Abstracts

Multifrequency radiometric determination of temperature profiles in a lossy homogeneous phantom using a dual-mode antenna with integral water bolus

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In the treatment of cancer, microwave hyperthermia has been established as an efficient adjunctive procedure to radiation therapy and chemotherapy. Wider acceptance of this method awaits schemes to measure volumetric temperatures noninvasively in human tissue for control of the heating process. This effort describes the design and performance of a new microstrip applicator intended for homogeneous heating of superficial tissue while at the same time monitoring temperature of the underlying tissue by noninvasive radiometric sensing of black-body radiation from the heated volume. Radiometric capabilities are assessed in terms of accuracy of up to six measured brightness temperatures applied in an inversion algorithm from which one-dimensional depth temperature profiles are generated. Based on radiometric signals recorded over the 1-4-GHz range, the temperature accuracy determined from statistical analysis of 200 realizations of the process is better than /spl plusmn/0.2/spl deg/C to a depth of 5 cm in phantom. Aperture heating uniformity is assessed with electric field scans in a homogeneous muscle phantom. As long as sufficiently thin (< 5 mm) water boli are used, SAR distributions at 1-cm depth in phantom extends effectively just outside the aperture perimeter, making this microstrip antenna an excellent building block element of larger multi-antenna array applicators.

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