Diversity Planar Monopole Antenna for WLAN Application with Enhanced isolation characteristics

Y. S. Shin and S. O. Park
Information and Communications University, 119, Munjiro, Yusong-gu, Daejeon, Korea
*Email:shinturtle@icu.ac.kr, sopark@icu.ac.kr

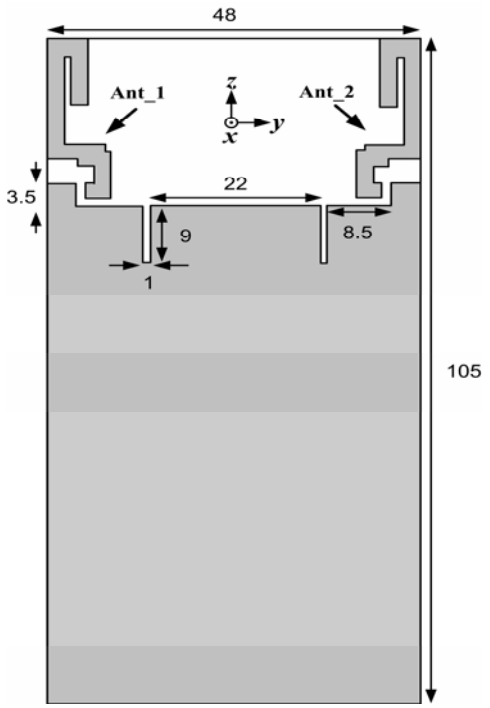
Abstract
A printed diversity monopole antenna for WLAN operation at the 5 GHz band, such as the 5.2GHz (5150-5350 MHz) and 5.8GHz (5725-5875 MHz) bands is presented. The proposed diversity antenna fed by a coaxial connector consists of two planar monopole antennas which are symmetrical and a ground which has two slots for enhanced isolation characteristic between two antennas. The bandwidth of the diversity antenna (S11<-10 dB) has achieved about 2360 MHz starting from 4520 MHz to 6880 MHz. Details of the antenna design and experimental results are demonstrated.

1. Instruction

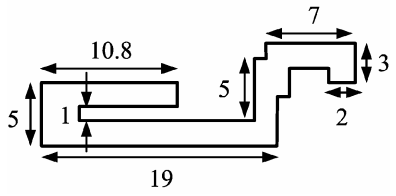
Antenna diversity is the technique where multiple antennas are the used for transmission or reception to help overcome the effects of multi-path fading, reduce outages and improve the quality and reliability of the communications link [1, 2]. Recently, in order to get rid of the multi-path fading effect, various diversity antenna designs have been proposed [3-5]. Diversity antennas mainly comprise two identical antennas which are far enough apart to separate with each other for good isolation performance [4, 5]. The antenna isolation (or coupling between antennas) is one of the important factors for performances of diversity antenna such as radiation efficiency and gain. Because many antennas such as monopoles and PIFAs are driven directly from the finite ground plane, this must be considered carefully. In this paper, a novel printed planar monopole antenna is presented. In order to reduce coupling between antennas, there is a ground which have two slots. With this technique, the proposed antenna is obtained a wide frequency bandwidth, 2360MHz (S11<-10dB), with enhanced isolation (S21<-20dB) between the two elements. Details of the proposed design are described and the measured results are presented.

2. Antenna design

The geometry and dimensions of the proposed planar monopole antenna are shown in Fig. 1. The antenna is printed on a FR-4 substrate which size is 48×105×0.8 mm^3 considered to be a personal computer memory card international association (PCMCIA) network card for the practical laptop application. Also, the metal of its ground only exist on the front substrate. The proposed antenna



(a) The top view (unit : mm)



(b) Detail dimensions of the proposed antenna

Figure 1. Geometry of the proposed diversity antenna

consists of two identical elements and a ground with two slots. As seen in Fig. 1(a), the antennas which comprise a metal strip with 2mm in width and placed on both side of the substrate are fed by a coaxial line. For small volume, the end part of the radiated elements is folded and the broad bandwidth can be achieved owing to the step shape of the antennas near feed part because there are the

