A New-Type Miniature Dual Wideband CPW-fed Monopole Antenna Fabricated on the Al_2O_3 Substrate

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1. Introduction

In the last, the development of the communication products grow rapidly, and the main requirements of the peripheral consumption products are miniaturization, low profile, low cost, and wideband or multi-band operation. Therefore, there are many papers report about the design techniques of the dual-band or multi-band devices, such as cutting a rectangular notch [1], using different current paths [2, 3], or using conductor-backed plane [4].

In this letter, a miniature and new-typed dual wideband monopole antenna with CPW-fed structure is presented, which exhibits advantages such as low radiation loss, less dispersion, easy to integrate with RF or other microwave components, and enabling a miniature hybrid or monolithic microwave integrated circuit (MMICs) [5]. Moreover, for the purpose of miniaturization, high dielectric constant Al_2O_3 ceramics (ε_r=9.8) were adopted as the substrates of the antennas. In addition, the bandwidth of the proposed antenna could enough cover wireless local area network (WLAN) IEEE802.11b/g (2400~2484 MHz), IEEE802.11a (5150~5350 MHz, 5725~5825 MHz) and HIPERLAN2 (5470~5725 MHz) systems.

2. Antenna Design

The geometry of the dual wideband CPW-fed monopole antenna is shown in Fig. 1, which is a meander-typed structure and an opened-stub is added into. In addition, the proposed antenna is fabricated on the Al_2O_3 ceramic substrates with dielectric constant of 9.8, and the thickness is 0.635 mm. Due to the higher dielectric constant of the substrates are used, the overall size of the antenna is only 16.7×16×0.635 mm^3. The 50Ω CPW fed line is designed with the center metal strip width W_f = 1 mm and a gap width W_g = 0.5 mm. The other dimensions are G_W = 4.75 mm, G_L = 6.5 mm, S_L = 3 mm, S_W = 1mm, L_1 = 14 mm, L_2 = 2.6 mm, L_3 = 2.3 mm, L_4 = 2 mm. It can be found that the opened-stub is added on the side of the transmission line for the purpose of bandwidth enhancement.

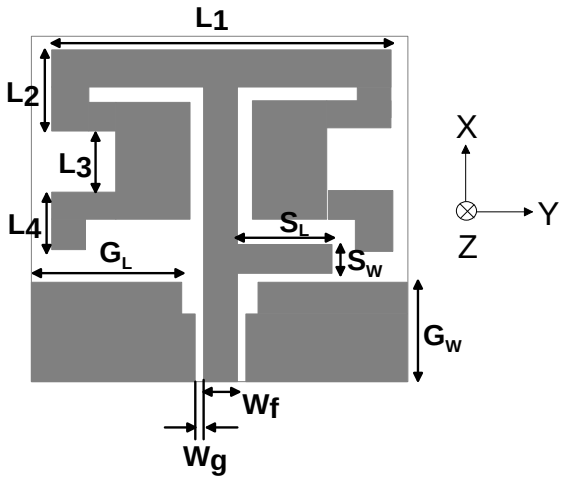

Fig. 1 Geometry of the antenna.

3. Results and Discussion

The simulated and measured return losses of the proposed antenna are shown in Fig. 2. The discrepancy in high frequency between simulated and measured can be found and is owing to the effects of the manufacturing and soldering processes. The measured center frequencies are 2.365 GHz with 13.1 % bandwidth (2.21~2.52 GHz) and 5.74 GHz with 23 % bandwidth (5.08~6.4 GHz). Therefore, this proposed antennas are suitable for the applications of WLAN IEEE802.11b/g (2400~2484 MHz), IEEE802.11a (5150~5350 MHz, 5725~5825 MHz) and HIPERLAN2 (5470~5725 MHz) systems, respectively.

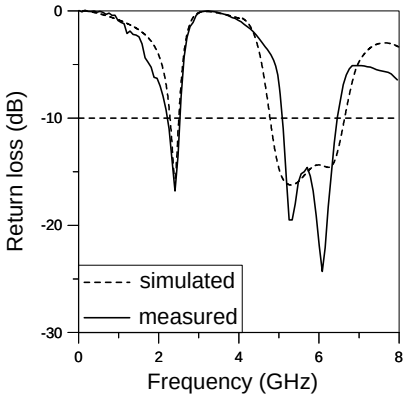

Fig. 2 Measured and simulated return loss.

