Abstracts

Analyses of Electromagnetic Fields Induced in Biological Tissues by Thermographic Studies on Equivalent Phantom Models

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One of the most vexing problems in studies involving the interaction of electromagnetic fields and living biological systems and tissues is the quantification of the fields induced in the tissues by nearby sources. This paper describes a method for rapid evaluation of these fields in tissues of arbitrary shape and characteristics when they are exposed to various sources including plane wave, aperture, slot, and dipole sources. The method, valid for both far- and near-zone fields, involves the use of a thermograph camera for recording temperature disitributions produced by energy absorption in phantom models of the tissue structures. The magnitude of the electric field may then be obtained anywhere on the model as a function of the square root of the magnitude of the calculated heating pattern. The phantoms are composed of materials with dielectric and geometric properties identical to the tissue structures which they represent. The validity of the technique is verified by comparing the results of the experimental approach with the theoretical results obtained for the case of plane layers of tissue exposed to a rectangular aperture source and cylindrical layers of tissue exposed to a plane-wave source. This technique has been used successfully by the author for improving microwave applicators.

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