# A Compact Monopole Antenna for WLAN Operation


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## 1. Introduction

Recently, the multi-band antennas have inspired high interest for communication systems. Wireless local area network (WLAN) technology is a wireless communication standard, which is operating range in the lower band from 2.4 to 2.484 GHz (IEEE 802.11b/g) and higher band from 5.15 to 5.825 GHz (IEEE 802.11a).

In recent years, the printed monopole antennas are arresting, because they have the advantages of easy to fabricate, simple structure, low cost, and low profile. Another advantage of the printed slot antenna is easily to integrate in active component or MMIC, so many monopole antennas in the literature have been proposed [1-5]. The antenna proposed in [1] is the typical microstrip-fed printed monopole antenna, which uses double-T structure to achieve the dual band. In [2], the triple-band microstrip antenna is uses two one-quarter wavelength resonating components. In [3], the compact dual-band monopole antenna has two rectangular elements having different shapes to achieve dual-band for WLAN operation. In [4], the geometry of meander monopole antenna used two strips with the same width and different lengths to resonance 2.4GHz band and 5GHz band. The proposed antenna in [5] is a CPW-fed microstrip monopole antenna, which uses a C-shape structure to obtain the dual-band and broadband.

In this paper, a novel compact design of monopole antenna for WLAN operation has been proposed. The dual-bands antenna can cover the standard IEEE 802.11a/b/g/n (2.4-2.484 GHz, and 5.15-5.825 GHz) for WLAN application and will be presented and discussed in this paper.

## 2. Antenna Configuration

Fig. 1 shows the configuration of the proposed antenna. The compact monopole antenna is fabricated on a FR4 substrate with a thickness of 1.6 mm (h), a relative permittivity of 4.4 ($\varepsilon_r$) and an overall dimensions of 20 × 25 ×1.6 $mm^3$ ($W_g \times L_g \times h$). The fed line of the proposed antenna connected to the 50$\Omega$ standard miniature adapter (SMA) has a width $W_f$ = 3 mm. The main structure of the proposed antenna is combined a geometry radiation patch and ground plane. Then, we etched a geometric of the open slot on the ground plane and use this to achieve impedance matching and resonance the low frequency. The ground plane designed is to provide a new path to excite a low frequency resonant mode. The detail parameters of the proposed antenna are listed in Table 1.

## 3. Experimental Results and Discussion

The measured return loss of the proposed antenna for WLAN operation is shown in Fig.2. The proposed antenna return loss is successfully measured by network analyzer. We have successfully obtained bandwidth of the proposed antenna at a lower band of 2.39 to 2.52 GHz and a higher band of 4.98 to 6.07 GHz, covering the bandwidths of 2.4 to 2.484 GHz and 5.15 to 5.825 GHz of WLAN standards. The U-shape resonance path of the ground plane can be resonated by the low frequency mode and the total length of U-shape is about 0.5λ, at the higher frequency, we used straight strip ($L_a \times W_a$) to resonate the frequency mode and the length of the strip is about 0.25λ. In this case, the parameters $L_1$ and $L_a$ are important parameters.

Figure 3(a) and (b) shows the measured gain against frequency of the proposed antennas in Y-Z plane. Fig. 4 shows the measured radiation patterns at 2.44 GHz and 5.5 GHz in Y-Z plane and X-Z plane, respectively. At low frequency band, the proposed antenna has a good radiation pattern and horizontal polarization in two planes. Due to a non-symmetric design of the proposed antenna, which have slightly distorted radiation pattern at higher frequency band.

## 4. Conclusion

The novel design of a compact printed monopole antenna for dual-band operation is proposed for WLAN applications. The lower-operating band is obtained from the U-shape resonance path of the ground plane. The proposed antenna was successfully implemented and verified. It also has small size, good radiation performances. In addition, the printed monopole antenna has an advantage of simple geometry.

