

The methods of optimizing and designing compact circular coils for a higher quality factor (Q-factor) and effective wireless power transfer (WPT) for an application of a WPT system in the megahertz frequency range to implantable medical devices are presented. For an optimal design, the ohmic resistance and inductance of the coils, including skin and proximity effects, are calculated by applying the volume filament model (VFM). In a calculation using the VFM, a circular coil is regarded as a concentric multiloop coil, and then, the resistance and inductance of the coil are derived by calculating the voltages of each loop obtained from the VFM. According to the results, the Q-factors of the coils are derived and analyzed. In addition, compact Rx and Tx coils for higher power transfer efficiency are properly designed at 6.78 MHz. For verification, theoretical calculation and analysis results are compared with the simulation and previous results. Coils properly designed are fabricated, and their resistance, inductance, Q-factor, and efficiency are measured. Measurement results have good agreement with the calculation. The fabricated system is compared with the previous results designed at a lower frequency from the viewpoint of size and efficiency.