
ABSTRACTS (MASTER THESIS)

Study on Wireless Power Transfer between Array Antennas in the Radiative Near Field towards Higher Efficiency

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In this paper, we analyzed the wireless power transfer between array antennas in the radiative near field. We can calculate the power transmission efficiency between array antennas by regarding array them as aperture antennas. However, it is re-reported that there is a considerable gap between theoretical efficiency and measured one in the previous study. As the reason, the theoretical calculation doesn't consider losses which occurs in the transmission. In the previous study, losses were estimated but the examination of concrete loss factors is insufficient. In the radiative near field, an incident wave on receiving antenna is a spherical wave and a loss occurs in power combined circuit because the amplitude and phase of spherical electric field are different at each element. We call it synthesis loss and this was not considered in the previous study.

Therefore, we defined 5 losses to clarify the factors of gap between theoretical efficiency and measured one; synthesis loss, antenna loss, reflection loss, beam formation loss and receiving efficiency. Then we estimated the effect of them on transmission efficiency in the simulation and calculated the efficiency compensated the effect of them. As the result, we found that the effect of synthesis loss can not be ignored in the radiative near field. Besides, the estimated efficiency was matched the measurement efficiency and it was shown our method of estimating transmission efficiency is useful.

Finally, we tried to enhance the transmission efficiency by designed a receiving antenna with an adjusted phase difference in the circuit. By using this antenna as a receiving antenna, the efficiency was improved by 0.9 point in the simulation. Further, in the simulation, we realized about 2.5 point increase of transmission efficiency by removing the corner elements of an array antenna when the transmission distance is enough small.

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