## Acknowledgement

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## References

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| | $L_g$ | $W_g$ | $L_1$ | $L_2$ | $W_1$ | $W_2$ |
|---|---|---|---|---|---|---|
| Unit (mm) | 25 | 20 | 14 | 4 | 4 | 3.5 |

| | $L_3$ | $L_a$ | $W_a$ | $L_b$ | $W_b$ |
|---|---|---|---|---|---|
| Unit (mm) | 8.5 | 6 | 3 | 7 | 4 |

Table 1. Parameters of the antenna structure

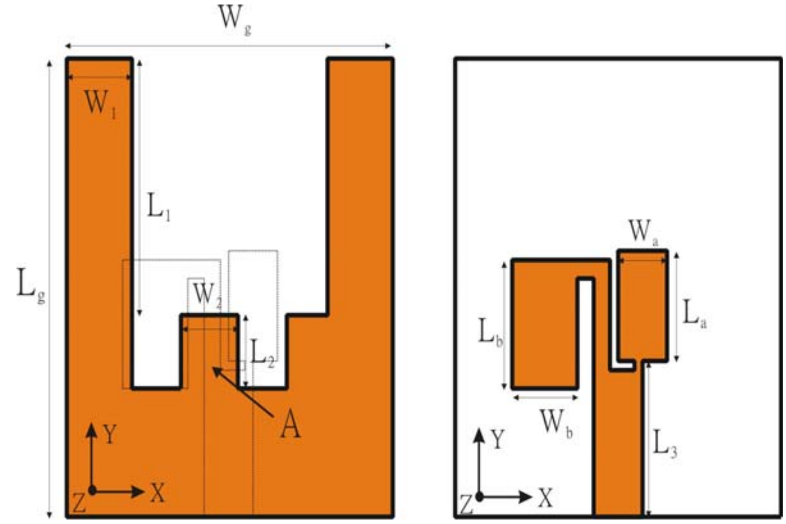



Fig. 1. The geometry of the proposed antenna

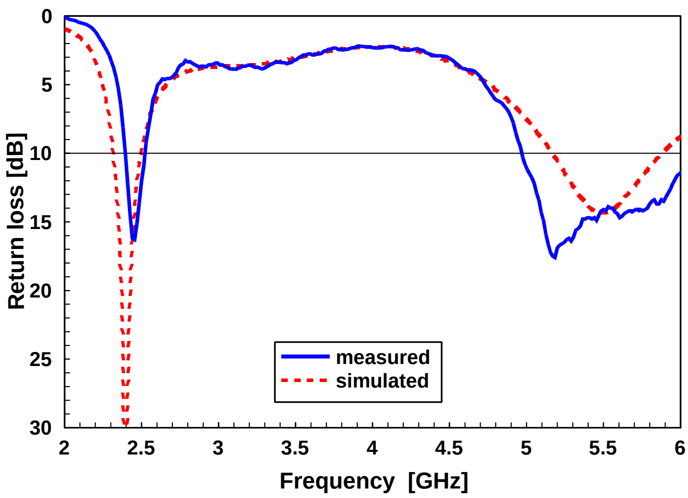
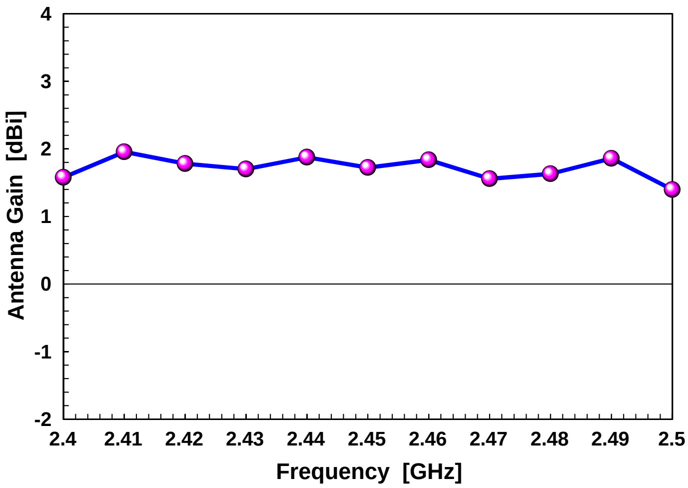
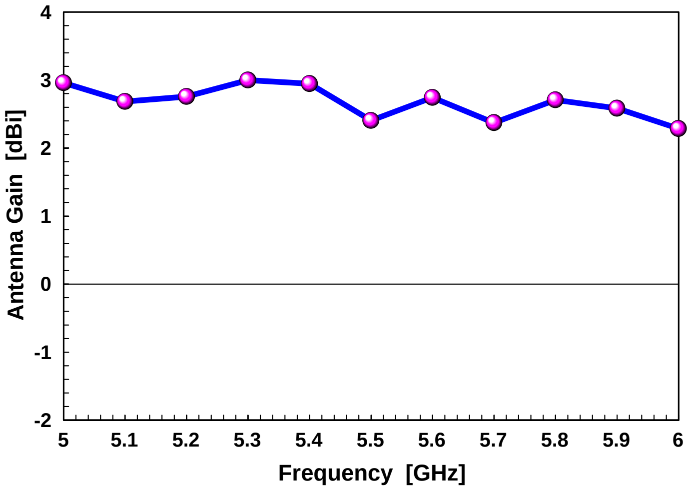



