

Ground-plane insensitive antenna design for WiFi triple-band USB dongle applications

Chia-Mei Peng⁽¹⁾, I-Fong Chen⁽²⁾, Jung-Sheng Liu⁽³⁾ and Pei-Quan Su⁽²⁾

(1) Department of Communications Engineering, Feng Chia University, Taichung City, Taiwan;
e-mail: chiampeng@fcu.edu.tw

(2) Jinwen University of Science and Technology, New Taipei City, Taiwan; e-mail: ex0206@just.edu.tw

(3) Ph.D. Program of Electrical and Communications Engineering, Feng Chia University, Taichung City, Taiwan; e-mail: jerry.liou@gmail.com

A very super compact ground-plane insensitive printed antenna for WiFi triple band USB dongle applications is presented. The WiFi USB dongle is an independent device, but it needs to be attached to a mobile device (eg., laptop) to function, and the reality is that it must face different ground-plane sizes. As a small antenna element is used, the utilization of the ground-plane is beneficial to enhance antenna performance because the ground-plane is usually larger than the antenna element. Therefore, the overall effective antenna dimensions augment dramatically. As a consequence, the corresponding gain and the bandwidth of the antenna system are increased. While the use of the ground-plane as a part of the radiator is advantageous, it also caused disadvantage at the same time in practical operation. The antenna performance in terms of gain and input impedance varies due to the influence of the varied ground-plane. The proposed antenna consists of asymmetric T-type monopole (ATM) and loop-structure which is protruded from ground-plane (USB dongle body), which is printed on FR4 glass epoxy substrate (with the thickness of 1.6 mm, relative permittivity of 4.3 and loss tangent of 0.023) as shown in Fig. 1.

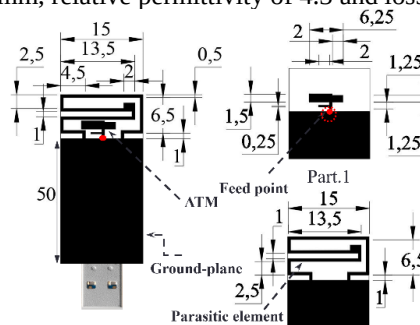


Figure 1. Geometry and dimensions of the proposed antenna module. (Unit: mm)

The electrical-length of ATM can be determined from the one quarter-wave length at the 5.15 GHz, jointly with 50 mm x 15 mm ground-plane for covering 2400 MHz-2500 MHz, 5150 MHz-5850 MHz and 5925 MHz-7125 MHz. In the real situation, the scenario of WiFi USB dongle by itself is denoted as "Original", and connecting to the laptop (which with larger ground-plane) is denoted as "Application", the measurement impedance bandwidth results as shown in Fig. 2. The function of loop structure is like a sleeve balun, which could overcome the frequency offset is verified.

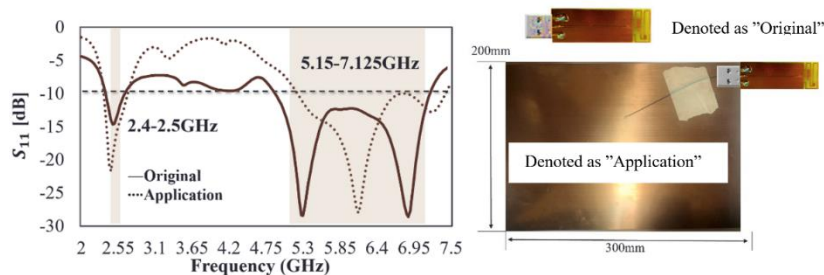


Figure 2. The measured reflection coefficient against frequency.

References

- [1] Jinke Ren, Guanding Yu, Yinghui He, Geoffrey Ye Li, "Collaborative Cloud and Edge Computing for Latency Minimization", *IEEE Transactions on Vehicular Technology*, vol.68, no.5, pp. 5031-5044, March, 2019. Doi: 10.1109/TVT.2019.2904244.
- [2] Shu-Chuan Chen, Jia-Le Zhu, Chung-I. G. Hsu, "Compact Double Shorted Loop Sub-6-GHz Dual-Band MIMO Quad-Antenna System", *IEEE Access*, vol.9, pp. 114672-114679, August, 2021. Doi: 10.1109/ACCESS.2021.3104306.

This paper's copyright is held by the author(s). It is published in these proceedings and included in any archive such as IEEE Xplore under the license granted by the "Agreement Granting URSI and IEICE Rights Related to Publication of Scholarly Work."