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Accurate Broadband Measurement of Electromagnetic Tissue Phantoms Using Open-Ended Coaxial Systems

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New technologies and devices for wireless communication networks are continually developed. In order to assess their performance, they have to be tested in realistic environments taking into account the influence of the body in wireless communications. Thus, the development of phantoms, which are synthetic materials that can emulate accurately the electromagnetic behaviour of different tissues, is mandatory. An accurate dielectric measurement of these phantoms requires using a measurement method with a low uncertainty. The open-ended coaxial technique is the most spread technique but its accuracy is strongly conditioned by the calibration procedure. A typical calibration is performed using an open circuit, a short circuit and water. However, this basic calibration is not the most accurate approach for measuring all kinds of materials. In this paper, an uncertainty analysis of the calibration process of open-ended coaxial characterization systems when a polar liquid is added to the typical calibration is provided. Measurements are performed on electromagnetically well-known liquids in the 0.5 -8.5 GHz band. Results show that adding methanol improves the accuracy in the whole solution domain of the system, mainly when measuring phantoms that mimic high water content tissues, whereas ethanol is more suitable for measuring low water content tissue phantoms.

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