Intra-Body Propagation Channel Investigation Using Electrically Coupled Loop Antenna

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Abstract:

Knowledge of propagation media, typically gathered through physical experiments and simulations, is absolutely critical in successful transceiver design. In the case of medical implants, physical experiments are extremely difficult. Therefore, we rely on simulations in most studies. In this paper, Path Loss (PL) between implanted antennas, as a measure of propagation channel characteristics, is investigated using High Frequency Structure Simulator (HFSS) and Remcom's XFDTD 7 (XF7). An Electrically Coupled Loop Antenna (ECLA) is designed to study PL inside human body models at different frequency bands: Medical Implanted Communication Services (MICS) band (402-405 MHz), Industrial Scientific and Medical (ISM) band (2.4 2.5 GHz) and 3.5 GHz band (3.55-3.65 GHz). The ECLA has dimensions (5×5×3 mm3), (3×3×3 mm3) and (2×2×2 mm3) at MICS, ISM and 3.5 GHz respectively. ECLA performance inside human body models is studied at the allowed frequency bands. The effects of frequency bands, human model electrical properties, and distance between implants on PL are considered. Simulation results are validated with experimental work. Our results show that the ECLA at MICS band has the lowest Specific Absorption Rate (SAR) and the highest allowed input power. Also, the MICS band has the lowest PL inside the human body model, shown to be less than 90 dB in the worst case scenario.

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