POS1-10

A Horizontally Polarized Omni-Directional Antenna

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1. Introduction

Omni-directional antennas are used in small-scale area. As an antenna which has a small diameter, vertically polarized Omni-directional antennas are generally used. On the other hand, in the present when the effectiveness of the polarisation diversity is confirmed, a horizontally polarized Omni-directional antenna with small diameter is reported [1][2][3].

At this article, we report the developed element of the horizontally polarized Omni-directional to make a diameter small by the simple structure which is due to an L-probe feed.

2. Antenna Element structure

The structure of this antenna element is shown in Fig.1. This structure consists of three elements: 1) a metallic cylindrical GND plane, 2) an L-probe, 3) radiating conductors.
Length (W+D) ×2 is decided to 0.5-0.6λ. As for the height H of the radiating conductor, λ/8 height provides relatively good band width and the deviation of the directivity in the horizontal plane according to parametric study.

The L-probe works as a matching-circuit between the feed point and the radiating conductor. This also drives a radiating conductor in the frequency band of interest. As for the L-probe, the length is λ/4 approximately. The L-probe is arranged in the height of the center H/2 of the radiating conductor.

The gap between the radiating conductors can achieve slight adjustment operating of frequency.

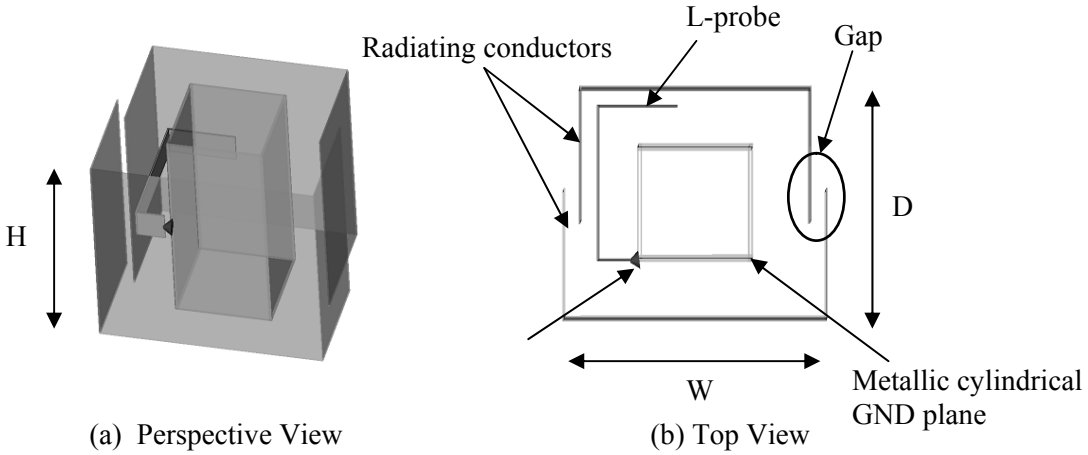


Figure 1: Structure of the Element

Relationship between perimeter of the element and the characteristic is shown in Fig.2: band width and deviation of radiation pattern. The obtained results show that both of the characteristics intersect at perimeter of 0.6λ in the case of height H of 0.13λ.

Fig.3 shows bandwidth and deviation of radiation pattern as a function of antenna height in the case of perimeter (W+D) ×2 of 0.6λ. As a result, it is found that both of the characteristics intersect at height H of 0.13λ.

