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7-2008

Internal Antenna for UHF-band Mobile RFID System

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Published in Choi, N., Yu, B., Harackiewicz, F. J., Park, M. J., Chung, Y. S., & Lee, B. (2008). Internal antenna for UHF-band mobile RFID system. *Antennas and Propagation Society International Symposium, 2008. AP-S 2008*, 1 - 4. doi: 10.1109/APS.2008.4619606 ©2008 IEEE. Personal use of this material is permitted. However, permission to reprint/republish this material for advertising or promotional purposes or for creating new collective works for resale or redistribution to servers or lists, or to reuse any copyrighted component of this work in other works must be obtained from the IEEE. This material is presented to ensure timely dissemination of scholarly and technical work. Copyright and all rights therein are retained by authors or by other copyright holders. All persons copying this information are expected to adhere to the terms and constraints invoked by each author's copyright. In most cases, these works may not be reposted without the explicit permission of the copyright holder.

Recommended Citation

Choi, Nakchung; Yu, Byunggil; Harackiewicz, Frances J.; Park, Myun-Joo; Chung, Yong-Seek; and Lee, Byungje, "Internal Antenna for UHF-band Mobile RFID System" (2008). *Conference Proceedings*. Paper 6.
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Internal Antenna for UHF-band Mobile RFID System

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Abstract

UHF-band radio frequency identification (RFID) antenna for mobile handset applications is presented. The proposed antenna consists of a radiating element and a parasitic element connected to the ground plane. The radiation pattern of proposed antenna is orthogonal to that of a monopole antenna. The impedance bandwidth (902 MHz ~ 923 MHz) covers a Korea mobile RFID service (908.55 MHz ~ 913.95 MHz). The measured antenna peak gain is -0.37 dBi at 911 MHz.

Introduction

As the radio frequency identification (RFID) system has been adopted for numerous areas such as museum tour, library management, package tracking, forgery identification, security, and movie information/ticketing. Since the RFID system is an emerging technology making ubiquitous identification possible, the demand for the RFID system in a new area increases. One of the potential applications of the RFID can be mobile handsets. The RFID system generally consists of two basic components: the reader and the tag. The RFID system reciprocates tag data via wireless communications. The tag is the data carrying device, and the reader can be a read or a read/write device. The collision problem may occur in the interrogation region when two tags try to respond to the reader at the same time in the same frequency band. Reader collisions also may occur when two neighboring readers interrogate a tag simultaneously and confuse it [1]. One of effective methods to solve this drawback is to adjust the shape of the antenna radiation pattern. The radiation pattern for conventional mobile handsets is omni-directional in the horizontal plane [2]. The broadband or multi-band antenna for mobile RFID services also has an omni-directional radiation pattern in the horizontal plane [3], [4]. The interference between this two antenna may occurs when the reader obtain the tag data. In this work, a UHF-band RFID antenna for handsets is proposed to reduce this problem so that the

proposed antenna is designed to have an omni-directional radiation pattern in the vertical plane. The proposed antenna is analyzed by the simulation and measurement. The measured impedance bandwidth of the proposed antenna is 902 MHz ~ 923 MHz, and the measured antenna peak gain is -0.37dBi at 911 MHz.

Antenna Structure and Design

Fig. 1 shows the structure and dimension of the proposed antenna. Fig. 1a shows 3D view of the proposed antenna. The dimensions of the radiator are shown in Fig. 1b. The overall size of the proposed antenna is $42 \times 15 \times 6 \text{ mm}^3$, and the ground plane size is $42 \times 65 \times 1 \text{ mm}^3$. The substrate used is FR4-epoxy (dielectric constants = 4.4). The proposed antenna is a balance type of PIFA. The proposed antenna consists of a radiating element and a parasitic element. The parasitic element is electrically connected to ground plane. Both elements are the same meander shape. Because the current on the radiating elements is out of phase in the y-axis, the direction of electric field is the same as y-axis. The radiation pattern of the proposed antenna is omni-directional in the vertical plane. The radiation pattern of the proposed antenna is orthogonal to that of conventional mobile handset antenna. This radiation pattern has the advantage of reducing the collision problems between near RFID readers. It may also avoid the collision problems between adjacent tags when the RFID reader identifies the tag data.

