between multiple antennas must be considered. In this paper, we propose the MIMO antenna design for laptop computer. Measured and simulated results will be discussed in next section.

II. ANTENNA CONFIGURATION

Fig. 1 (a) shows the antenna geometry with a ground size of 205 × 267 mm^2. Antennas are placed at middle of top edge of the ground plane (started at 98.5 mm). Fig. 1 (b) shows the proposed antenna and isolation design of the proposed design. The overall size of the antenna is 70 × 8 × 0.8 mm^3, and antenna is fabricated on the Fiberglass dielectric substrate (FR4) thickness of 1.6mm, relative dielectric constant is 4.4.

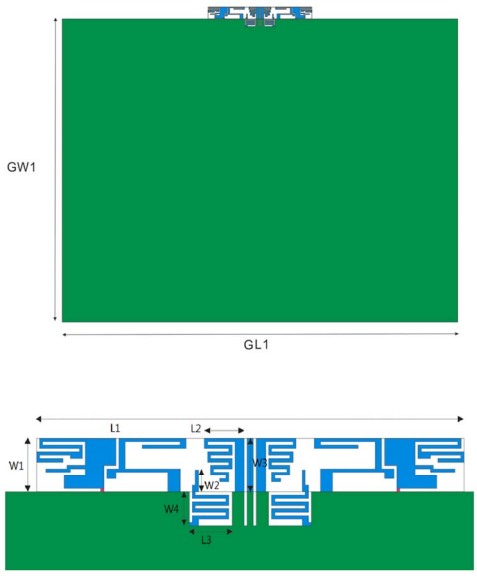

Fig. 1. (a) Geometry of the proposed design, (b) Detail description of proposed antennas and isolation design

The antenna is directly fed by using mini-coaxial cable (feeding point at pink). The feed point connected to meandered monopole and coupled to the meandered monopole connected to the ground plane. Two antennas be placed back to back, and separated by 21 mm. The length of the isolation element is 21 mm. Because two antennas are very close to each other, we introduce the slot at the ground (W4 by L3) to increase isolation performance.

TABLE I DIMENSIONS OF PROPOSED ANTENNA

GW1	GL1	W1	W2	W3	W4
205	267	8	3.3	8	5
L1	L2	L3	Antenna Parameters		
70	6.5	7	Unit : mm		

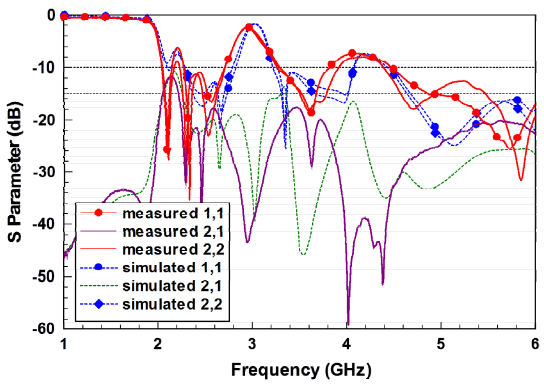

Fig. 2 Measured and Simulated S parameters of the proposed design

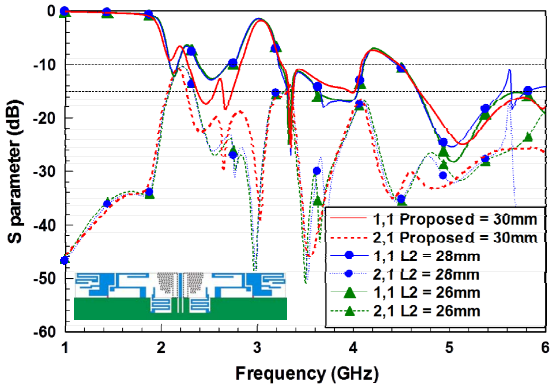

Fig. 3 Simulated S parameters of the proposed design with different lengths of L2.

III. EXPERIMENTAL RESULTS AND DISCUSSION

Fig. 2 shows the measured and simulated S parameters of the proposed design. Because of the tolerance of manufacturing, there are some differences between the measured and simulated ones. From the measured results, S12 is below -15dB from 2.275GHz, and S12 at high band are all below -20dB. Fig. 3 shows the S parameters of the proposed design with different lengths of L2. When L2 is reduced from 30mm to 26mm, the impedance at lower band is not obtained. And, the mode of high-band and isolation has some frequency shift. Isolation dip is shifted to higher at lower band. Fig. 4 shows the S parameters of the proposed design with different lengths of W2. The length of W2 could affect the matching of WiMAX band of 3.4GHz to 3.7GHz. It can be founded the isolation dip at 3.45GHz will be shifted to higher frequency.

Fig 5 shows the S parameter of the proposed design with different lengths of W3. The length of W3 could affect the impedance of the design at lower band of 2.3GHz-2.7GHz.

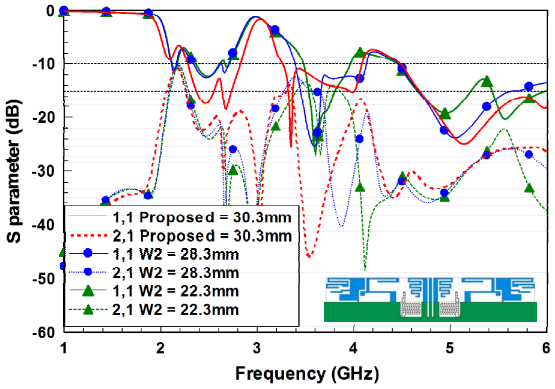

Fig. 4 Simulated S parameters of the proposed design with different lengths of W2

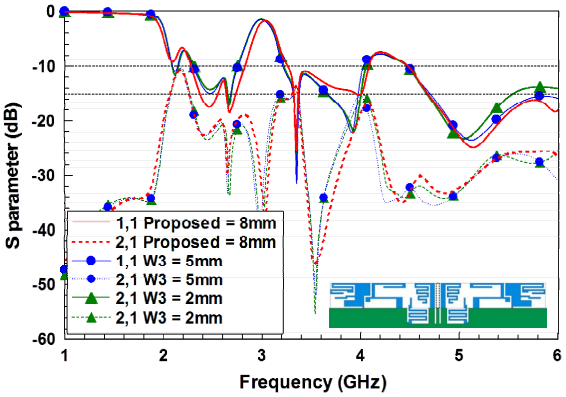

Fig. 5 Simulated S parameters of the proposed design with different lengths of W3

IV. CONCLUSION

A compact and small of WiMAX MIMO antenna design have been proposed and investigated. The bandwidth covers the bands of 2.3-2.7 GHz, 3.4-3.7 GHz, and 5.15-5.85 GHz, and it can be applied to LTE2300, LTE2500 and WLAN a/b/g/n applications. Good isolation with S12 below -15dB, even S12 below -20dB at the high-band can be obtained. The design of MIMO antennas with compact size and good isolation is very suitable for Laptop computer applications.

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