

CROSSED PLANAR MONOPOLE ANTENNA HAVING A BAND-NOTCHED CHARACTERISTIC

W.S.Lee, D.Z.Kim, K.J.Kim, K.S.Son, W.G.Lim and J.W.Yu

Department of Electrical Engineering

Korea Advanced Institute of Science and Technology (KAIST)

373-1 Guseong-Dong, Yuseong-Gu, Daejeon, 305-701, Korea

E-mail : drjwyu@ee.kaist.ac.kr

1. Introduction

Antenna designers who want to obtain a wide impedance bandwidth show a keen interest in the planar monopole antennas because of the good impedance matching, compact and simple structure, and easy of construction [1-3]. Also, the frequency notched planar antennas have been studied and implemented by inserting various shaped slot [4-6]. In this paper, two types of the crossed planar monopole antenna having a band-notched feature are presented.

2. Antenna design

The designed antenna structure is shown in Figure 1. It consists of two copper-plate monopoles of size $25 \times 15 \text{mm}^2 (L \times W)$ with 0.2 mm thickness: top-cut plate and bottom-cut plate. The two plates are orthogonally placed to form the crossed planar monopole antenna. The band-notched characteristic can be created by etching the 'U' shaped slot in the interior of the radiating element. In Figure 1(a), the band notch slot is all in one because it is connected on the basis of a central axis. On the other hand, Figure 1(b) symmetrically places the four U-shaped slots. Except for the geometries of U-shaped slots, other parameters are set to be the same. The U-shaped slots are placed from a distance (D_f) at feeding point A. The slot length having notch function in crossed planar antenna is similar to the two dimensional case [6]. Therefore, each length (L_{s1}, L_{s2}) has to become quarter wavelength, respectively.

The proposed antenna has a finite ground plane with the 150 mm diameter. The design parameters (D_f, G_a, t) of the proposed antenna structure are set to be $4\text{mm}, 1\text{mm}, 0.5\text{mm}$, respectively. The slot lengths (L_{s1}, L_{s2}) are same to compare the notch characteristics.

3. Experimental results

Figure 2 shows the measured and simulated return loss versus frequency for the proposed antennas. Using CST Microwave Studio software, the simulation results are obtained, and reach a good agreement with the measured data in the edge of the lower frequency or the higher frequency. In Figure 2(b), the proposed antenna with a single U slot fails to reach an accord because of the difficulty of assembling the single notch slot. To be more exact, Table 1 shows the notch characteristic of the proposed antennas. The impedance bandwidth is obtained for crossed planar monopole antenna by controlling a beveling (α) so as to good impedance matching. The omni-directional radiation pattern is gotten in three dimensional antenna rather than two dimension [7]. Also, because the plate is orthogonal, the linear phase feature is found.

4. Conclusion

In this paper, two types of the crossed planar monopole antennas having a band-notched characteristic have been proposed and measured. Using the orthogonal monopole plate, the radiation pattern and phase characteristics are improved. It was also found that a simple U-shaped slot has been used to achieve a notch function in the case of the crossed planar monopole antenna.

References

- [1] M.J.Ammann, "Square planar monopole antenna", *IEE Na'l Conference on Antennas and Propagation*, no.461, April, 1999
- [2] M.J. Ammann and Z.N. Chen, "Wideband monopole antennas for multi-band wireless systems", *IEEE Antennas Propagation Magazine*, pp.146-150, 2003
- [3] Saou-Wen Su, Kin-Lu Wong, Tuan-Tung Cheng and Wen-Shyang Chen, "Finite-Ground-Plane Effects on the Ultra-Wideband Monopole Antenna", *Microwave and Optical Technology Letters*, Vol.43, no.6, pp.535-537, 20 Dec. 2004
- [4] Schantz, H.G., Wolynec, G, and Myszka, E.M., "Frequency notched uwb antennas", *IEEE Conference on Ultra Wideband Systems and Technologies* , pp.214-218, Nov. 2003
- [5] Aaron Kerkhoff and Hao Ling, "A parametric study of band-notched UWB planar monopole antenna", *IEEE Antennas and Propagation Society Symposium*, Vol.2, pp20-25, June 2004
- [6] Wang-Sang Lee and Jong-Won Yu, "Frequency-notched wideband planar monopole antenna with a l-shape ground plane", *KJJC-AP/EMC/EMT*, pp49-52, Nov 2004.
- [7] P.V. Anob, K.P. Ray, and G. Kumar, "Wideband orthogonal square monopole antennas with semi-circular base", *IEEE Antennas and Propagation Society International Symposium*, Vol.3 , pp294-297, July 2001

