Modeling of Practical Radiation Concerns of Wireless Charger for Electrical Vehicles

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Recently, Wireless Power Transfer (WPT) technologies have attracted many attentions because of the emerging of massive mobile electronic products such as laptops, smart phones, tablets and other mobile devices. Two technologies which are now being discussed the most is inductive power transfer (IPT) and magnetic resonant coupling (MRC). For traditional IPT systems, the charging distance is less than one centimeter, requiring the mobile product to be placed on a charging pad. The recent IPT wireless charger adopted by electrical vehicles increases the distance up to 20cm. The MRC uses a higher frequency than the IPT, and allows a longer charging distance without comprising the efficiency.

Safety is the same important as performance when evaluating and considering a product for both civilian and military applications. Electromagnetic field (EMF) exposure is one of the major safety concerns for the wireless charging technology employed for EVs. This work evaluates the radiation fields and other performance parameters of an IPT system presented by Koga, T. from ANSYS Japan. ANSYS tools are used for this modeling investigation. The IPT system model operates at the frequency of 20 kHz, and each charging pads is composed by coil, core, and shielding plate as shown. The shielding plates are modeled using perfect conductor. Ferrite magnetic materials are used for modeling the cores. Litz wire with radius of 25mm and 384 wires in parallel are used for coil and the material of litz wire is copper. Magnetic field results with misalignment between the primary and secondary charging pads are shown which simulates the practical misalignment issue when parking the vehicle over the charger. Comparison of magnetic fields level is demonstrated between misalignment and normal aligned operation. For results, the B fields near the power transferring zone expand to its nearby areas when the secondary pad misaligns with primary pad.