RECENT RESEARCH ACTIVITIES

Microwave Power Transmission to a Sensor Terminal for Wireless Sensor Network

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Wireless sensor network is becoming an attractive application for monitoring systems such as energy conservation systems of buildings and houses, traffic management systems, environment monitoring systems etc. One of the critical issues of the wireless sensor network is the way to supply electric power for sensor terminals. Primary batteris need to be changed soon or later even though power consumption of the sensor terminals is quite small. Natural energy utilization like solar cells with a charging system will drive the sensor terminal permanently; however their installation location and regular operation are limited because the natural energy is quite unstable. We therefore suggest wireless power supply to the sensor terminals by microwave power transmission (MPT), in order to realize a fruitful wireless sensor network.

The objective of the present study is to drive or charge a wireless sensor terminal by MPT. We adopt a ZigBee device as wireless sensor terminal because of its low power consumption. ZigBee is one of the radio communication standards and appropriate for the sensor network for the following reasons: its power consumption is lower than wireless LAN and Bluetooth, its production cost is low, and its network capacity is large. Its low power consumption is beneficial for a MPT system from the viewpoint of electromagnetic compatibility between MPT and ZigBee.

We experimentally investigated electromagnetic compatibility between ZigBee and microwave power transmission, and found that there were some frequencies and power levels of microwave power transmission not to interrupt ZigBee. We also developed a microwave power receiving system which consists of a receiving antenna, a rectification circuit, a dc-dc converter, and a power storage circuit or a secondary battery. Finally we succeeded establishment of ZigBee network while driving a ZigBee device without batteries by microwave power transmission, as shown in Figure 1. Through the experiments, we found out intermittent microwave power transmission was preferable to CW microwave power transmission with respect to electromagnetic compatibility and rf-dc efficiency [1, 2].

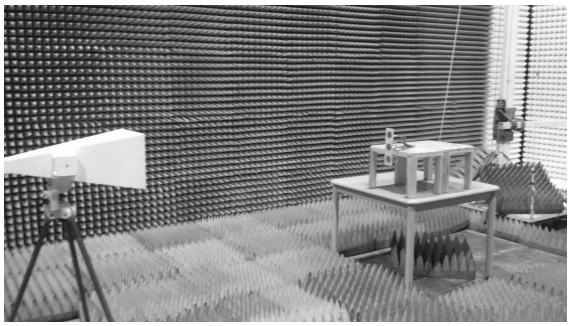

Figure 1. Photograph of intermittent MPT demonstration to a ZigBee terminal.

As future works, we will study on scheduling management between MPT and ZigBee. Although we succeeded intermittent MPT demonstration to a ZigBee device as a feasibility study, scheduling management will be essential for realizing a fruitful wireless sensor network. Also we will have to study how to transmit microwave power to multiple ZigBee devices in a wide area.

References

[1] Suzuki, N., T. Mitani, and N. Shinohara, “Study and Development of a Microwave Power Receiving Circuit for ZigBee Device,” *Proc. of Asia-Pacific Microwave Conference 2010 (APMC 2010)*, pp.45-48, Yokohama, Dec. 2010.

[2] Ichihara, T., T. Mitani, and N. Shinohara, “Study on Intermittent Microwave Power Transmission to a ZigBee Device,” *Proc. of 2012 IEEE MTT-S International Workshop Series on Innovative Wireless Power Transmission: Technologies, Systems, and Applications (IMWS-IWPT 2012)*, pp.209-212, Kyoto, May 2012.