

Diversity Receptions of Waveguide Sheet Terminated with Switching Diodes

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1. Introduction

Radio-frequency identification (RFID) system in management and administration of the books and documents has received much attention [1]. A waveguide sheet developed by Teijin Limited is used as the reader antenna in RFID smart bookshelf system. For this system, it is desired that all of the RFID tags located on the waveguide sheet can be detected. The waveguide sheet with switched open/short termination has been proposed to increase the receiving level [2]. In this report, switching diodes are used to terminate the sheet to realize the diversity receptions of the waveguide sheet.

2. Proposed diversity receptions of waveguide sheet terminated with switching diode

The waveguide sheet consists of a conducting mesh layer, a ground plane and a substrate. Because the standing wave occurs due to discontinuity at the end of the waveguide sheet, low sensitivity areas occur on part of the planar waveguide sheet. Therefore, diversity reception is considered here to enhance the RFID reception performance. Switching diodes are used to terminate the sheet as shown in Fig. 1. A variable bias voltage is applied to the diodes. By changing the bias voltage to change the impedance of these diodes, the field distribution on the sheet can be changed and the reception of switching diversity can be realized.

3. Experiment result

In the experiment, diodes (Toshiba 1SS352) were used to terminate the sheet. The diodes were electrically connected between the conducting mesh layer and ground plane at the end of the sheet.

The impedance of the diode was changed from capacitive value to inductive value when the bias voltage of diodes was varied. By varying the bias voltage, the electric field distribution on the sheet was varied and the measurement results are shown in Fig. 2. The electric field intensity in low sensitivity areas was increased when the bias voltage of the diodes was changed. The CDF of received power distributions with different bias voltage is shown in Fig. 3. It is known that diversity gain can be increased by 7.5dB by using diversity reception at CDF of 1%.

4. Conclusions

It was experimentally shown that the problem of low sensitivity

areas on the waveguide sheet could be solved by using the switching diversity reception where diodes biased with variable voltage are terminated to the sheet waveguide. It was demonstrate that a diversity gain of 7.5 dB at 1% CDF could be obtained by using the proposed system.

References

- [1] C. R. Medeiros, et al., IEEE Antennas Propag. Mag., vol. 53, no. 2, pp. 39-50, Apr, 2011.
- [2] K. H. Chen, et al., IEICE Tech. Report, EMCJ2012-111, pp.53-56, 2013.

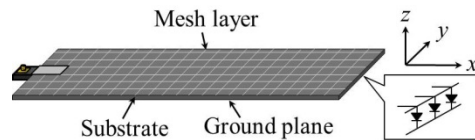


Fig.1 Geometry of planar waveguide sheet.

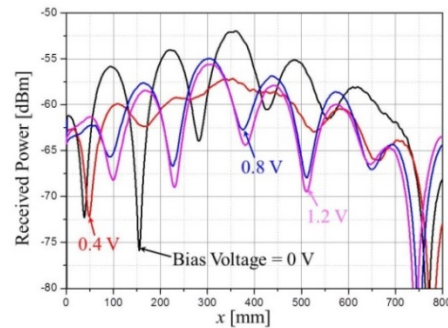


Fig. 2 Received power distribution on sheet with different bias voltage.

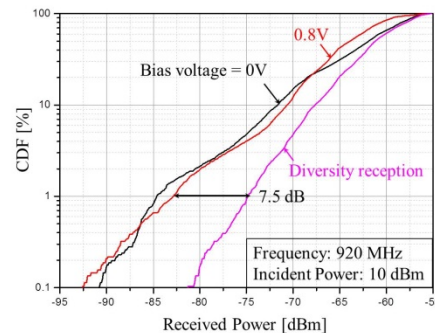


Fig. 3 CDF of received power distribution