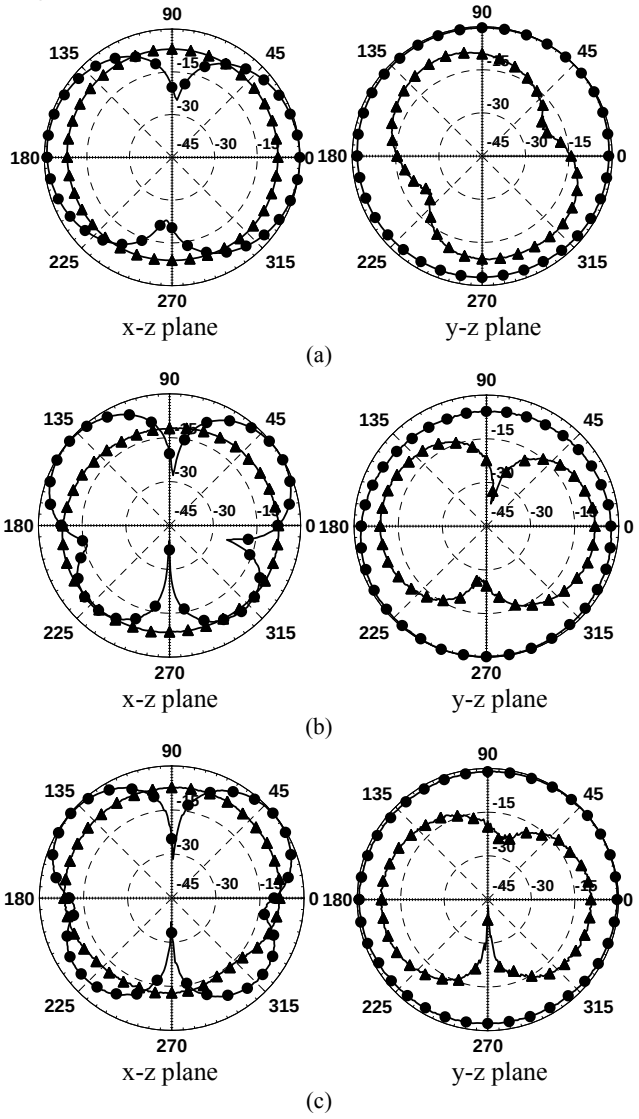

Fig. 3 Measured x-z plane and y-z plane radiation patterns for (a) 2.4 GHz (b) 5.3 GHz (c) 6.1 GHz.

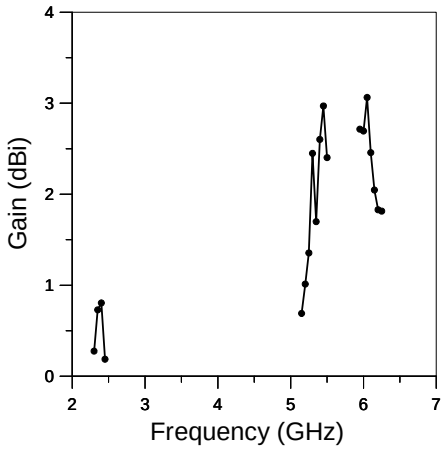

Fig. 4 Measured gains of the proposed antenna.

The measured x-z plane (E-plane) and y-z plane (H-plane) radiation patterns at 2.4 GHz, 5.3GHz and 6.1GHz of the antenna are shown in Fig. 3, respectively. It is found that for all of the operation bands, the radiation patterns of y-z planes are omni-directional approximately, which is suitable for the applications of WLAN systems. Fig. 4 shows the measured gains of the proposed antenna, in addition, it is 0.85 dBi for 2.4 GHz and 3 dBi for 5.4~6.1 GHz. Finally, as Fig. 5 shows, the size of the miniature proposed dual wideband monopole antenna is only 16.7×16×0.635 mm^3.

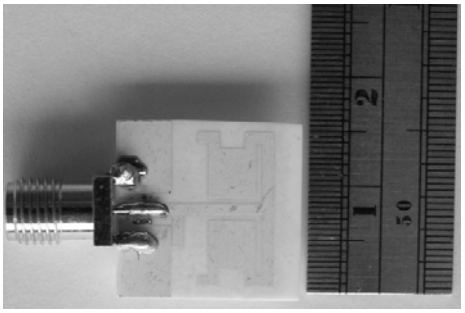

Fig. 5 Photograph of the proposed antenna.

4. Conclusions

A compact and new-typed dual wideband CPW-fed monopole antenna has been investigated in this letter. With the insertion of an opened-stub on the side of the transmission line, a wider bandwidth about 13.1 % (2.21~2.52 GHz) at low frequency and 23 % (5.08~6.4 GHz) at high frequency could be obtained, and which could operate at IEEE IEEE802.11b/g (2400-2484 MHz), IEEE802.11a (5150-5350 MHz, 5725-5825 MHz) and HIPERLAN2 (5470-5725 MHz) systems. Finally, good radiation characteristics and miniaturization could be obtained easily for this dual wideband monopole antenna.

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