Power Transmission with Wire Antennas

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Abstract

A power transfer system is designed with wire antennas. There are three wires, which are transmitter, receiver, and counterpoise. The counterpoise wire is placed between the transmitter and receiver to modify the electric field between transmitter and receiver so that the transmitter current is reduced and the transfer efficiency is increased.

Description

By the end of 19th century, Nikola Tesla invented wireless power transfer system. As shown in Fig. 1, Tesla used two short monopole antennas, one is transmitter and the other one is receiver. Now a modification to Tesla's work is presented with three wire antennas, which are transmitter, receiver, and counterpoise. The counterpoise wire is placed between the transmitter and receiver, as shown in Fig. 2. The distance between the counterpoise to the transmitter, as well as to the receiver, can be adjusted for optimization.

Measurement

An experimental measurement is performed to validate this working principle. The three wires are 1.0 meter long for each. The distance between the counterpoise to the transmitter and receiver is 9.0 cm and 4.0 cm respectively. The working frequency is 33.4 MHz and the loading R is 40 ohm. The input voltage U is 1.84 V. The output voltage on R is 0.38 V. The current through the transmitter is 0.4 mA.

Conclusion

The radiation loss is negligible because wire length is much shorter than wavelength. Since the counterpoise is placed between transmitter and receiver, it reduces the current through the transmitter and thus increases transfer efficiency.

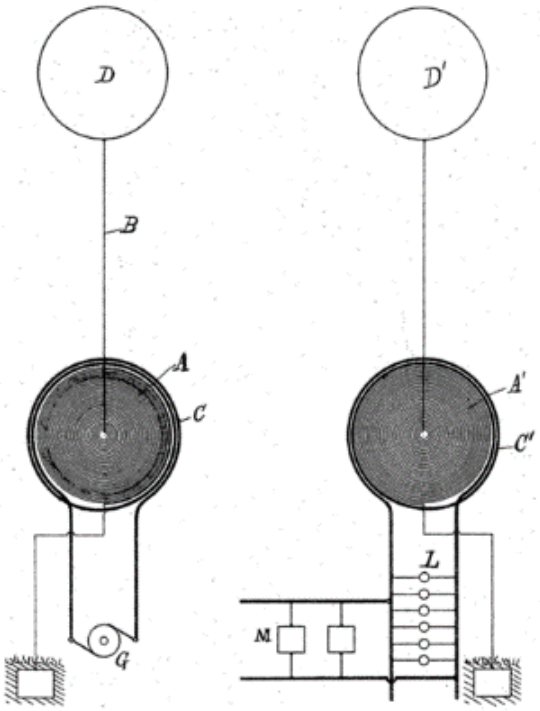

Figure 1: Wireless power transfer by Nikola Tesla (copy from Wikimedia.org)

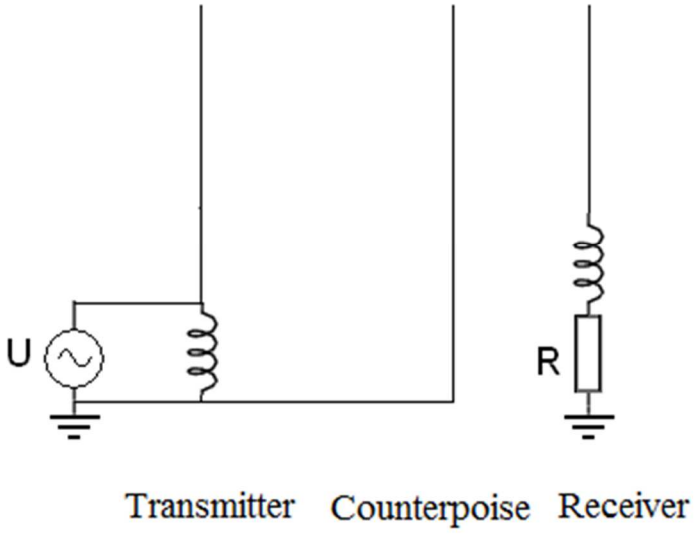

Figure 2: Power transfer system composed of wire antennas of transmitter, receiver, and counterpoise. The counterpoise is placed between transmitter and receiver.