

USB Memory Size U-Shaped Antenna for 2.4GHz Wireless LAN and UWB

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1. Introduction

Recently, wireless-PAN systems using a UWB technique are considered. Antennas such as a planar trapezoidal monopole or dipole antenna for a UWB was developed.[1],[2] Since a 5 GHz band is allocated for wireless LAN service such as an IEEE802.11a, a UWB antenna should have a band notch to avoid an interference between two systems. To fulfil this requirement, several UWB antennas having a band notch developed. And many band notched antennas at 5 GHz band have reported.[3],[4],[5] As the next stage, the antenna of a terminal equipment for a wireless PAN or a wireless USB is required. In these applications, the antenna have wide bandwidth or multi band and has to be small in order to be installed in size of 10 mm by 30-40mm, which was USB memory size of a terminal side equipment.[6],[7]

2. Antenna configuration

The planar asymmetrical trapezoidal planar dipole antenna was reported in references [3],[5]. In general, dimensions of a USB memory were 30-40 mm length, 10 mm width and 5 mm thickness. Therefore, the antenna as reference [5] can not be installed in a USB equipment.

A simple method in order to install the antenna as the reference[5] has to be folded in U-shape. This method has been reported by the author's paper [7]. The proposed antenna in reference [7] was the only UWB use antenna.

The purpose of the paper is to propose the multi and broad band antenna for 2.45 GHz wireless LAN and UWB and the band notch having a 5 GHz band for the UWB.

Fig.1 shows the proposed USB memory size antenna configuration for 2.45 GHz wireless LAN and UWB. The conductor 1 is the folded trapezoidal antenna element and the conductor 2 is the ground plane. The length of the antenna was 38.5 mm. This conductor 1 consists of the folded trapezoidal antenna element having 15mm length. And the conductor 2 is the ground plane with the slot having 25 mm width and 19 mm length. The length of the slot is the half of the wave length at 2.45GHz. In this configuration, the dimensions of the proposed antenna were 35 mm length, 10mm width and 5 mm thickness.

Fig.2 shows the proposed antenna configuration of the multi band for 2.45 GHz wireless LAN and the UWB having the band notch at 5 GHz band. The length of the slot on the conductor 1 was the half of the wave length at 5 GHz.

3. Simulated results

Fig.3 shows the simulated VSWR of the planar trapezoidal monopole antenna and the U-shaped monopole antenna as shown in Fig.1. The solid red line shows the U-shaped multi band antenna for 2.45 GHz wireless LAN and UWB. The solid black line shows the multi band planar antenna.

The VSWR less than 2 was obtained in the frequency range 2.39-2.49 GHz and 3.0 - 12 GHz in case of the planar and the U-shaped antennas. Almost same results were obtained by folding the planar antenna.

Fig.4 shows the simulated results of the VSWR of the antenna as shown in Fig.2. The multi band and the band notch were generated by using these slots on the trapezoidal monopole antenna element and the ground plane. The band notch having the VSWR about 20 was obtained. And, the VSWR above 6 was obtained in the frequency range of 4.6 GHz - 4.8 GHz. It is necessary that the band notch frequency have to move at 5 GHz.

Fig.5 (a) shows the simulated current distributions on the conductors at the 2.45 GHz. The strong current distribution was observed along the slot on the conductor 2. So, the resonance frequency at 2.45 GHz was created by this current distribution along the slot. On the other hand, the current distribution of the trapezoid element edge was very weak.

Fig.5 (b) shows the calculated current distribution at 4.7 GHz. The strong current distribution was observed along the slot on the conductor 1. The band notch was generated by this current distribution.

It was confirmed that the proposed antenna with the slot on the conductor 1 is useful to avoid the interference between the 5 GHz wireless LAN such as the IEEE802.11a and the UWB.

An USB memory built-in the proposed antenna was connected to a computer. In general, the USB memory was used near a table. So, the table affects the performances of the proposed antenna.