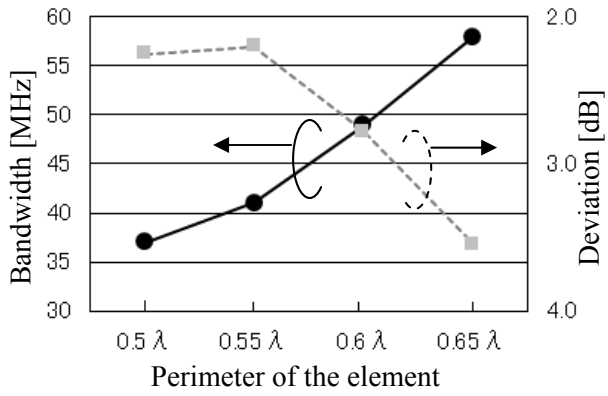


Figure2: Bandwidth and deviation as a function of perimeter of the element

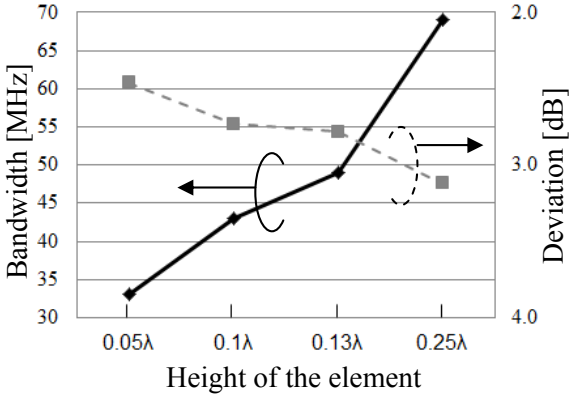


Figure3: Bandwidth and deviation as a function of height of the element

3. Experimental and evaluation results of the antenna element

Fig.4 shows comparison between a measurement and simulation results. This antenna satisfies 30 MHz bandwidth at the 2.6 GHz band by adjustment L-probe shape.

As a result, we achieved about relative bandwidth (VSWR≦1.5) of 2% and a directivity deviation in the horizontal plane within 3 dB by single element.

