**Power Transfer Characteristics of Four-coil Magnetic Resonance System according to the Position of Self-resonant Coils**

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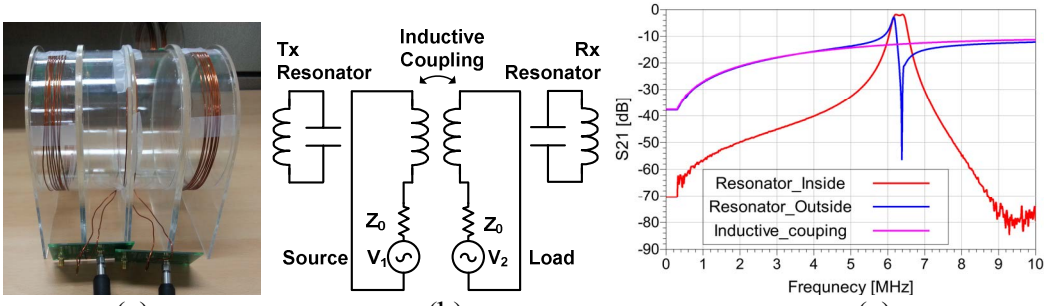
The electromagnetic resonance is important candidate of wireless power transfer (WPT) technology for ubiquitous power system. The MIT proposed four-coil WPT scheme based on coupled magnetic resonance. Frequency splitting and critical coupling are shown by distance of resonators. But it is still necessary to assess power transfer characteristics according to various resonator positions.

In this work we present experimental results of inductively coupled source and load coils with two self-resonant coils outside the source and load as fig. 1(a) to investigate wireless power transfer characteristics. A simple equivalent circuit model is also simulated to find the mutual coupling parameters with resonance coils position as fig. 1(b). The 0.5 mm radius copper wire is wound on plexiglass ring of 15 cm diameter. The transmitting (TX) and receiving (RX) resonator coils have 8 turns, and the source and load coils have single turn. Inductors and capacitors in resonator circuits had the same value of 30 uH and 22 pF, respectively, yielding the same 6.2 MHz resonant frequency for TX and RX resonators. Comparative experiments are performed to verify the impact of the resonator position upon the power transfer performance of the system. The distance of resonators is fixed to 14 cm, the source and load coils are various configuration. We measured the S-parameters as fig. 1(C) and extracted the model parameters. When the resonators are located between the source and load coils, S21 shows almost critical coupling, the 3dB bandwidth is about 400 kHz. While the resonators located outside the inductive coupling, S21 shows peak at 6.16 MHz and valley at 6.38 MHz. The resonators at outside position decrease the bandwidth of power transfer, which reduce the interfere effect.




(a) (b) (c)

Figure 1. (a) Experimental setup (b) Equivalent circuit (c) Measured results for the system having the resonator outside and inside the inductive coupling, and purely inductive coupling without resonator.