Abstracts

The dependence of electromagnetic energy absorption upon human head tissue composition in the frequency range of 300-3000 MHz

A. Drossos, V. Santomaa and N. Kuster. "The dependence of electromagnetic energy absorption upon human head tissue composition in the frequency range of 300-3000 MHz." 2000 Transactions on Microwave Theory and Techniques 48.11 (Nov. 2000, Part II [T-MTT] (Special Issue on Medical Application and Biological Effects of RF/Microwaves)): 1988-1995.

The requirements for testing compliance of cellular phones with electromagnetic safety limits demand evaluation of the maximum exposure that may occur in the user group under normal operational conditions. Under these conditions, the tissues of the ear region are most exposed, the tissue composition of which is complex and varies considerably from user to user. The objective of this paper is to derive head tissue equivalent dielectric parameters that enable the utilization of one generic homogeneous head for testing compliance for the entire user group, i.e., granting no underestimation, but also not greatly overestimating the actual maximum user exposure. As a primary study, a simple analytical model of an infinite half-space layered tissue model exposed to a plane wave was utilized to investigate the impact of impedance matching standing waves, etc. On the spatial-peak specific absorption rate. The tissue layers were varied in composition and thickness, representing the anatomical variation of the exposed head region covering the user group including adults and children (<10% to >90% percentile). Based on the worst-case tissue layer compositions with respect to absorption at each frequency, head tissue equivalent dielectric parameters for homogeneous modeling were derived, which result in the same spatial-peak absorption. The validity of this approach for near-field exposures was demonstrated by replacing the plane wave by different near-field sources (dipoles and generic phones) and the layered structure with magnetic-resonance-image-based nonhomogeneous human head models.

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