Table 1. Comparison of notch frequency for the proposed antenna with $L_{s1} = L_{s2} = 21mm$

| Antenna Type | Center notch frequency (GHz) | | | Notch frequency range (GHz) | |
|--------------|------------------------------|-----------|----------|-----------------------------|-------------|
| | Calculated | Simulated | Measured | Simulated | Measured |
| Figure 1 (a) | 3.57 | 3.92 | 3.76 | 3.42 ~ 4.02 | 3.39 ~ 3.83 |
| Figure 2 (b) | 3.57 | 3.65 | 3.62 | 3.32 ~ 3.73 | 3.18 ~ 3.69 |

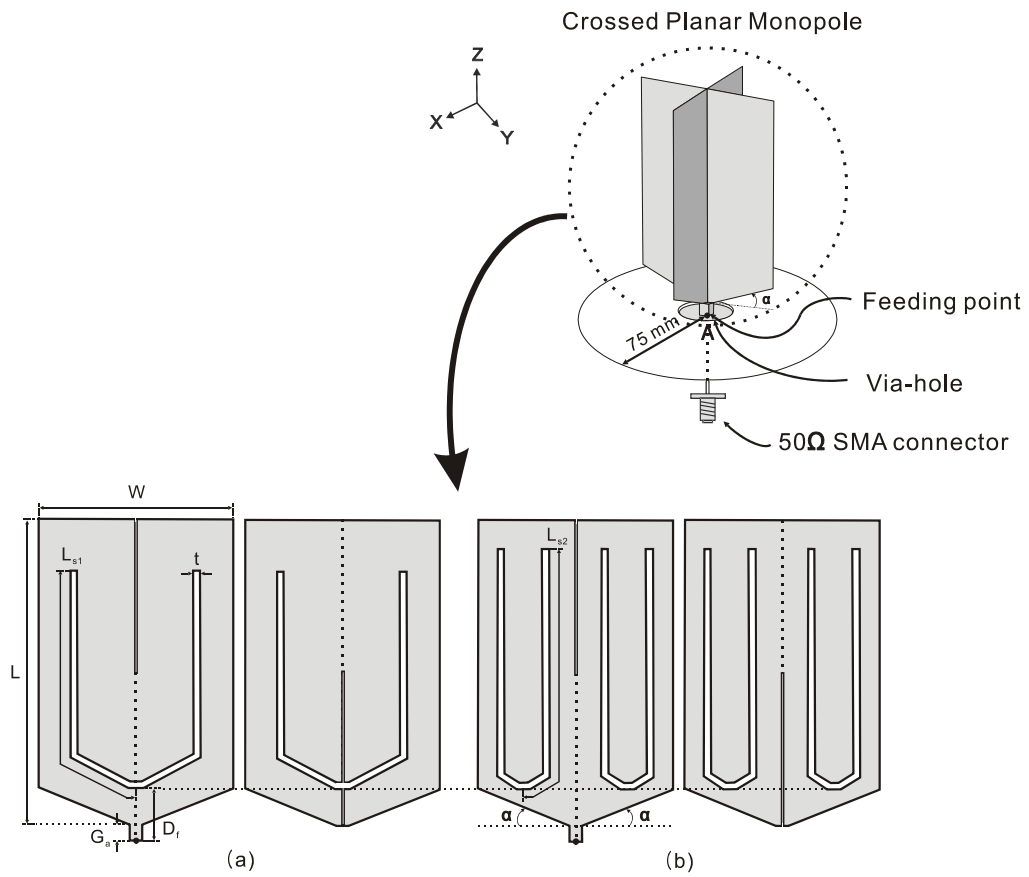
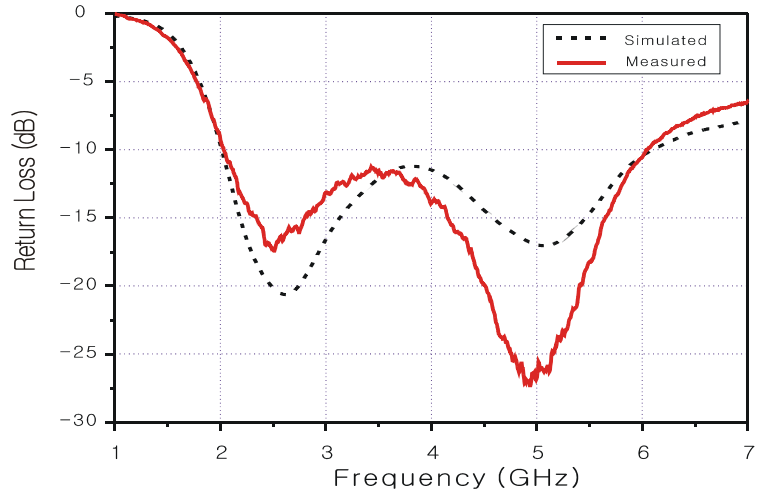
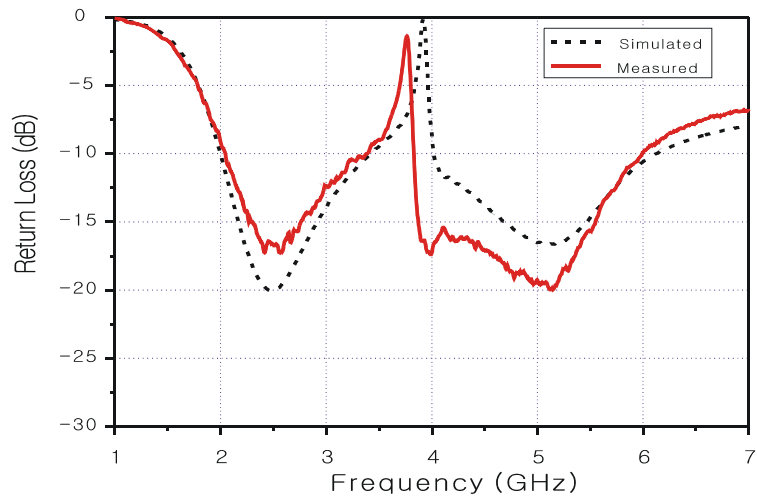


