

Improvement of Read Success Rate of RFID Smart-Shelf System with Diversity Reception

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1. Introduction

Radio-frequency identification (RFID) system in management and administration of the books and goods has received much attention [1]. A sheet called CELL FORM was developed by Teijin Limited and it has been used as the reader antenna in RFID smart-shelf system [2]. High read success rate is desired in the system. A diversity approach where the sheet is terminated with switching diodes was proposed to increase the electric field intensity in the low sensitivity area [3]. In this report, it is demonstrated the diversity reception using switching diodes is used in the smart-shelf system to increase the reading success rate.

2. Approach

The waveguide sheet consists of three layers: a conducting mesh layer on top, a ground plane at the bottom and a substrate in the middle. Low sensitivity occurs on part of the planar waveguide sheet because the standing wave occurs due to discontinuity at the end of the waveguide sheet. Therefore, diversity reception is proposed to enhance the RFID reception performance. Switching diodes are used to terminate the sheet. 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. Experimental results

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

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 distribution on the sheet was changed when the bias voltage of the diodes was changed. The experiment results using diversity reception is showing Fig. 3. It is known that smart-shelf system using diversity reception can increase reading ability and the read success rate.

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 demonstrated that the read success rate could be highly improved by using proposed approach.

References

- [1] C. R. Medeiros, et al., IEEE Antennas Propag. Mag., vol. 53, no. 2, pp. 39-50, Apr, 2011.
- [2] CELL FORM http://www.teijin.com/products/advanced_fibers/poly/specifics/selfform.html#features
- [3] K. H. Chen, et al., IEICE Tech. Report, EMCJ2012-111, pp.53-56, 2013.



Fig.1 Experiment environment of smart-shelf system.

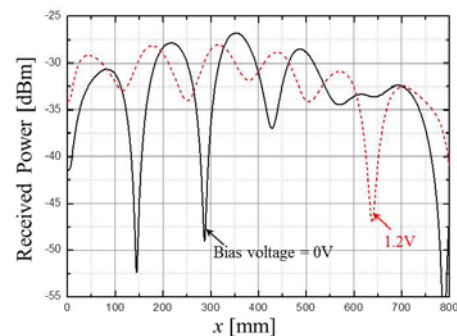


Fig. 2 Received power distribution on sheet with different bias voltage.

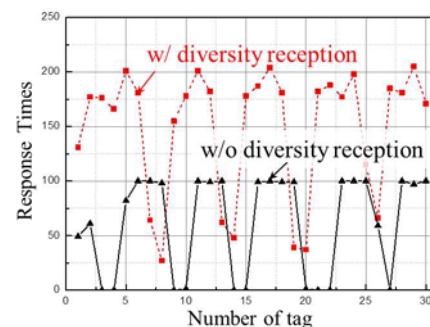


Fig. 3 Response times of smart-shelf system in one minute.