Results

Fig. 2 shows the measured VSWR. The measured impedance bandwidth (VSWR<3) is 21MHz. The impedance bandwidth covers the mobile RFID service in Korea. The measured radiation pattern at the resonant frequency is shown as Fig. 3. The radiation pattern is orthogonal to that of conventional handset antennas. The measured antenna peak gain is -0.37 dBi at resonance frequency (911 MHz).

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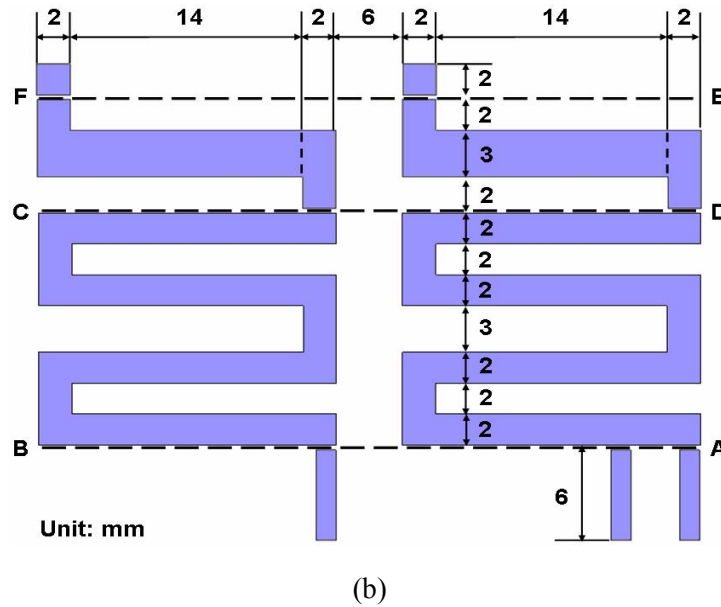
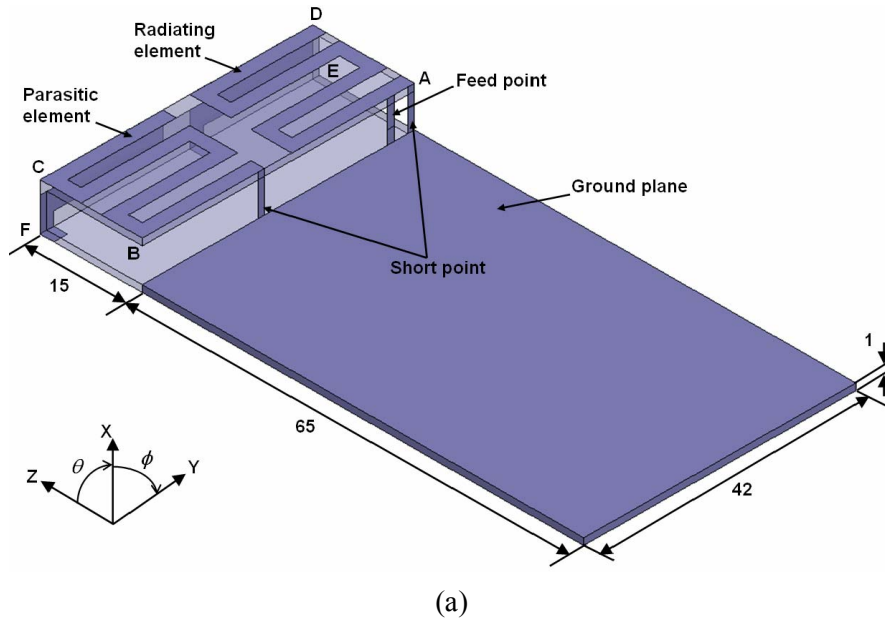


Fig. 1 Structure of the proposed antenna: (a) 3D view, (b) unfolded structure of the radiator.

