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OPTIMAL FREQUENCY BAND FOR IMPLANTABLE WIRELESS INTRAOCULAR PRESSURE SENSORS INTO DISPERSIVE TISSUE

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Abstract. This paper studies the attenuation in the electromagnetic waves caused by the dispersive tissue of the human eye. A wireless link is simulated between an external coil (Antenna) and an implanted sensor inside the eye model . The implanted sensor is restricted to a squared area of 25 mm2 and it is design as an RLC series resonator. In the simulation, the eye tridimensional model uses the Cole-Cole equations to calculate the dielectric relaxation properties into the dispersive tissue of the eye. In the proposed multiphysics model, different parameters were used to model the cornea, sclera, lens, iris and humor vitreous according to their composition and as described in (S. Gabriel et al., Phys. Med. Biol., 41(11): 2271–2293 (1996)). In the simulations, the conductivity and the permittivity were obtained as function of the frequency for every layer of the eye model. The finite elements method was used to solve the Maxwell's equations to evaluate the effects of the dispersive tissue in the coupling between the antenna and the sensor. The sensor frequency was tuned to maximize the electromagnetic coupling. Specific absorption rate (SAR) was measured at the optimal frequency band for the sensor and the antenna. This work shows a pathway for the design of implanted antennas into dispersive tissue, wich also contributes to the reduction of the energy transmitted into the body in order to communicate with implanted wireless sensors.