ABSTRACTS (MASTER THESIS)

Study and Development of an Intermittent Microwave Power Transmission System for ZigBee Devices

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The objective of the present thesis is to develop a microwave power transmission (MPT) system for ZigBee device, shown in Figure 1, in order to realize wireless and battery-less sensor network. For saving on the frequency resources, it is recommended that the frequency of MPT system be in the same frequency band as that of ZigBee communication. In the case, however, the MPT would interfere with the ZigBee communication, and ZigBee devices would get disabled to communication. To solve the interference problem between MPT and ZigBee communication, we propose intermittent MPT, which is the method that microwave is irradiated for power supply while the ZigBee devices sleep. In the previous studies, we confirmed that a ZigBee device worked and communicated correctly by intermittent MPT without a battery. However, it is concerned that communication interference with MPT would occur stochastically without any scheduling rules. Therefore we develop a way of scheduling management between ZigBee communication and MPT in the present thesis. First, we developed the transmission scheduling program. The scheduling program successfully worked on the system with a single ZigBee device with battery drive. Next, we improved the power receiving devices. We developed a rectifying circuit with a slave circuit. The RF-DC conversion efficiency of the rectifying circuit was 58 % with the wide range of the output load from 150 ohm to 1100 ohm. Thus, we improved the total RF-DC conversion efficiency of rectifying circuit from 27.5 % to 55.7 %. We also developed an estimation program for selecting the size of capacitors. Then, with the developed scheduling program and improved receiving device, we conducted the intermittent MPT demonstration for both a single and two receiving circuits and ZigBee devices, as shown in Figure 2. Finally, we successfully conducted the demonstration for 24 minutes in the case of a single ZigBee device and for 74 minutes in the case of two ZigBee devices.

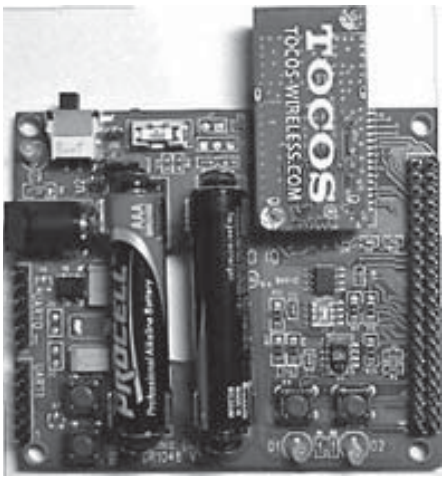

Figure 1. ZigBee device.

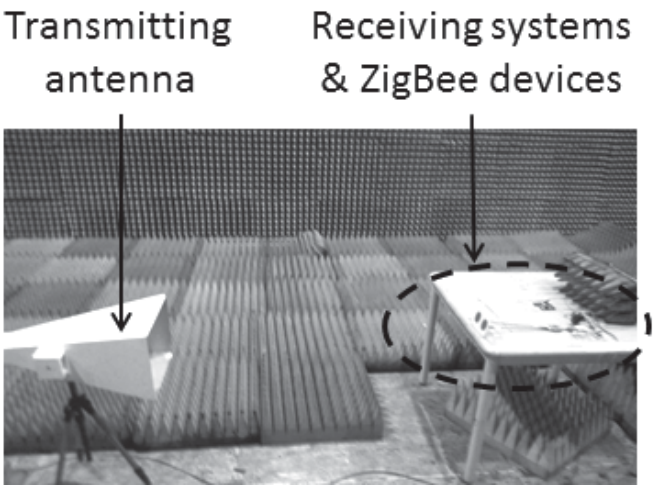

Figure 2. Demonstration of intermittent MPT for two receiving systems and ZigBee devices.