

Microwave Applicators Compatible “NMR”

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Abstract: *Design of a new hyperthermia applicator for animal experiments is being described and explained. The applicator is designed to be compatible with noninvasive temperature measurements by aid of US or NMR. Further, experimental evaluation of the discussed applicator is given. This applicator is planned to be used for a hyperthermia-treatment of the experimentally induced pedicle tumors of the rat to verify the feasibility of diagnostic ultrasound and magnetic resonance imaging respectively to map the temperature distribution in the target area of the treatment.*

DESCRIPTION OF THE DESIGNED APPLICATOR

The goal of the planned biological experiment is a hyperthermia-treatment of the experimentally induced pedicle tumors of the rat to verify the feasibility of diagnostic ultrasound and magnetic resonance imaging respectively to map the temperature distribution in the target area of the treatment. That means to heat effective volume of approximately cylindrical shape (diameter approximately 2 cm and height approx. 3 cm). Temperature to be reached is 41 °C or more, time period of heating is 45 minutes. Considering the necessary effective heating depth for the planned experiments, we have found 915 MHz to be suitable frequency.

As compatibility with noninvasive temperature measurements (ultrasound or NMR) is asked, we should minimise the metallic mass of the applicator. Therefore the applicator itself is created by two inductive loops tuned to resonance by capacitive elements. Dimensions of the inductive elements was designed by our software, developed for this purpose. Optimum coupling between resonating loops was adjusted by microwave network analyser.

The position of the loops is fixed by perspex holder. There is a special cylindrical space for experimental animal in lower part of this perspex holder. As the heated tissue has a high dielectric losses, both loops are very well separated and no resonance in heated area can occur. From this follows, that either the position of the loops with respect to heated area or the distance between the loops is not critical.

EVALUATION OF THE DISCUSSED APPLICATOR

First measurements to evaluate the basic properties of the discussed applicator were done on agar phantom of muscle tissue:

- evaluation of microwave properties (power to be delivered to the applicator, reflections, etc.),
- measurement of the temperature distribution,
- compatibility with “NMR” system.

The results of the above mentioned evaluation are very good. More details on these results and other experiences we would like to present at the conference.