Abstracts

W-band investigation of material parameters, SAR distribution, and thermal response in human tissue

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This investigation is divided into three parts. First, the W-band dielectric properties of different biological tissues are determined. Then, the electromagnetic field in the human eye and skin is simulated for plane-wave exposure. An analytical method is used to investigate the specific absorption rate (SAR) inside a layered model of the human skin between 3-100 GHz. Furthermore, the SAR inside a detailed model of the human eye is investigated numerically by the finite-difference time-domain method for a frequency of 77 GHz. Maximum local SAR values of 27.2 W/kg in skin tissue and 45.1 W/kg in eye tissue are found for 77 GHz and an incident power density of 1 mW/cm/sup 2/. In the third part of the investigation, the temperature changes of superficial tissue caused by millimeter-wave irradiation are measured by a thermal infrared imaging system. The exposure setup is based on a horn antenna with a Gunn oscillator operating at 15.8-dBm output power. The measurements showed a maximum temperature increase of 0.7/spl deg/C for a power density of 10 mW/cm/sup 2/ and less than 0.1/spl deg/C for 1 mW/cm/sup 2/, both in human skin (in vivo), as well as in porcine eye (in vitro). The comparison of the temperature measurements with a thermal bio-heat-transfer simulation of a layered skin model showed a good agreement.

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