

Modelling of Loop Antenna Depending on Interval between Source Coil and Resonant Coil

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Abstract

In this paper, alterations of parameter that loop antenna has depending on interval between source coil and resonant coil are the focus of attention. Such interval influences mutual impedance and resonance frequency. We propose modelling of loop antenna's impedances, reflection coefficients and resonance frequencies. Through this study and results, the design process can be easily performed.

Keywords : Loop Antennas W.P.T(Wireless Power Transmission Resonance

1. Introduction

Many research institutes have developed new various devices in the field of electronics. Especially, development of devices to communicate data in wireless have increased continually. As a result, many kind of portable batteries have been studied and researches about interesting W.P.T(wireless power transmission) were begun in many research institutes because many people pursue convenience.

W.P.T is technology that can substitute for battery without wire. Recently it is studied in communication range from 1~2cm (short distance) to 4~5km (long distance) through various methods. There are radiation method and non-radiation method. Transferring power using general antennas used in device for communication through micro wave is radiation method and Transferring power using loop antenna through electromagnetic induction is non-radiation method. There are inductive coupling method and resonant coupling in non-radiation method.

In this paper, loop antennas used in resonant coupling method that transfers power via resonance and has advantage of high efficiency in short distance were studied to make antenna that has more effective transmission capacity. We designed loop antenna composed of source coil and resonant coil. Changes of frequencies, impedances and s11 depending on Interval between Source Coil and Resonant Coil were measured.

2. Design and Fabrication

The antenna designed for study is composed of two part, source coil and resonance coil. Source coil is circular one layer. Diameter of antennas is 9.5cm, thickness of coil is 1.6mm and material is copper. And resonant coil has helical structure and 3turns. Diameter of antennas is 9.5cm, thickness of coil is 1.6mm and material is copper. Also, loop antenna that has identical condition is designed in simulation program. Resonant coil has 96MHz self resonant frequency in simulation program.

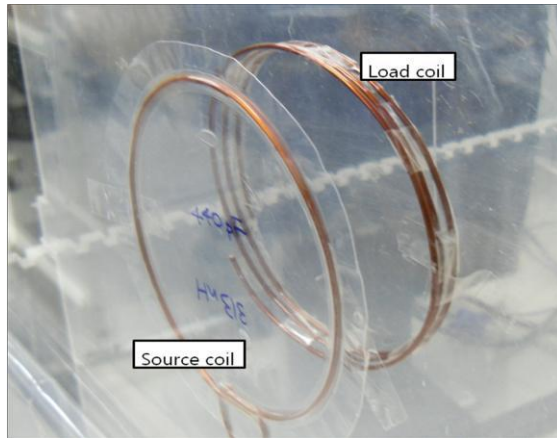


Figure 1: Source coil and Load coil designed.

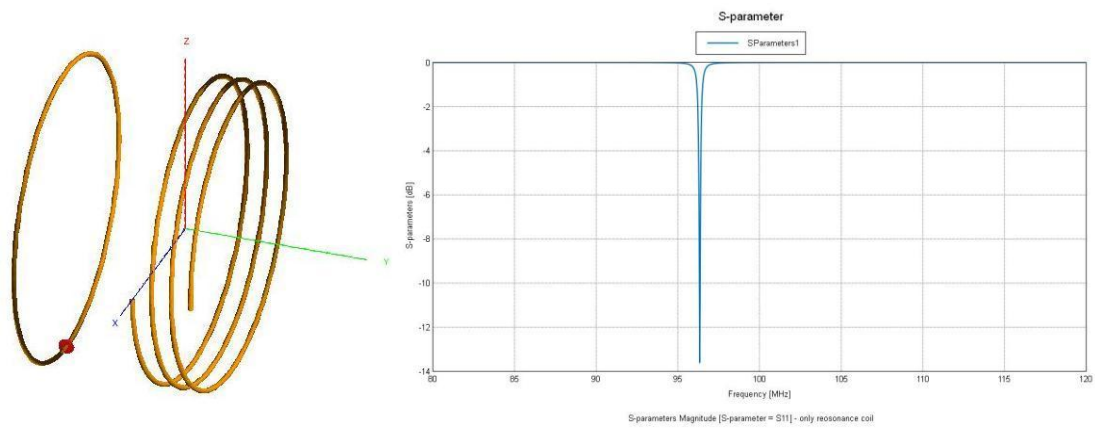


Figure 2: Source coil and Load coil designed and S11 spectrum in simulation program.

3. Experiment

In chapter 2, antenna designed for study was introduced. In chapter 3, parameters of antenna measured were showed and explained.