Fig. 2. Measured and simulated return loss of the proposed antenna

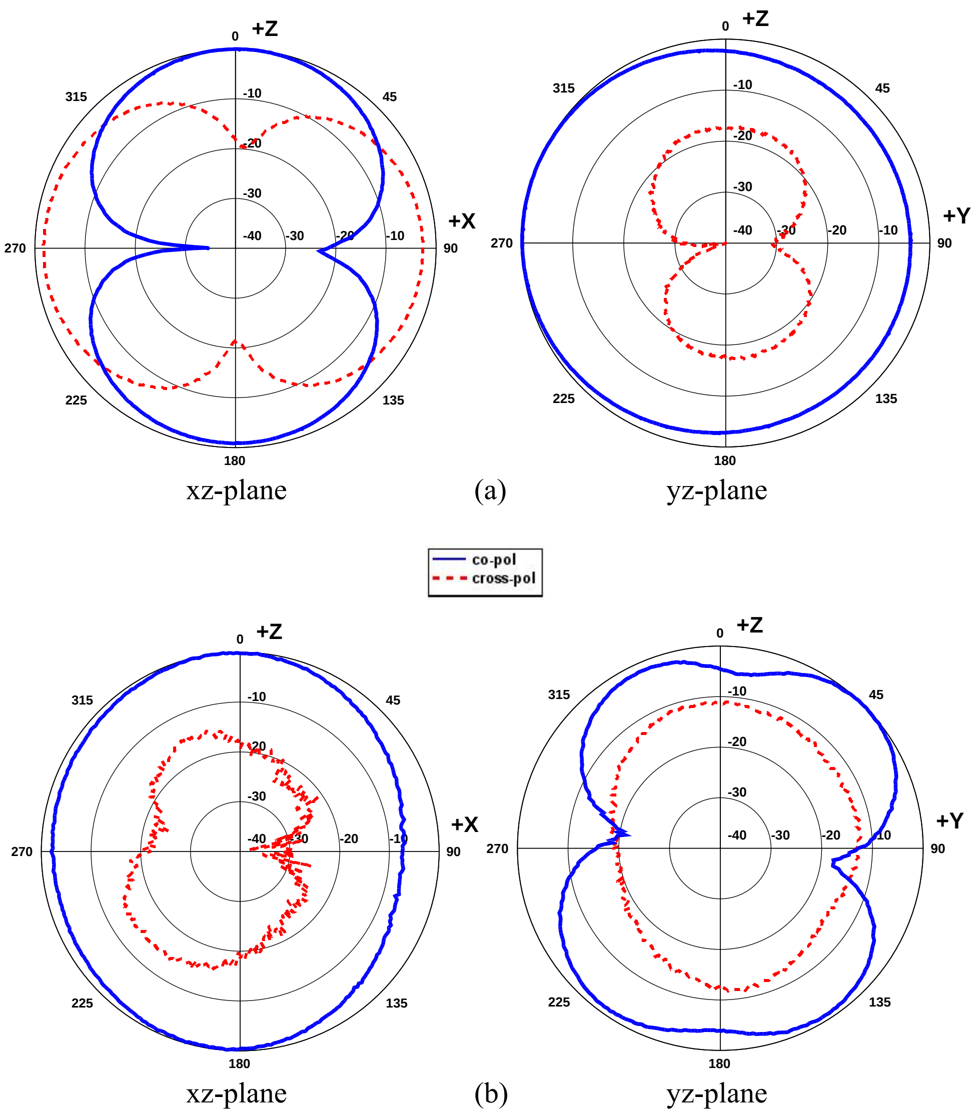



(a)



(b)

Fig. 3. Measured gain of the proposed antenna (a) low freq. band (b) high freq. band



(a)

(b)

Fig. 4 Measured radiation patterns of the proposed antenna (a) 2.44 GHz. (c) 5.5 GHz.