Compact PIFA antenna for USB Dongle Application

Wen-Shan Chen[1], Wei-Syun Sin[1], and Fa-Shian Chang[2]
[1]Department of Electronic Engineering, Southern Taiwan University of Science and Technology, 1 Nan-Tai St., YungKang Dist., Tainan City 710, Taiwan
[2]Department of Electronic Engineering, Cheng Shiu University, No. 840, Chengcing Rd, Niaosong Dist., Kaohsiung City 833, Taiwan.
chenws@mail.stust.edu.tw

Abstract - **In this paper, A PIFA antenna with a U-shape strip for WLAN application is proposed. The antenna is used W1 and L2 to resonant mode at 2.4 GHz .The higher band is used W2 and L7 to operates modes for 5.15 and 5.725 for WLAN GHz bands. The proposed antenna overall size is 40mm x 10 mm x 1.6mm and the antenna area is 14 mm x 10 mm. From the simulated and measured S11, the 10 dB operating bands cover the IEEES02.11 a/b/g WLAN applications. The results of radiation efficiency, antenna gain are also shown and investigated in the paper.**

I. INTRODUCTION

In recent years, wireless communication systems have been developing rapidly, mobile phones, GPS, RFID, and WLAN applications [1]. In practical applications, IEEE 802.11 WLAN standard includes 2.4/5.2/5.8 GHz (2.4-2.484, 5.15-5.35, 5.725-5.85 GHz), so the antenna device for the use in WLAN applications needs these bands. One important characteristic of wireless devices is easy to carry. WLAN USB Dongle is the most convenient device. In [2] [3], its a complex meander path resonant mode at 2.4/5.2 GHz. On the other hand, [4] [5] used monopole antenna to resonant mode at 2.4 GHz/5.2 GHz. In [6] used multi-path to resonant mode at 2.4/5.2 GHz.

The propose antenna occupied a size of 40 mm x 10 mm x 1.6 mm. And, the antenna used U-shape strip is simple structure and ease to design.

II. ANTENNA DESIGN AND EXPERIMENTAL RESULTS

The geometry of the proposed antenna shown in Fig. 1 is fabricated on an FR4 substrate with thickness of 1.6 mm, relative permittivity of 4.4, and loss tangent of 0.024. And detailed dimensions of the proposed antenna are also listed in table 1. The overall dimensions of the antenna of 40 mm ×10 mm×1.6 mm contain an antenna portion of 14 mm × 10 mm×1.6 mm and a ground plane of 16 mm × 10 mm×1.6 mm. And a 50-ohm mini-coaxial feed-line is used for RF signal input.

The length of W1 and L2 is for resonance at lower operation band at 2.4 GHz. The length of L7 and W2 is for resonance at higher bands. The simulated results are obtained through HFSS simulation software.

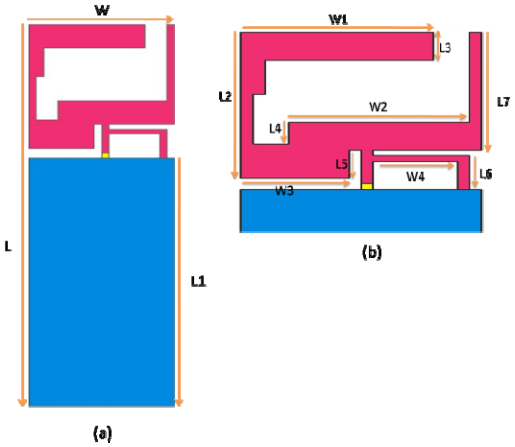


Fig. 1 (a) overall antenna (b) the description of the antenna portion

Table 1 Detailed dimensions of the proposed antenna

Parameter	Unit(mm)	Parameter	Unit(mm)
L	40	L7	10.5
L1	26	W	10
L2	13	W1	8
L3	2.5	W2	7.5
L4	1.5	W3	4.5
L5	2.5	W4	4
L6	3		

