

## Electromagnetic Fields near Wireless Power Transfer Systems

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Wireless power transfer using near-field is receiving a considerable amount of attention from both research and industry. In order to use a wireless power transfer in practice the effect of wireless power transfer on the human body and electronic devices must be investigated. In addition, such systems must adhere to relevant regulations. Therefore, it is needed to calculate electromagnetic fields near wireless power transfer systems. In this paper, we calculate electromagnetic fields near two coupled antennas.

To calculate the antenna mutual coupling, we first express antennas as the scattering matrix in terms of spherical vector waves. An antenna mutual coupling can be considered as the cascading of a transmitting antenna network, a space network and a receiving antenna network. Each port in the space network represents the mode port. Here the antenna networks are expressed as a scattering matrix and the space network is expressed as an impedance matrix. The element of the space network is determined by the addition theorem.

The region where electromagnetic fields are calculated is divided into two regions and the method for calculating fields in each region is different (Fig. 1). This is because the formulas of the addition theorem are different in the two regions. In region 1 (blue region), both incoming and outgoing spherical waves exist. In region 2, only outgoing spherical waves exist. If we know the voltages and currents of ports in the space network, we can determine the spherical mode coefficients in both regions. From the spherical mode coefficients, we can calculate electromagnetic fields near wireless power transfer system and far-field that the system radiates.

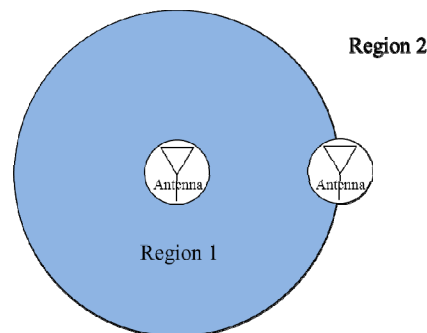


Fig .1 Two regions where electromagnetic fields are calculated