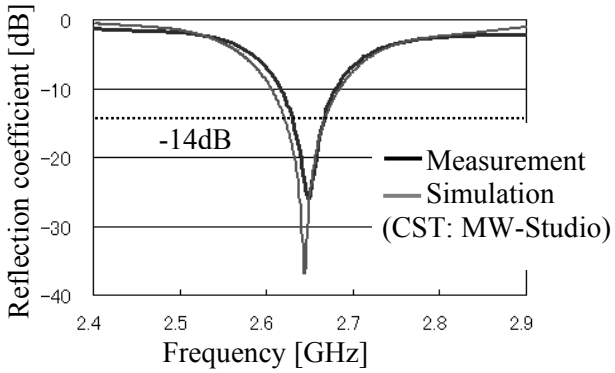


Figure 4: Reflection coefficient of single element

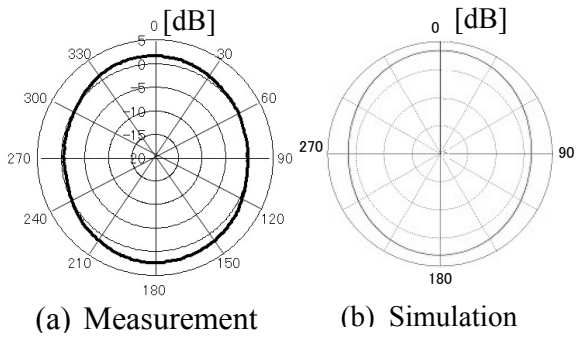


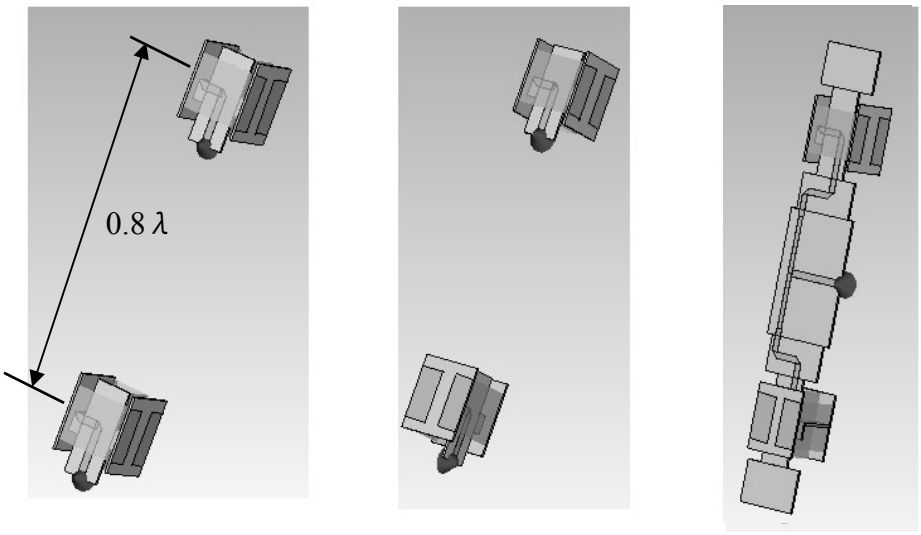
Figure 5: The directivity deviation in the horizontal plane at 2.61GHz

4. Improvement of deviation by making Array

It is generally expected that combination of the radiating conductor with and without 90 degree rotation provide less deviation of radiation pattern. We have evaluated three kinds of structures. We can see that the deviation of equal to or less than 0.7 dB was gotten.

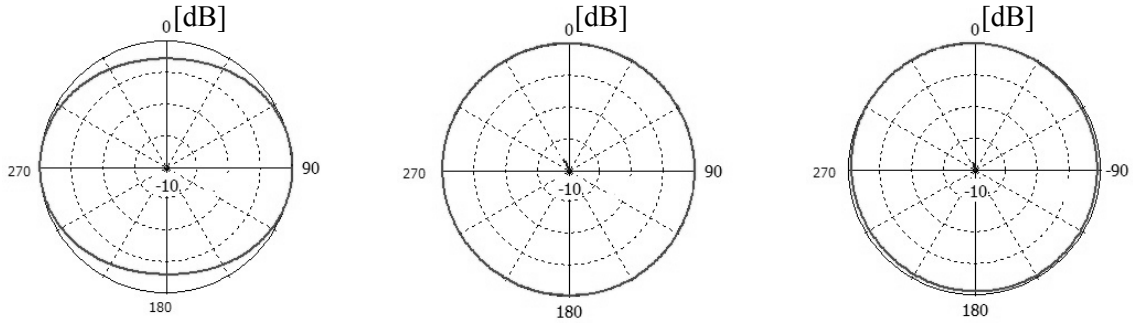
Each directivity in the horizontal plane is shown in Fig. 7.

The obtained results are also listed in table 1.



(a) Without rotation (b) 90 degree rotation (c) 90 degree rotation structure by microstrip line

Figure6: The improvement of the directivity by the array arrangement



(a) Without rotation (b) 90 degree rotation (c) 90 degree rotation structure by microstrip line

Figure 7: The improvement of the directivity by the array arrangement
(Normalized directivity in the horizontal plane (Theta=90degree) at 2.61GHz)

Table 1: The improvement of the directivity by the array arrangement

Structure	Peak Gain [dBi]	Deviation [dB]
Single Element	2.98	2.69
(a) Without rotation	6.19	2.51
(b) 90 degree rotation	5.04	0.25
(c) 90 degree rotation structure fed by microstrip line	4.92	0.68

5. Conclusion

We made it possible for the Omni-directional antenna of the horizontal polarization with diameter is of about 0.22λ.

References

[1]Y. Ojiro , H. Kawakami, “Horizontally polarized omni-directional antenna, "IEICE General Conference, B-1-60, March, 2001.

[2]H. Hagiwara, “Polarisation Diversity Omni Directional antenna,”IEICE General Conference, B-1-143, March, 2009.

[3]K. Cho, T. Hori, "Space diversity antenna arrangements mounted on a metal pole for illuminating a street cell," IEEE Transactions on Vehicular Technology, vol.47, no.2, pp.531-536, May, 1998.