

Current Sheet Applicators for Clinical Microwave Hyperthermia

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Current sheet applicators (CSAS) are light-weight, small size applicators intended to be operated in array configurations. Their radiative fields are induced by RF currents in a conducting sheet embedded a few millimeters below the dielectric covered aperture surface. In arrays, these elements can be used over breast lesions, for superficial head tumors, torso regions and other curved body sites where conformity to body curvatures is necessary. Our clinical prototypes are tuned to 434 MHz and have a bandwidth of almost 20 MHz, which accommodates the tuning and coupling changes due to site differences of the body, body movement and tissue heterogeneities. The relative insensitivity of these units to air bubbles in bolus and scar tissues are attractive clinical features. The inherent linear polarization allows easy visualization of the superposition of electric field vectors of each element of an array, as well as provides deeper penetration on curved surfaces due to the electric field vector addition in the medium. In the case of a large breast tumor, depth of heating of over 4 cm was achieved along the central axis of a 2x2 coherent array. Experimental evaluation of these elements, leading up to their clinical implementation, is described in detail along with the results of a clinical example.

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