

Study on Transmission Efficiency of Wireless Power Transfer System with Lossy T-Section Impedance Matching Circuits

Lifei Zheng*, Hiroyasu Sato*, Qiang Chen*, Qiaowei Yuan**

Tohoku University*, Sendai National College of Technology**

1. Introduction

Wireless power transfer(WPT) is the process which electromagnetic energy is transmitted from a source to a load without lines. WPT technology with impedance matching circuits can enhance the transmission efficiency. But the losses of components in matching circuit should be considered. This paper will confirmed our proposed exact approach of designing a lossy impedance matching circuit for a WPT system with the consideration of the losses. An example will show the effect on the efficiencies due to the lossy components of the matching circuit.

2. Calculation method & Simulation result

The 2-dipole WPT system can be represented as two-port network shown in Fig.1. The maximum transmission efficiency can be calculated by S-parameter. As discussed in [1], the conjugate matching condition at two ports is expressed as equation (1).

$$\Gamma_{in} = \Gamma_s^* \quad \Gamma_{out} = \Gamma_l^* \quad (1)$$

Where Γ_{in} and Γ_{out} is the input and output reflection coefficients at ports. And Γ_s and Γ_l is the reflection coefficient at source Z_s and load Z_l .

2 dipole antennas have same radius with 2 mm and same material with PEC. The transmission efficiency is studied when designing the impedance matching circuits with and without the consideration of losses of matching circuit components. And the Q factor represents the loss of matching circuit components. The result in Fig.2 shows that the transmission efficiency with considering losses of matching circuit components is about 55%, and it is about 18%when designing without the consideration. Compared the transmission efficiency, the improvement of transmission efficiency with consideration of losses is about 37%.

3. Conclusion

In this paper, a wireless power transfer system with two-side lossy T-Section impedance matching circuits was studied by two dipole antennas model. The result of

transmission efficiency in Fig.2 also showed that the Q -factor has a great influence on transmission efficiency.

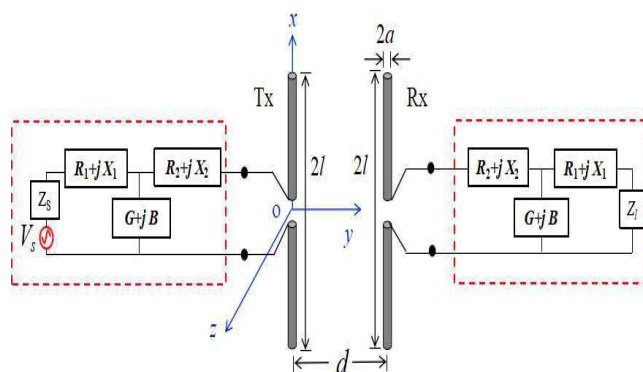


Fig.1 Two-dipole WPT system with two-side lossy T-Section impedance matching circuit

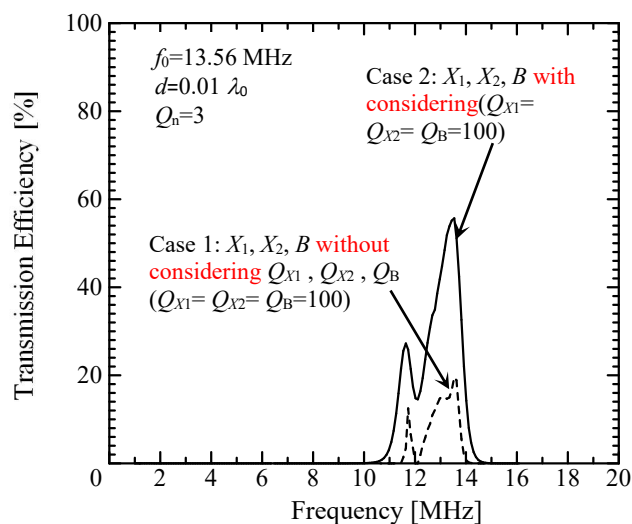


Fig.2 Transmission efficiency frequency characteristics

References

- [1] Q.W.Yuan, S.Suzuki, and Q.Chen, " Design Method of Lossy Impedance Matching Circuit," IEICE Tech. Rep., vol.116, No.218, AP2016-106, pp.97-100, Sept.2016.