MEASUREMENT PROBES FOR COMPLEX PERMITTIVITY DETERMINATION - EVALUATION OF REFLECTION METHOD

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The knowledge of copmplex permittivity is important e.g. for the design and impedance matching of the thermotherapeutic applicators (to treated area) in microwave hyperthermia cancer treatment. Also in the medical diagnostics the knowledge of dielectric parameters of biological tissues enables to diagnose a tumor cell nest in the human body. Common to all papers in the field of dielectric measurements is a more or less extensive tabulation of the dielectric properties of tissues selected to illustrate the theoretical deliberations provided by the authors. The objective of the research reported here is to analyze an open ended coaxial line sensor for in vivo and nondestructive measurements of complex permittivity, and to develop a precision measurement system. It involves also feasibility study of different types of measurement probes.

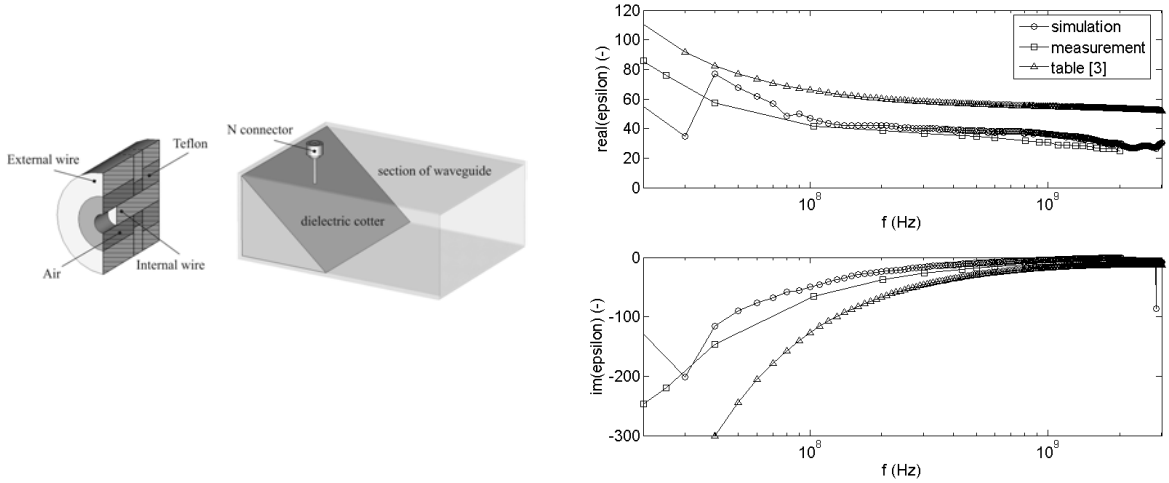

Figure: Example of measurement probes (coaxial and waveguide type) and obtained values of complex permittivity (real and imaginary part) on author's arm by aid of coaxial probe. We can see good agreement between the data from experimental measurement and data from numerical simulation.

The reflection measurement method is convenient method for the determination of dielectric parameters of biological tissues. It was found that our coaxial probe is useful in frequency range from 40 MHz. The description by two-element equivalent circuit (fringing capacitance and radiating conductance) is necessary because of the probe radiation at higher frequencies (dimensions of the probe are comparable with the wavelength). The planar probe and waveguide probe are suitable – achieved reflection coefficient is sufficient. This enables us to consider the use of measurements in reconstruction method of biological tissue.