Magnetic resonance coupling for 5G WPT applications

ABSTRACT

Inductive Wireless Power Transfer (IWPT) is the most popular and common technology for the resonance coupling power transfer. However, in 2007 it has experimentally demonstrated by a research group from Massachusets Institute of Technology (MIT) that WPT can be improved by using Magnetic Resonance Coupling Wireless Power Transfer (MRC WPT) in terms of the coupling distance and efficiency. Furthermore, by exploiting the unused, high-frequency mm-wave band which are ranging from 3~300 GHz frequency band, the next 5G generations of wireless networks will be able to support a higher number of devices with the increasing data rate, higher energy efficiency and also compatible with the previous technology. In this work, a square planar inductor with the dimension of 6.1 x 6.1 mm is designed, and the resonators have the same self-resonance frequency at 14 GHz. The coil resonators have been laid on Silicon and Oxide substrate to reduce the loss in the design. From the CST software simulation and the analytical model in MATLAB software, it has been shown that the MRC WPT design has improved the performance of IWPT design by 40% power transfer efficiency. MRC WPT design also has larger H-Field value which is 705.5 A/m, as compared to the IWPT design which has only 285.6 A/m when both Transmitter(Tx) and Reciever(RX) is at 0.3 mm coupling distance.

Keyword: 5G; Inductive coupling; Magnetic resonance coupling; Wireless power transfer