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Tailor-Made Tissue Phantoms Based on Acetonitrile Solutions for Microwave Applications up to 18 GHz

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Abstract—Tissue-equivalent phantoms play a key role in the development of new wireless communications devices, which are tested on such phantoms prior to their commercialization. However, existing phantoms cover a small number of tissues and do not reproduce them accurately within wide frequency bands. This paper aims at enlarging the number of mimicked tissues as well as their working frequency band. Thus, a variety of potential compounds are scanned according to their relative permittivity from 0.5 to 18 GHz. Next, a combination of these compounds is characterized so the relation between their dielectric properties and composition is provided. Finally, taking advantage of the previous analysis, tailor-made phantoms are developed for different human tissues up to 18 GHz and particularized for the main current Body Area Network (BAN) operating bands. The tailor-made phantoms presented here exhibit such a high accuracy that would allow researchers and manufacturers to test microwave devices at high frequencies for large bandwidths as well as the use of heterogeneous phantoms in the near future. The key of these phantoms lies in the incorporation of acetonitrile to aqueous solutions. Such compound has a suitable behavior to achieve the relative permittivity values of body tissues within the studied frequency band.

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