To evaluate variation with or without the table, the simulation was done. In this simulation, the proposed antenna as shown in Fig.1 was located as shown in Fig.6. The dimensions of the table were 100 x 100 mm and the distance between the table and the proposed antenna was 10 mm. The table was the conductor plane.

Three cases were considered. One was parallel in x-z plane. This is Desk 2. The other was parallel in y-z plane. These were Desk 1 and Desk 2.

Fig.7 shows the simulated VSWR. The VSWR of the proposed antenna located near the table became higher below 5 GHz. The influence from the table was very low in case of the Desk1. The influence of the proposed antenna performances from the table was made clear.

4. Conclusion

The paper describes the simulated results of the novel USB memory size U-shaped asymmetrical trapezoid monopole antenna having the multi band or the band notch for the UWB and the 2.45 GHz band.

The dimensions of the proposed antenna were 38.5 mm length, 10 mm width and 5 mm thickness. So, this proposed antenna can be installed in the USB memory of the terminal side equipment.

The operational mechanism became clear by simulating the current distributions on the antenna element. The influence of the proposed antenna performances from the table was made clear.

References

- [1] M.Teshima, H.shimazaki, S.Mizoguchi and T.Amono,"A Study of Trapezoidal Monopole Antenna with Wideband Characteristic,"IEICE National Conference, B-1-143,2005.
- [2] Atsushi Horita and Hisao Iwasaki,"A study of the Planar Diople Antenna with Wide band Characteristics for UWB and Wiless LAN,"IEICE Trans., Commu., VOL.J89-B, No.9, pp.1633-1640., 2006.
- [3] Toshihiro Nakamura and Hisao Iwasaki,"Planar Monopole Antenna Having a Band-Notched Characteristics," 2006 IEEE AP-S Int.,Symp., Digest, Vol.5, pp.4641-4644, July , 2006.
- [4] K.Chang, H.Kim,and Y.J.Yoon,"Multi resonance UWB Antenna with improved band nooth Characteistiscs," IEEE AP-S Int., Symp., Digest, Vol.3A, pp.516-519., July, 2005.
- [5] Mizuho Katsuta and Hisao Iwasaki," Planar Trapezoid Dipole Antenna Having Band Notch at 5 GHz and Multi band for 2 GHz WLAN and UWB," 2007 IEEE AP-S Int., Symp., Digest, pp.641-644, June, 2007..
- [6] A.Kuramoto," Small UWB Antenna Using Trianglar Elements," in Proceedings of the IEEE AP-S pp.371-3718, July, 2007.
- [7] Hisao Iwasaki and Keigo Matsuzaki," USB MEMORY SIZE BROADBAND MONOPLOE ANTENNA FOR UWB," The 18th Annual IEEE International Symposium on Personal, Indoor and Mobile Radio Communications," IEEE 2007 PIMRC07, pp. 641-644, Sept., 2007.

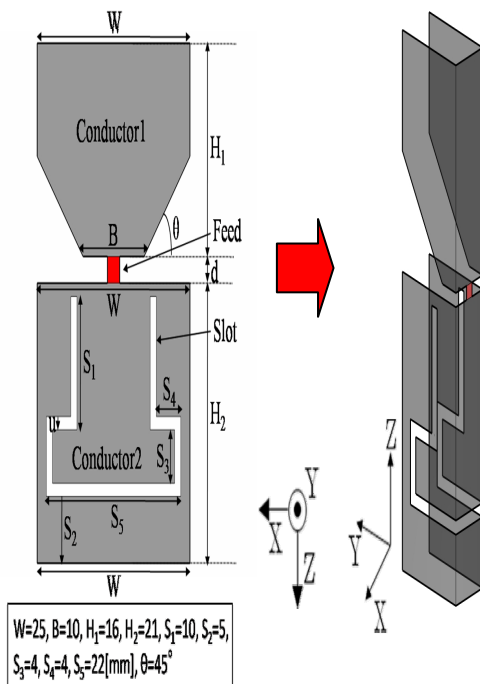


Fig1 The proposed USB memory size 2.45 GHz and UWB antenna.

