A Wireless Power Transfer System for Implanted Devices

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There have been different generations of implanted sensors/actuators presented in the scientific literature as well as in some products introduced by various biotech companies. Smart pills and pacemakers have already been used as mobile and static implanted devices while the implanted brain machine interface (BMI) are becoming popular. However, the major challenge is still associated with powering up these devices since many of implanted devices cannot exclusively rely on batteries as power sources. Among all the technologies which have been proposed to power up the implanted devices Wireless Power Transfer (WPT) might be the best candidate. The classical WPT designs consist of a drive coil, transmitting or primary coupler (transmit antenna), receiving or secondary coupler (receive antenna), and the load coil. These systems should be optimize for wireless power transfer efficiency, which translates to the ratio of the delivered power to the load to the available power to the drive coil. To adapt the WPT technology for implanted applications, one needs to reduce the number of coils to two, one transmitter and one receiver, and also reduce the volume of the coils by making them two dimensional.

An implanted WPT system will be presented based on the Electrically Coupled Loop Antenna, ECLA. The proposed coupler is studied for two different dimensions to investigate the miniaturization effects on the power transfer efficiency. To estimate the maximum power allowed to be delivered to the transmit coupler, the Specific Absorption Rate (SAR) is computed for different cases. Various simulation models have been provided to expedite the design optimization and the final design has been simulated using a more detailed model using XFDTD software. This WPT system has been investigated experimentally to verify the simulation results. A liquid with electrical property of muscle is prepared for measurement. Three different antennas are prototyped and tuned at 403MHz. The prototyped antennas are used for experimental validation of the simulated data.
At the end the experimental result will be presented as part of this research.