A Efficiency GPS/WLAN Antenna for Tablet with Full Metal Housing

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I. Introduction

In current industry, full metal housing mobile device like tablet and cellular phone are more preferable from ID perspective, However, it is quite challenging to design antennas at this condition with multiband support and high efficiency. In this paper, we proposed a compact and high efficient antenna to support both GPS and WLAN a/b/g/n bands at the commercial full metal house tablet condition by using unique antenna structure. 44%, 64% and 82% system efficiencies were achieved at GPS, 2.4 and 5 GHz respectively for industrial application.

II. Antenna Design

The simulation model is based on standard tablet size of 180 mm by 240 mm, including PCB, battery, metal housing, glass display and etc as shown in Figure 1. The antenna design details were shown in Figure 2. The idea is to use dualbranch IFA to create WLAN where longer length arm operates at 2.4 GHz and shorter arm works at 5 GHz, both about ¼ wavelength. How to excite cavity between metal housing and PCB board becomes the key to create radiation at GPS antenna. Here, a stub is selected to touch metal housing edge at one end and connect with IFA long arm at the other end, good GPS resonance and efficiency was achieved. To improve GPS efficiency and fine tuning frequency, a few ground points between PCB and metal housing were added.

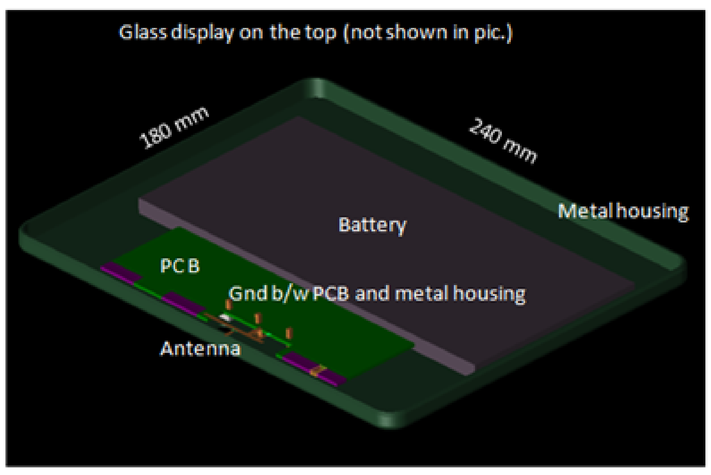

Fig.1. Tablet simulation model.

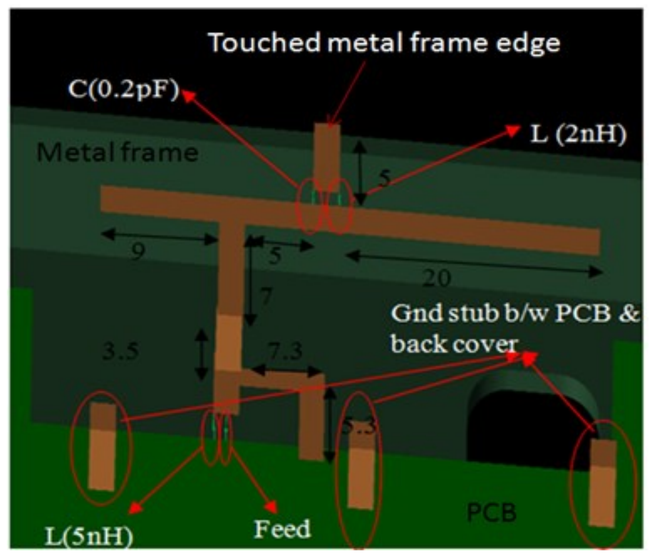

Fig.2. Antenna geometry.

III. Measured results and discussions

By using xFDTD as the simulation tool, we were able to get three very clean S11s at 1.575, 2.4 and 5 GHz respectively for GPS and WLAN operations (Figure 3) and system efficiency of 44%, 64% and 82%, respectively. The high efficiency was suspected from the cavity radiation.

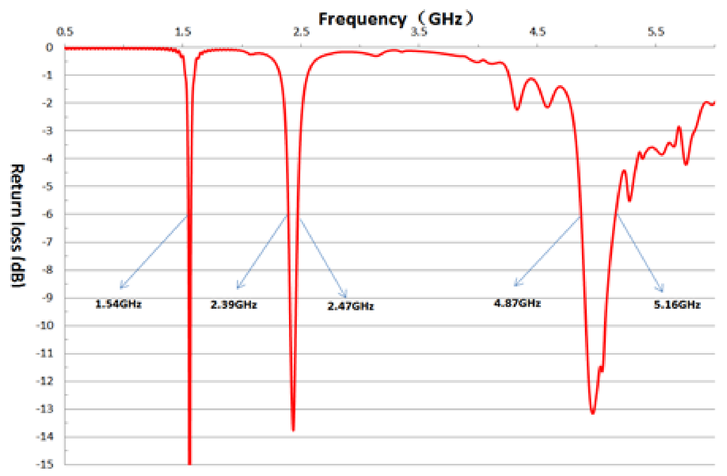

Fig.3. Simulated return loss (S11) of the proposed antenna.

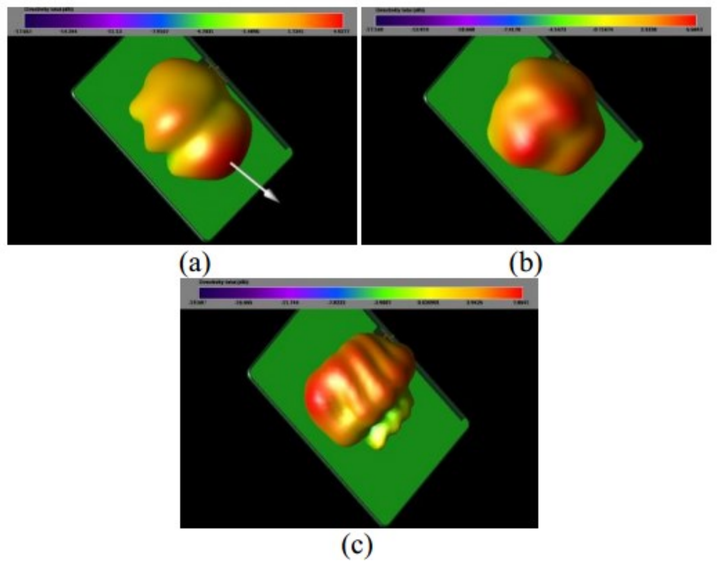

Fig.4. Radiation Patterns at (a) 1.575 GHz, (b) 2.4 GHz (c) 5 GHz.

Simulated antenna radiation pattern, metal cover and PCB board current distribution proved this assumption. Unlike traditional IFA radiation pattern, more "ripple" created at radiation pattern at GPS and WLAN bands in Figure 4.

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