Abstracts

Theoretical and Experimental SAR Distributions for Interstitial Dipole Antenna Arrays Used in Hyperthermia

K.M. Jones, J.A. Mechling, J.W. Strohbehn and B.S. Trembly. "Theoretical and Experimental SAR Distributions for Interstitial Dipole Antenna Arrays Used in Hyperthermia." 1989 Transactions on Microwave Theory and Techniques 37.8 (Aug. 1989 [T-MTT]): 1200-1209.

Theoretical predictions and experimental measurements of power deposition in muscle tissue phantoms from arrays of microwave dipole antennas used for hyperthermia cancer therapy are compared. The antennas are linear coaxial dipoles, constructed from coaxial cable approximately 1 mm in diameter, which are inserted into small nylon catheters implanted in the tumor volume. The antennas have a tip section consisting of an expanded extension of the inner conductor, and a second section consisting of the outer conductor and extending from the tip section back to the insertion point into the tissue or phantom. In this work these two sections have equal length; i.e. the antennas are symmetrical dipoles. The specific absorption rate (SAR, W/kg) patterns for a 2 cm square array of four 915 MHz antennas are presented for both resonant and nonresonant dipoles. Arrays of dipoles with lengths much shorter than the resonant half-wavelength have a far more reactive input impedance and a much smaller absolute SAR magnitude in the array center than is seen for arrays of resonant diodes, and the maximum SAR shifts from the array center to the antenna surfaces. The absolute length of the volume heated by the small-diameter antennas with the longer half -wavelength was longer than that for the larger diameter antennas. SAR distributions for 4 cm square arrays of eight and nine antennas fed with equal amplitude and phase are also compared. It is found that much of the array volume has a power deposition less than 25 percent of the maximum SAR and that the distribution is nonuniform for both the eight- and nine-antenna configurations.

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