

Development of a wireless charging system for an electric vehicle

Kenji Shinoda

Graduate School of Engineering, Kyoto University

In this thesis, we study on development of a wireless charging system for an electric vehicle (EV) with wireless microwave power transmission (WPT) at 2.45GHz. Generally the EV may contribute to energy problems and environment affairs because of two features. One is that the EV is superior to a gasoline motorcar in the total energy conversion efficiency from fossil fuels. Another is that the EV has few exhaust gases. However, the EV has defects such as low mile and slow charging. To defeat these disadvantages, we developed a wireless rapid charging system with WPT.

Firstly, we explained configuration and components of the wireless charging system. In this system, the components have to be designed with high microwave density. Hence, we newly developed high power rectennas of 13W with RF-DC conversion efficiency of 52%.

Secondly, we experimented on the whole wireless charging system to the EV. The experiment was conducted with 5 transmitting systems and 81 receiving systems. As the experimental result, we succeeded the energy charging of 333kJ in 70 minutes with WPT.

Thirdly, we investigated the dependence of a distance between the transmitting antennas and the receiving antennas to establish an efficient wireless charging system. From this investigation, accordingly we found out that charging power has the distance regularity of an approximate $\lambda/4$ periodicity.

Finally, we researched the relation between RF-DC conversion efficiency and diode SPICE parameters, and represented that SiC devices is the best match to a rectenna's diode by own performance in the future.