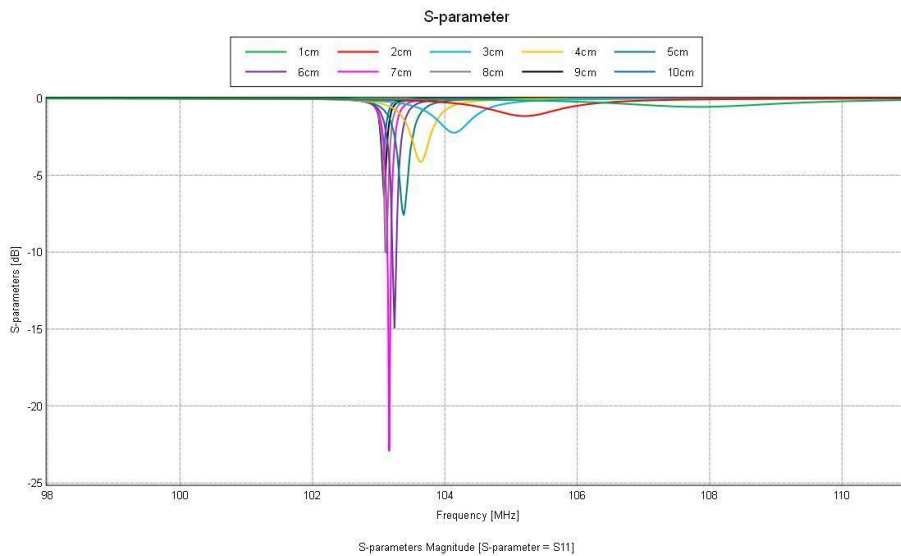


Figure 3: S11 Spectrum to interval between source coil and resonant coil in simulation.

Table 1: Resonance Frequency according to interval between source coil and resonant coil in simulation

Interval(cm)	1	2	3	4	5	6	7	8	9	10
Frequency(MHz)	107.8	105.2	104.2	103.6	103.4	103.2	103.1	103.1	103.1	103.1

Figure 3 and Table1 show change of resonant frequency depending on interval between source coil and resonant coil in simulation program. As interval increase, resonant frequency decrease. Because mutual impedance changes as interval changes, mutual impedance has a effect on impedance and resonant frequency of loop antenna. Figure 4 shows change of impedance depending on interval between source coil and resonant coil in simulation program. Through S11 spectrum and smith chart, loop antenna has low reflect coefficient and impedance closed to 50Ω when interval between source coil and resonant coil is 7cm under this condition.

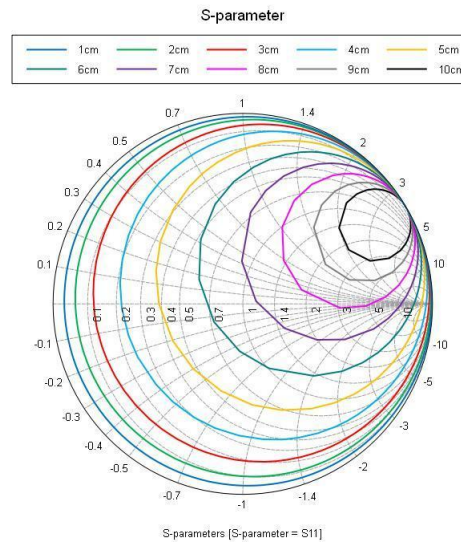


Figure 4: Smith chart according to interval between source coil and resonant coil in simulation.

Figure 5 shows change of resonant frequency depending on interval between source coil and resonant coil when loop antenna designed in simulation is realized. In common with simulation, similar characteristic appears. Because of difference between real structure and simulation in accuracy of design (real structure is hand made.), frequency and impedance of real structure are different from frequency and impedance of simulation.

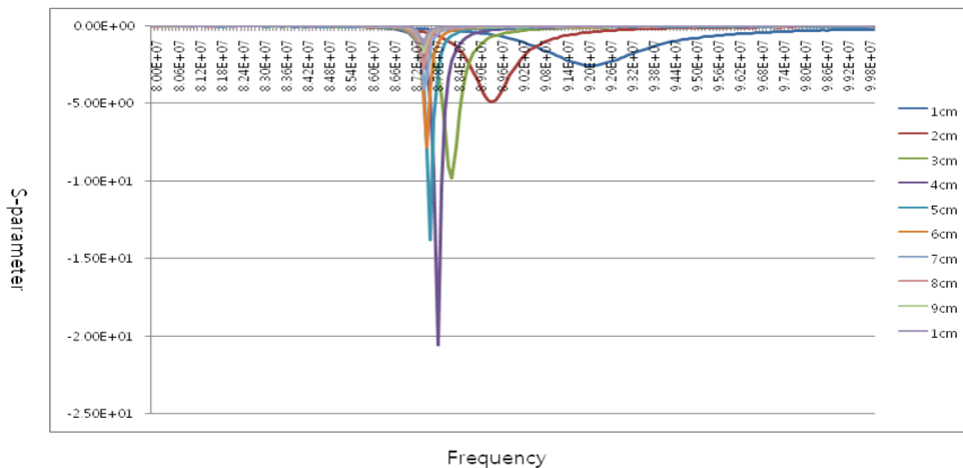


Figure 5: S11 Spectrum according to interval between source coil and resonant coil.

4. Conclusion

Until now, we confirm changes of frequencies, impedances and S_{11} depending on the interval between the source coil and resonant coil. There are many applications of W.P.T. and necessary distances of each application are different. According to size and distance, using changes of frequencies, impedances and S_{11} depending on the interval between the source coil and resonant coil, we designed a loop antenna.

5. Acknowledgements

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