# ABSTRACTS (MASTER THESIS)

## Study on Microwave Propagation for Wireless Sensor System in Car Engine Compartment

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Recently, a large number of sensors are installed in vehicles to monitor their conditions. However, the power wires for these sensors increase the vehicle's weight. To solve the weight increase problem, a microwave power transfer system is proposed as one of the management systems, which can provide electric power with sensors without the wires. In this paper, we investigated microwave propagation for wireless sensor system in car engine compartment. The maximum consumption power of the sensor is 100mW and the power of the Tx antenna is 500 mW from the limit of usable power in the engine control unit. We assumed the rf-dc conversion efficiency as 70%. Therefore, 140mW is necessary for the rectenna input. Then our target of the transmission efficiency is set to 28%.

First, we designed 2.45 GHz and 900 MHz antennas as Tx and Rx antennas. Then, we simulated and measured the antenna characteristics. Second, we simulated and measured the transmission efficiency in a simple engine compartment model. When Tx antenna faced Rx antenna, we confirmed the transmission efficiency in the simple engine compartment became larger than that in free space. The transmission efficiency at 900 MHz became larger than that at 2.45 GHz. In addition, we examined the transmission to the plural points or the over-the-horizon condition in the simple engine compartment model. Finally, we simulated and measured the transmission efficiency in a real engine compartment model. We changed the direction of the Tx and Rx antennas in the over-the-horizon condition, and obtained the simulation result of 2.8% and the measurement result of 1.2%. To improve the transmission efficiency, we simulated the transmission efficiency when Tx antenna faced Rx antenna. As a result, we obtained more than 28% of the transmission efficiency at 900 MHz when we used a dipole antenna with a reflector for Tx and Rx with a distance of 18 cm.

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