MICROWAVE APPLICATORS FOR LOCAL THERMOTHERAPY

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We investigate and evaluate various types of microwave applicators suitable for local or deep local hyperthermia treatment, like e.g. waveguide applicators, lucite (horn) applicators, microstrip applicators and T-monopole applicators. These applicators are designed to work at 434 or at 70 MHz. In the conference contribution we would like to discuss its effective heating depth, based on the comparison of the theoretical and experimental results. Basic mechanisms and parameters influencing (limiting) heating effective depth are to be described and explained.

The basic type of applicator for local treatment is a waveguide applicator. The construction of such applicator is very simple and numerically modeled (i.e. by software SEMCAD calculated) and measured "Specific Absorption Rate" ("SAR") distribution in front of the applicator aperture is well homogeneous and also the effective heating depth is approaching the theoretical limit of a plane wave. Modified results in SAR and temperature 3D distribution we can obtain e.g. by aid of Lucite cone applicator or by T-monopole applicators.

A an example we would like to give simple description of T-monopole applicator for frequency 915 MHz (blue lines in the level coordinates) is placed on the surface of a water bolus (2 cm layer), phantom of biological tissue (e_r = 49, s =0.8 S/m) is beneath the water bolus.

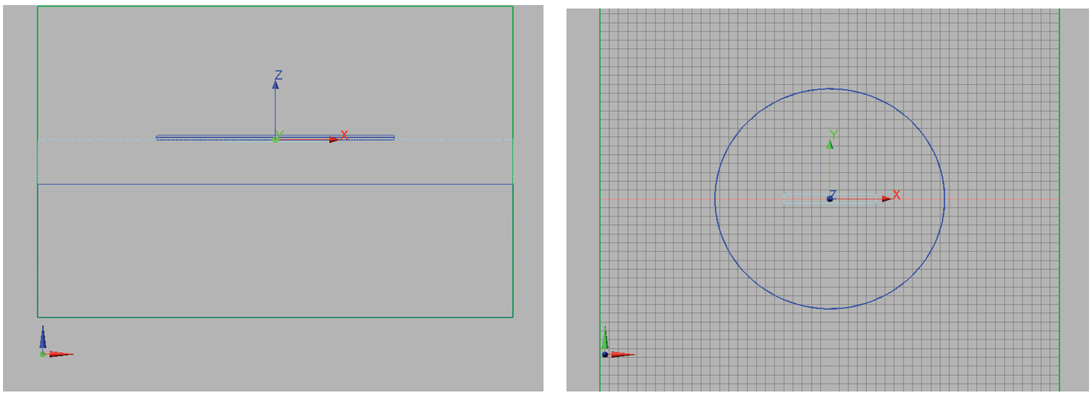

Fig. 1.

Applicator itself consists of circular metalic plate (diameter 10 cm – see please blue-line circle), dielectric layer (thickness 2 mm) and a simple rectangular metalic patch (oriented along *x*-axis), see light-blue rectangle in Figure 1.

Next figures then presents numerical simulations of the mentioned applicator in SEMCAD software. Figure 2 gives example of SAR distribution in plane *x*=0 (perpendicular to the patch in its middle plane). The 50% decrease of SAR in this figure is given by interface of violet and blue colour – little bit more than 1 cm depth penetration. For given dielectric parameters of water phantom depth of penetration is comparable to TEM (plane) wave penetration.

