

A Planar UWB Monopole Antenna Formed on a Printed Circuit Board

Masahiro Yanagi[†] Shigemi Kurashima[†] Takashi Arita[†] Takehiko Kobayashi[‡]
[†]FUJITSU COMPONENT LIMITED [‡]Tokyo Denki University

1. Introduction

A monopole antenna is known as an antenna that can implement low VSWR in wide bands. In a design where the height of the monopole unit is 1/4 the wavelength of the minimum frequency or more and the shape (tear drop) and dimensions are optimized, a VSWR < 1.3 in 3 – 20 GHz was implemented [1]. This paper reports on the design and prototyping result of a planarized monopole antenna formed on a printed circuit board with decreased volume.

2. Configuration of antenna and optimization

(1) Configuration of antenna

The initial structure of the antenna is formed on a 50 x 50 mm, 0.8 mm thick printed circuit board (FR-4, dielectric constant 4.7), as shown in Fig. 1. With this at the start, volume was decreased targeting the antenna characteristics to be a VSWR < 2.5, and to be omni-directional in the XY plane in a frequency range of 3.1 – 10.6 GHz. It is known that the input impedance of such an antenna depends on the opening angle θ of the feeding point portion [2].

(2) Optimization

The length is decreased in the sequence of A, B and C to satisfy the target. By decreasing A, the low limit frequency increases, and by decreasing B and C, the wideband characteristics change. For each case, θ , to minimize the maximum VSWR in 3.1 – 10.6 GHz, is searched. The moment method is used for this calculation.

The minimum size to satisfy the target performance was A = 15 mm, B = 16 mm and C = 30 mm. At this time $\theta = 63^\circ$.

3. Characteristics of prototyped antenna

Fig. 2 shows the prototyped antenna, and Fig. 3 shows the VSWR characteristics thereof. VSWR < 2.5 was implemented in 3.1 – 10.6 GHz, which roughly matches the simulation result. Fig. 4 shows the radiation pattern at 3,6,9 GHz. In the XY plane, rough omni-directional characteristics were implemented.

4. Conclusion

A UWB antenna formed on a printed circuit board, where the VSWR is 2.5 or less in 3.1 – 10.6 GHz and is roughly omni-directional in the XY plane, was implemented by optimizing the parameters.

References

- [1] T. Taniguchi and T. Kobayashi, "An omnidirectional and low-VSWR antenna for the FCC-approved UWB frequency band," in *2003 IEEE AP-S International Symp.* volume: 3, pp. 460-463, June 22-27, 2003.
- [2] J. D. Kraus, *Antennas*, 2nd edition, McGraw-Hill, New York, 1988, pp. 692-694

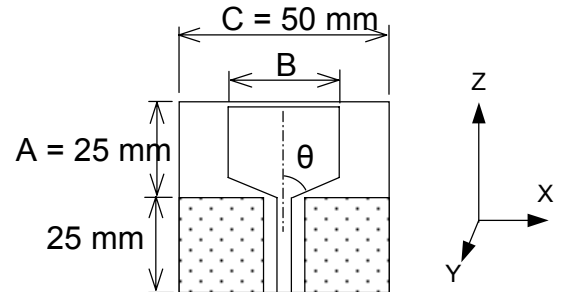


Fig. 1 Initial structure

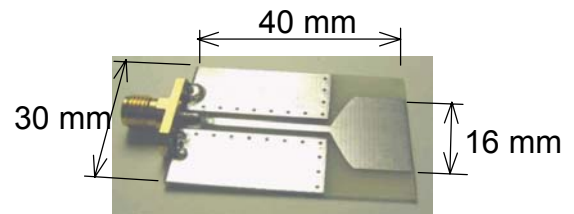


Fig. 2 Prototyped antenna

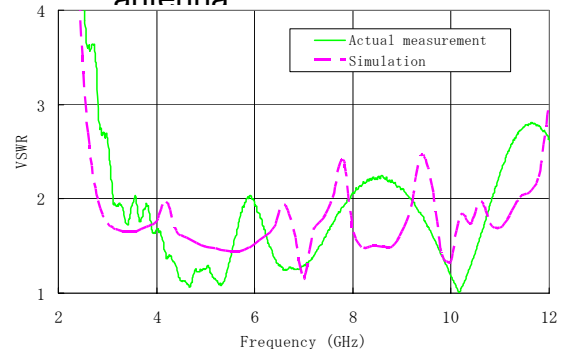


Fig. 3 VSWR characteristics

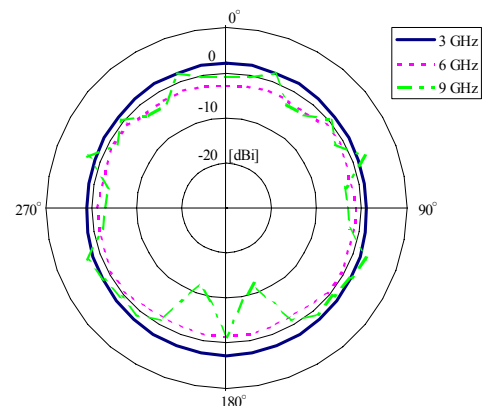


Fig. 4 Omni-directional characteristics in XY plane