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Experimental Wireless Link and SAR Assessments of an Implantable PIFA for Biotelemetry in the 2.45 GHz Band

Abstract

An experimental wireless link and specific absorption rate (SAR) assessment is presented in this work. A compact planar inverted-F antenna (PIFA) is designed and evaluated for biotelemetry application as an antenna at 2.45 GHz band. The proposed antenna provided a satisfactory bandwidth per unit volume using a two-layered stacked structure consisting of a high-frequency laminate and a low loss ceramic layer. The antenna was first co-designed inside several different types of phantom boxes to optimize its performance, considering computational resources. Next, a semisolid intestinal phantom model used in simulations were chosen to be fabricated for experimental evaluations. Evaluation results indicated a satisfactory antenna's operation from 2.13 to 2.81 GHz (bandwidth of 27.8%), with realized gains of -26.49 dBi when implanted at 45 mm inside the phantom. Next, measurements were performed on the antenna's communication link with a wearable antenna to study the effects its depth (from 10 to 45mm), indicating transmission coefficients of between -40 and -60 dB at 2.45 GHz. Finally, its SAR levels are evaluated experimentally using a commercial measurement system when implanted within the human tissue. Results indicated satisfactory level of 0.685 W/kg (averaged over 10 g of tissues) and is suitable for biotelemetry application.

Keywords

biomedical telemetry; Capsule antennas; implantable antennas; specific absorption rate