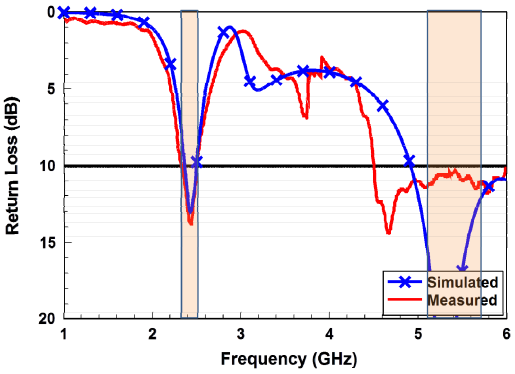


Fig.2 Simulated and measured return losses of the proposed antenna

By optimizing the antenna parameters, both the simulated and measured return loss meet the WLAN application bands (2.4 to 2.484 GHz, 5.15 to 5.35 GHz and 5.725 to 5.85 GHz) as shown in Fig. 2. The measured and simulated return losses have good agreement to ensure the reliability of the design. Two parametric studies for the antenna are also studies in the section.

Fig. 3 shows the return loss of the proposed antenna with different lengths of L3. When the length of L3 is decreased, the proposed antenna excites a mode below 2.4 GHz. Fig. 4 shows the simulated return losses of proposed antenna with different length of L7. We can find that the impedance matching of the antenna at 5GHz bands impedance is not match when L7 equals to be 2.5 mm.

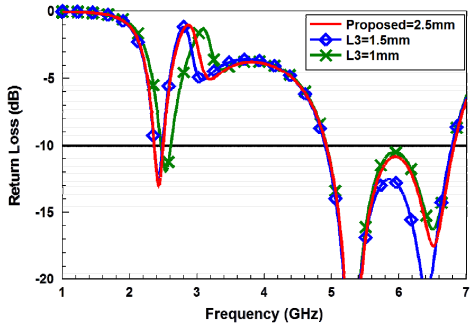


Fig. 3 Simulated return losses of the proposed antenna for different lengths of L3.

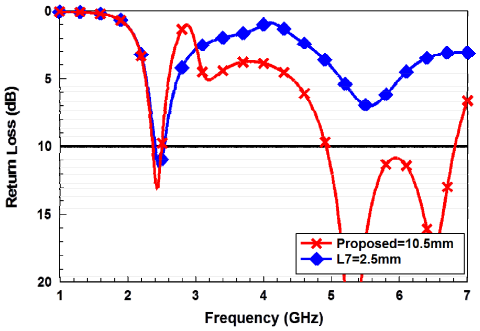
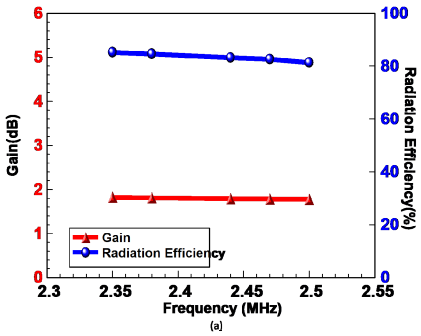


Fig. 4 Simulated return losses of the proposed antenna for different lengths of L7.



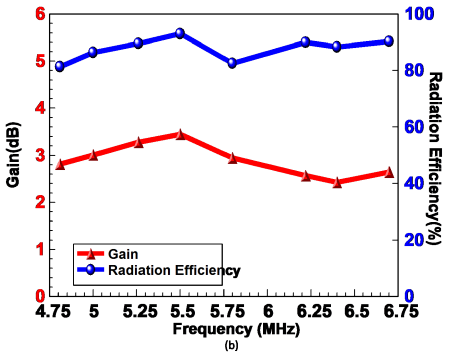


Fig. 6 Simulated antenna gain and efficiency of the proposed antenna at the band of (a) 2.3 - 2.5GHz, (b) 4.75 – 6.75 GHz.

III. Conclusion

A PIFA with U-shape strip for USB dongle application has been implemented and investigated. The obtained bandwidth covers the bands of 2.4/5.2/5.8 GHz (2.4-2.484, 5.15-5.35, 5.725-5.85 GHz). The antenna design with simple structure and easy to design is good candidate of the antenna for wireless USB applications.

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