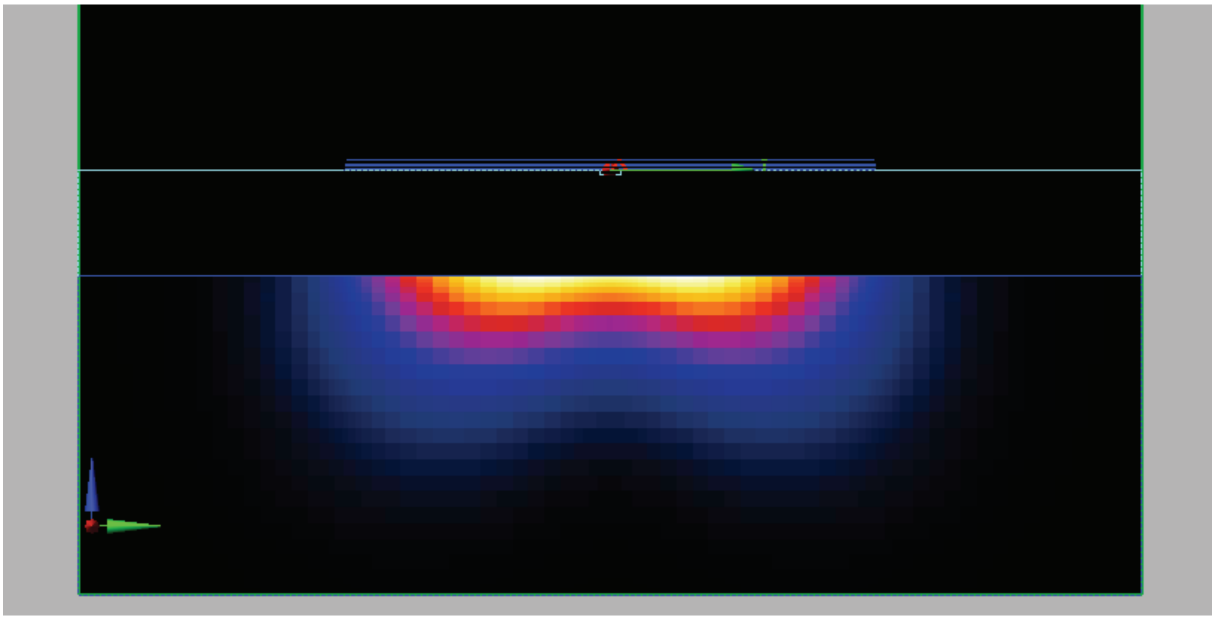

Fig. 3.

Figure 3 shows SAR distribution in the surface layer of the water phantom. Just with one single patch we can cover more than 50% of the “ground” circle.

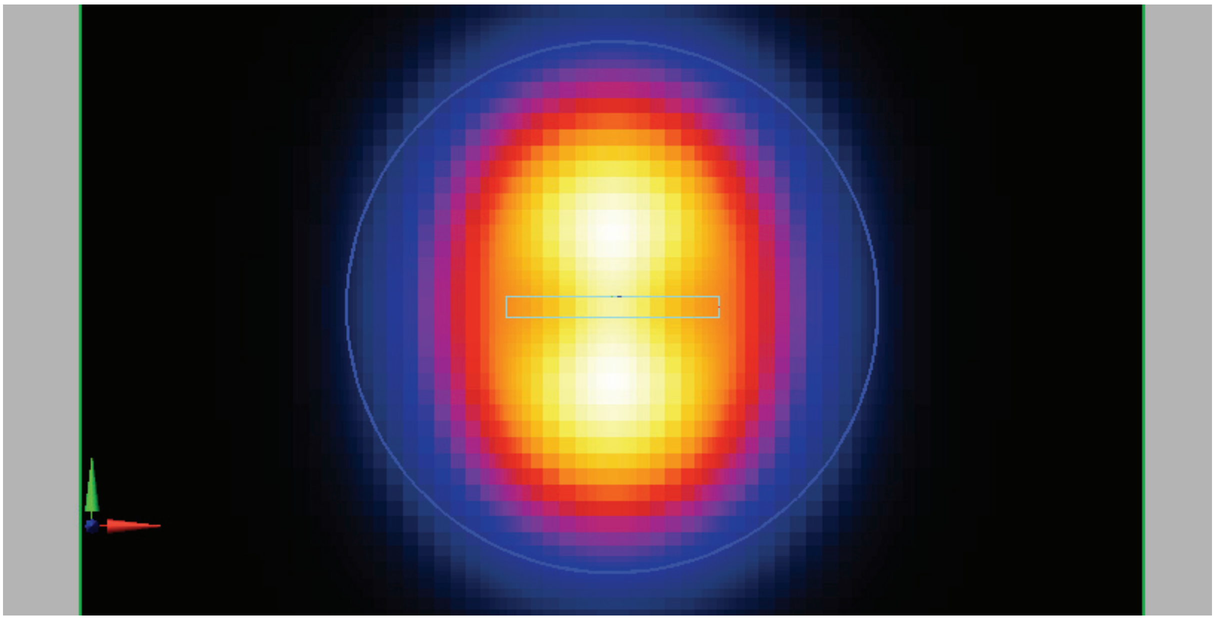

Fig. 4.

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