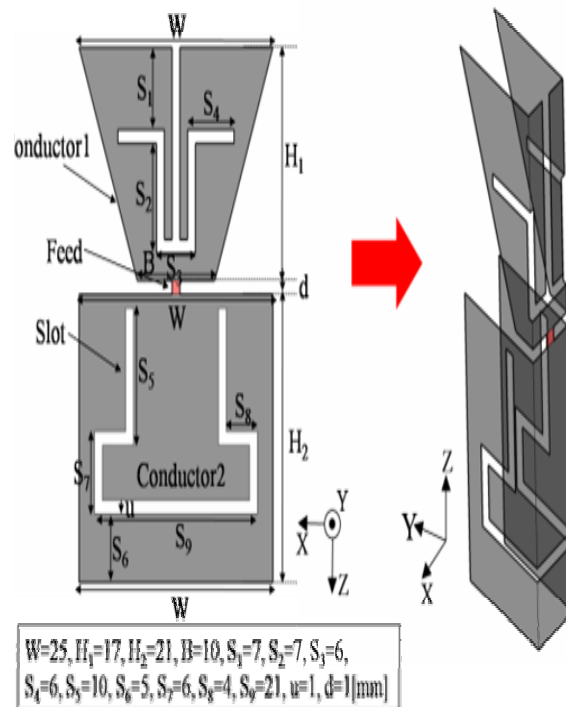


Fig.2 The proposed antenna configuration having a band notch at 5 GHz band.

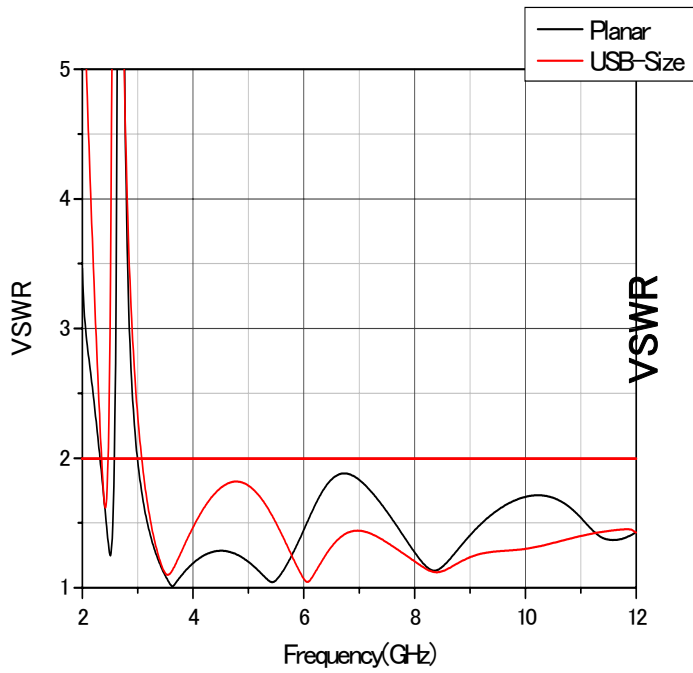


Fig.3 The simulated VSWR of the proposed antenna as shown in Fig.1.

