A Hybrid Coupler for 6.78MHz Desktop Wireless Power Transfer Applications with Stable Open-loop Gain

The open-loop gain of capacitive power transfer (CPT) circuit, especially for applications like wireless charging of laptop or keyboard, is sensitive to the changes of coupling capacitance, which makes the regulating of output voltage and output power difficult. Hybrid coupler has been proved to be able to combine the advantages of both inductive power transfer (IPT) and capacitive power transfer. In this paper, a hybrid coupler is designed with the aim of keeping a stable open-loop gain when the coupling capacitance changes. The structure as well as the operation principles of the hybrid coupler is explained firstly. Then, the open-loop gains of CPT, IPT and hybrid wireless power transfer (HWPT) are derived and followed by a simplified design guideline of the whole HWPT system using the proposed hybrid coupler. Finally, the proposed coupler is verified with a 40W, 6.78MHz experimental prototype.