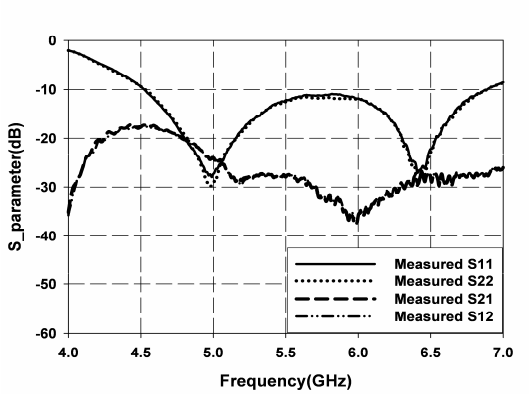


Figure 2. Measured S-parameter for the proposed antenna

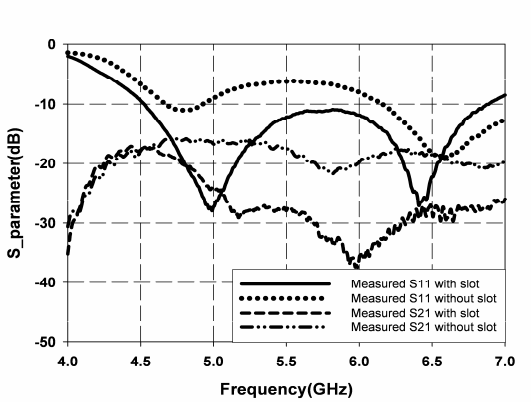


Figure 3. Measured S-parameter (with slot and without slots)

several current paths at slightly different resonant frequencies. The separation distance between two elements and a ground shape are important parameters affecting the isolation of them. Especially, antennas excite currents in the ground plane and these currents are common to all antennas attached to it. Accordingly, in order to reduce the mutual coupling, the two elements are spaced with a distance, 32mm corresponding to a half wavelength at 5GHz and the ground which has two slots is applied because the coupling between two antennas is noticeably by slots. The experimental results are presented in the following section.

3. Results and discussion

The proposed diversity antenna has constructed and measured with an Agilent 8510C network analyzer to confirm its performance. Figure 2 shows the measured scattering parameters of the fabricated prototype. Since their symmetrical structures are same, the results of S11(reflection coefficient) and S21(isolation) are mostly equal to them of the S22 and S12. In Fig. 2, the proposed antenna has the wide bandwidth 41.4% at S11<-10dB covering the 5.2GHz (5150-5350 MHz) and 5.8 GHz (5725-5875 MHz) bands for WLAN operations. The figure 3 describes the compared data with and without slots in the ground plane. In case of two slots exist, the good isolation (S21<-20dB) between two elements and broader bandwidth can be obtained. Figure 4 shows the measured radiation patterns at 5150MHz and 5725MHz for the ant-1 and ant-2 excitations. The measured maximum gain in two elements is about 4.1dBi and 3.9dBi at 5.15GHz, respectively.

4. Summary

A planar monopole antenna printed on a dielectric substrate in WLAN communications has been proposed and experimentally studied. The proposed diversity antenna has a low profile to the PCMCIA network card. The diversity antenna achieved a broad bandwidth due to step shape near feed part and has low coupling between two elements owing to a ground with two slots. Experimental results show good impedance matching (S11<-10dB) across 5.2GHz and 5.8GHz bands and high port isolation (S21<-20dB).

Acknowledgments

This work is supported by Intelligent Radio Engineering Center(IREC) of Korea Science and Engineering Foundation, Korea, under contract R11 – 2006 – 029 – 02004 – 0.

