Resonant Wireless Power Transfer Cable is no longer a constraint

Wireless setting for portable devices has become increasing popular. While data transmission of portable devices has turned wireless, power charging still relies on power cable for connection. Wireless charging will be a vital step for making portable devices completely wireless for users. Resonant wireless power transfer will be presented to you to make portable completely wireless in all settings.

Free from the Constraint of Cable

The inductive wireless charging design could be operational for the time being. Yet, the receiver of this device must be positioned at the charging pad at high precision for effective power transfer. The use of resonant wireless power transfer does not require high precision for the positioning of the receiver, and may be mounted at any spot on the resonant charging pad to perform the function of power transfer.

In a wireless design, two coupling coil were adopted for wireless power transfer. Electric energy in the coil of the emission device will be converted into magnetic energy for picking up by the coil of the receiver, where the magnetic energy will be converted into electric energy. Inductive wireless power transfer (WPT) is limited by the distance of only a few millimeters between the transmitter and receiver. Coupling within the gap of just a few centimeters will be diminished. The transmission efficiency will decline with the increase in distance. The operation within the gap of a few centimeters yields an air gap where the solution of coupling resonant coil for resonance is required, as it could help to map with coupling factors. AirFuel has defined a standard for resonant wireless power transfer. This standard is based on the operation at the frequency of 6.78 MHz and allows for charging several devices at the same time.

AirFuel also defined the coupling resonant coil with the use of wireless energy transfer. The transmitter is a LC-series capacitor resonator and is composed of a capacitor $C_{T.}$ and loaded L_T coil and effective serial resistor R_T. The receiver is a LC-series resonator with a capacitor C_R and coil (L_R and R_R) and loaded resistor (R_L) for connection with the receiver. In the process of energy transfer, coupling occurs between the coil of the transmitter and the receiver where M is the mutual inductance of the system.

If the receiver is placed in the electric field of the transmitter, it picks up part of the energy from the electric field of the transmitter coil. In the absence of resonance, transmission not passing through the receiver coil will not contribute to wireless power transfer. The narrow distance between the sensor and the receiver is the typical mode of transducing non-resonant wireless power transfer solution. This narrow distance will result in high coupling between the transmitter and the receiver.

When C_T and L_T resonate with each other (operation frequency is at 6.78 MHz), the transmitter coil will form a highly reinforced magnetic field in the absence of a receiver. In the absence of resonance, the magnetic field will be reinforced due to resonance. The reinforcement of the resonant magnetic field in the transmitter coil allows the receiver coil to pick up energy at a longer distance and lower the coupling from the transmitter field. Yet, the receiver cannot input more energy than the transmitter, so that the maximum energy the receiver can pick up will be the input capacity of the transmitter.

Each transmitter features the maximum voltage of the amplifier and the maximum current restrained by the amplifier or the transmitter. For maximizing the power of the receiver, the receiver should approximate maximum current and voltage. As such, there are three scenarios in coupling: over-coupled, under-coupled and ideally coupled.

In the over-coupled case, coupling level is high and/or loading resister R_L is relatively lower ($R_{L,input}$ is higher). The receiver can acquire ample power from the field of the transmitter coil. As such, the resonant enhanced field cannot be formed. The energy will then be consumed by the receiver with the enhancement of the input resistance (or impedance) of the transmitter that the transmitter will be restrained by the voltage of the amplifier.

In the under-coupled case, coupling level is low and/or loading resister R_L is relatively higher ($R_{L,input}$ is lower).The transmitter coil forms a powerful electric field but the receiver cannot acquire sufficient power to achieve maximum efficiency. The transmitter will be restrained by the maximum current of the system.

In the ideally coupled case, coupling k and loading resister R_L match with each other so that the electric field in the transmitter coil could be formed and the transmitter can pick up the ideal capacity of energy.

Currently, the inductive wireless power transfer solution performs in an environment without cable. However, it must be positioned on the charging pad at high precision, such as a smart phone, so as to transfer power effectively. Resonant wireless power transfer will change the means of wireless power transfer once and for all. It is because it really is a wireless means of power transfer. If the receiver could be mounted on the charging pad of the charger, it could effectively activate power transfer.

The design of resonant wireless power transfer requires an understanding of the properties of the switches. Effective design also requires the working principle of magnetic system. At the design stage, the optimization of the wireless power transfer system will be the application of an equation to calculate the resistance observable from the transmitter and the estimate of the maximum power for transfer. In addition, an understanding is needed of the coupling between the transmitter and the receiver, and the quality of the two coils will affect the overall efficiency of the system.