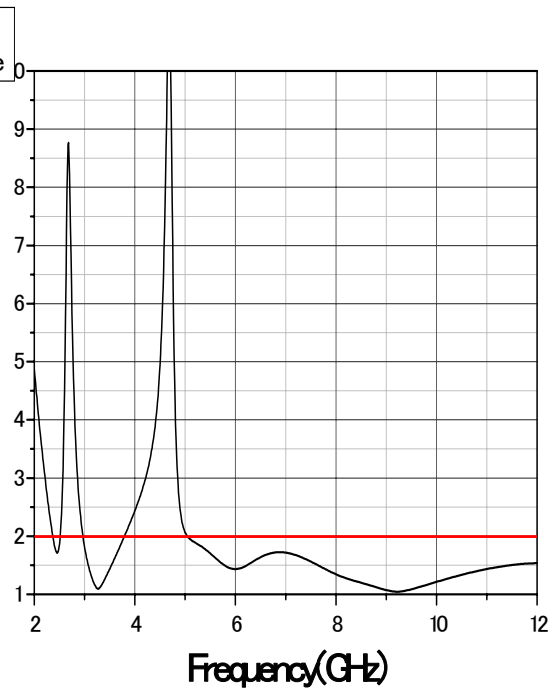


Fig.4 The simulated VSWR of the proposed antenna as shown in Fig.2.

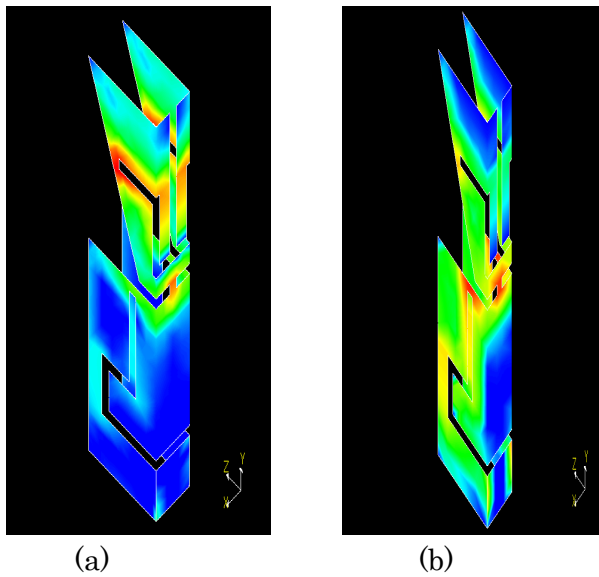


Fig.5 The simulated current distributions.

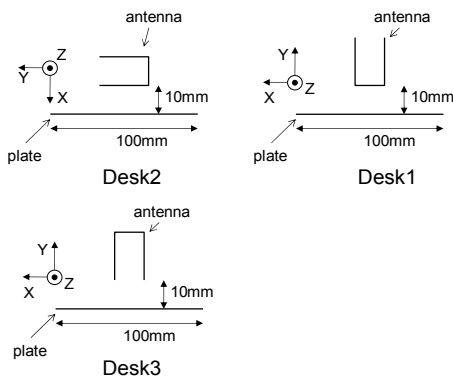


Fig.6 The relationship between the table and the U-shaped antenna..

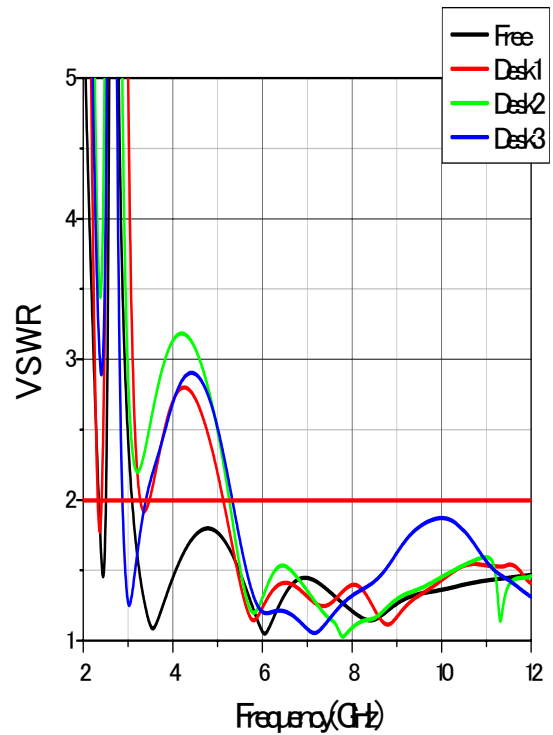


Fig.7 The simulated VSWR with or without the table.