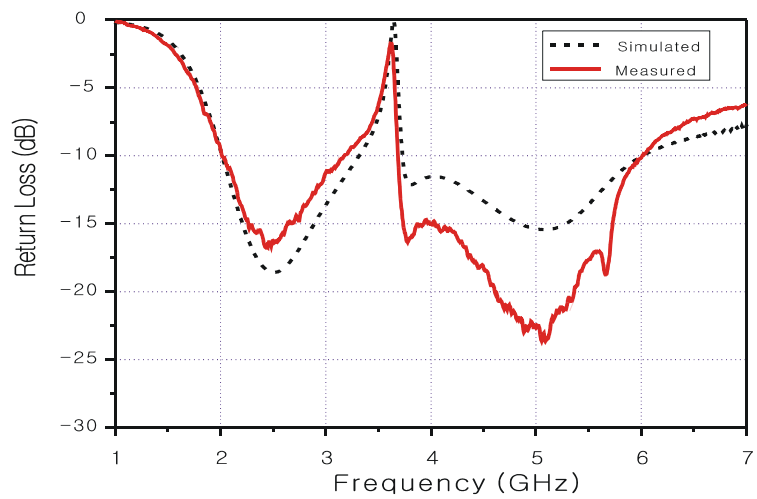
Figure 1 Geometry of the proposed crossed planar monopole antennas: (a) with the single U slot (b) with the multiple U slot



(a)



(b)



(c)

Figure 2 Measured and simulated return loss versus frequency : (a) without slots (b) with the single U slot in Fig.1 (c) with the multiple U slot in Fig.1