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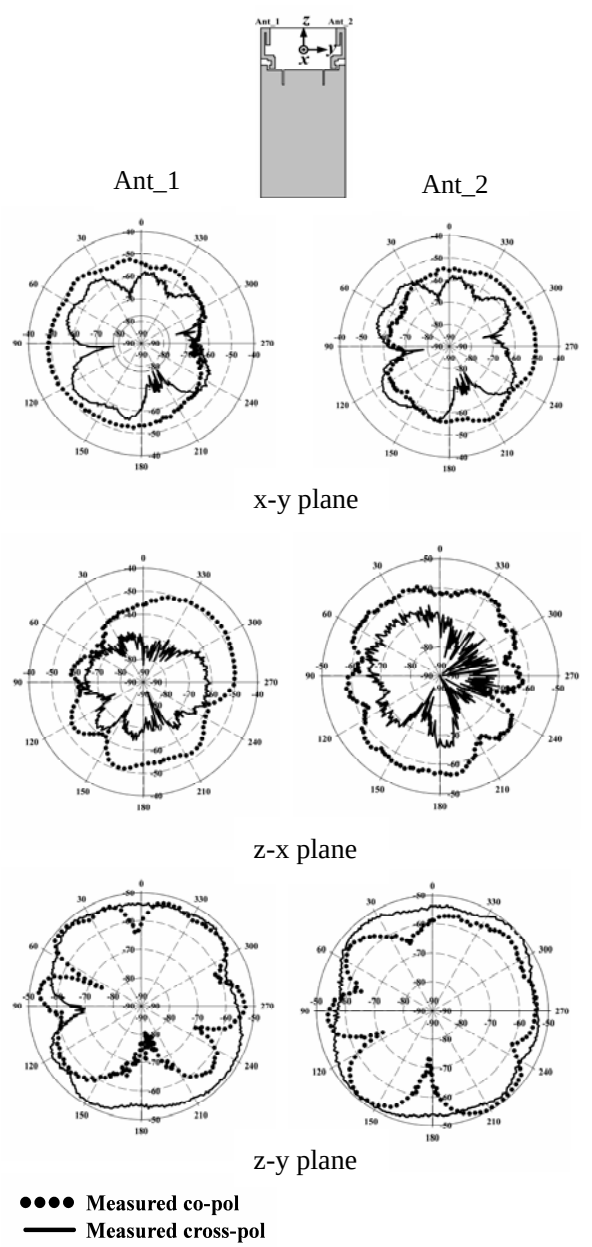

Figure 4. Measured radiation patterns at 5150MHz

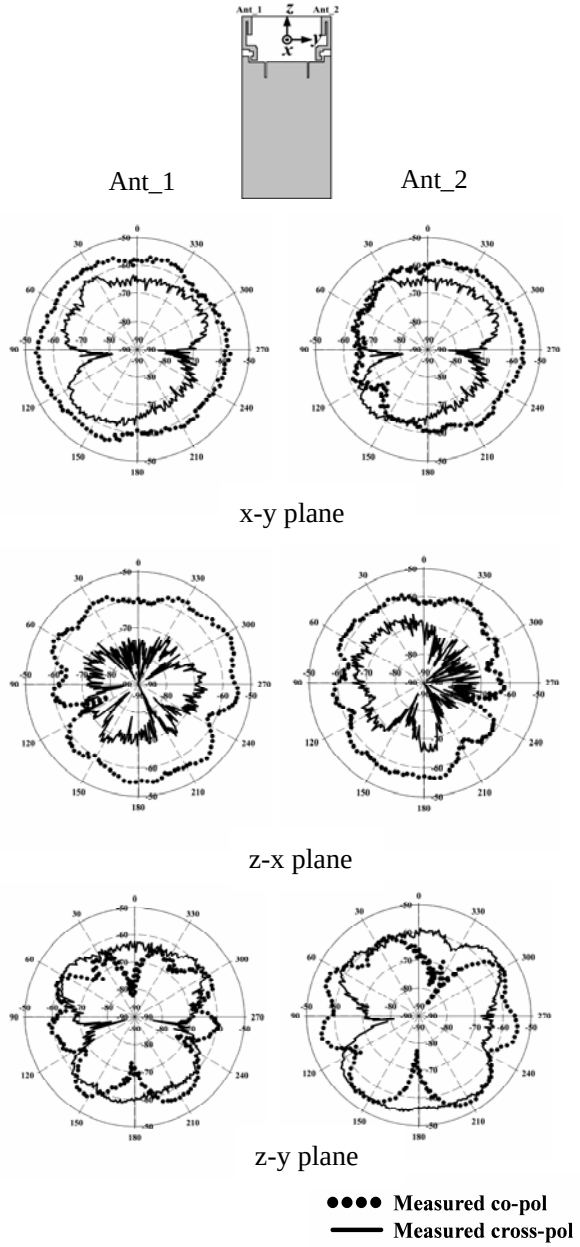

Figure 5. Measured radiation patterns at 5725MHz