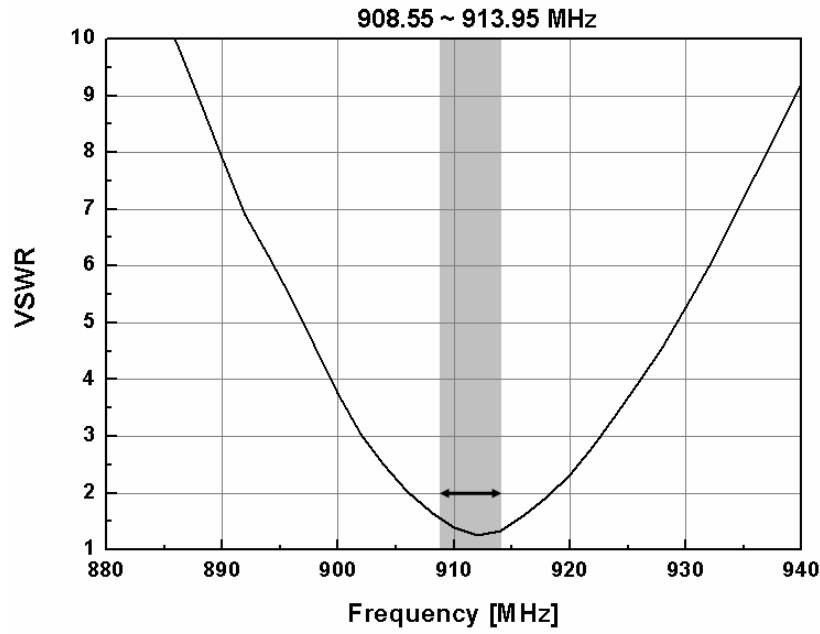


Fig. 2 Measured VSWR of the proposed antenna.

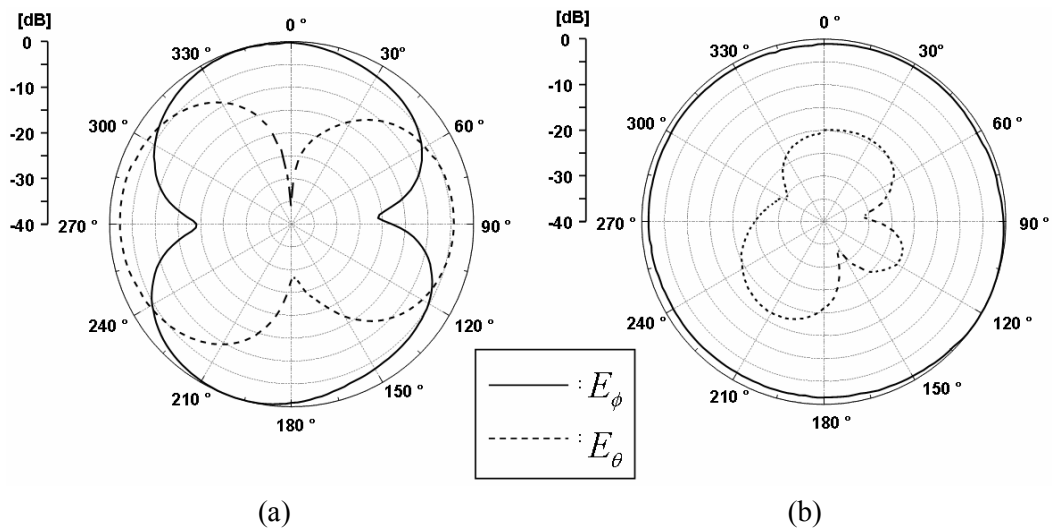


Fig. 3 Measured radiation pattern of the proposed antenna at 911 MHz: (a) xy plane, (b) xz plane.