

Comparison of SAR distribution in homogeneous phantom and in anatomical model by array of microwave TEM mode applicators

Barbora Vrbová, Jan Vrba

Department of Electromagnetic Field, Faculty of Electrical Engineering, Czech Technical University in Prague

vrbovbar@fel.cvut.cz, vrba@fel.cvut.cz

Introduction

• Purpose:

- we deal with simulations of SAR distribution obtained by array of microwave stripline TEM mode applicators of the same type. We compare the SAR
- by setting of phases or/and amplitude of several applicators we can accomplish required shape of SAR distribution







distribution in a homogeneous agar phantom with radius 4 cm (which has similar characteristics to muscle tissue and represents human extremity) and in an anatomical based biological model .

Hyperthermia applicator

• Microwave stripline applicator with TEM mode



- working at frequency of 434 MHz
- simulated by the FDTD simulator SEMCAD X
- the upper and bottom places are made from copper and lateral sides are made from dielectric material – acrylic glass
- Design and dimensions
 - non-divergent section of stripline (50 x 30 mm) is at one end short circuited and at the other end passes into a divergent horn (80 mm)
 - length of applicator double wavelength

Anatomical based biological model

- is a 3D model of woman's left calf
- is created from CT DICOM scans by segmentation program 3D DOCTOR
- consists of three types of tissue, such as fat, muscle and bone

Array of 3 applicators on cylindrical agar phantom



Normalized SAR in cylindrical agar phantom

Array of 3 applicators on anatomical model



Normalized SAR in anatomical model

Array of four applicators

• for treatment tumors located in the middle of human limb





Name	Conductivity [S/m]	Relative Permittivity
Agar	0,80	54,00
Bone Cortical	0,09	13,07
Muscle	0,80	56,86
Fat	0,04	5,56
Dielectric properties at frequency 434 MHz		



Dielectric properties at frequency 434 Minz

3D anatomical model of woman's calf

Array of two applicators

• for treatment of tumors, which cover larger area near to surface of human extremity



Array of 2 applicators on cylindrical agar phantom





Array of 2 applicators anatomical model



Array of 4 applicators on cylindrical agar phantom



Normalized SAR in cylindrical agar phantom

Array of 4 applicators on anatomical model



Normalized SAR in anatomical model

Conclusions

From the basic results of discussed SAR distribution flows, that these arrays of applicators of the same type could be used for treatment tumors located in various areas of human extremities. For better results we changed phases and amplitudes of several applicators. The SAR distributions are influenced by bone and fat tissue in 3D anatomical model.

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