Abstracts

Characterization of the complex permittivity of brain tissues up to 50 GHz utilizing a two-port microstrip test fixture

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Broad-band complex-permittivity values of biological tissues above 20 GHz obtained from direct measurements have not been reported in the literature. This paper presents for the first time the measurement results of complex permittivity of brain grey and white matters from 15 to 50 GHz utilizing a two-port microstrip test fixture. Test fixture S-parameters are simulated employing the finite-element method. To apply the data obtained from the simulation in complex-permittivity extraction, an efficient procedure, using the linear least square technique, is introduced to fit the modeling results to a rational function of complex permittivity, which is similar to the transfer function for a linear system. This fitting procedure is computationally more efficient than the previously developed fitting methods. Measurements are performed on slices of brain sample using a calibrated network analyzer utilizing custom designed through-reflect-line (TRL) calibration standards. The measurements are corrected for the residual errors observed in the measurement results due to the lack of performance repeatability of coaxial-to-microstrip launchers utilized in the TRL calibration standards. Finally, the measured results for brain matters are fitted to a single term Cole-Cole relation representing the dispersion characteristics of white and grey matters up to 50 GHz.

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