

# Antenna Measurement Challenges and Opportunities – the Next Ten Years

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**ABSTRACT** - Modern society relies increasingly on well-functioning wireless systems - for communication, for sensing, or for energy transfer - and wireless systems rely significantly on well-functioning antennas. Though computational tools improve continuously, the increasing complexity of modern antennas in terms of their functionalities, materials, and structures, as well as always stricter performance requirements, mean that experimental measurements remain of utmost importance for development, validation, and calibration of antennas. But antenna measurement techniques and technologies face numerous near-future challenges due to the wide variety of modern antenna technologies in terms of frequency, bandwidth, radiation pattern, adaptiveness, size and weight, device integration, and dependence on environment, as well as demands for increasing accuracy, decreasing cost and time, and need for characterization in production lines or in-situ operational conditions outside controlled measurement ranges. Furthermore, new wireless technologies call for determination of non-traditional antenna performance metrics which often require substantial post-processing of the raw measurement data. This presentation aims to address state-of-the-art antenna measurement techniques and survey solutions to the many challenges. The presentation takes outset in the recent roadmap paper [O. Breinbjerg and M. Sierre Castañer (Editors), “Antenna Measurement Challenges and Opportunities”, EurAAP Reviews of Electromagnetics, vol. II, 2023] with 19 inspiring contributions by 34 leading experts in antenna measurements.

**BIO** - Olav Breinbjerg received the M.Sc. and Ph.D. degrees in electrical engineering from the Technical University of Denmark (DTU) in 1987 and 1992, respectively. He was on the Faculty of DTU's Department of Electrical Engineering as Assistant Professor from 1991 to 1995, Associate Professor from 1995 to 2005, and Full Professor from 2006 to 2021. From 1997 to 2021 he was also Head of the Electromagnetic Systems Group and the DTU-ESA Spherical Near-Field Antenna Test Facility, and he founded the DTU Electromagnetic Test Centre. He resigned his position at DTU in 2021 and founded ElMaReCo for independent research consultancy. Olav Breinbjerg was a Visiting Scientist at Rome Laboratory in 1988, a Fulbright Research Scholar at the University of Texas at Austin in 1995, and a Visiting Professor at the University of Sienna in 2011 and 2022. His research is generally in applied electromagnetics - and particularly in antennas, antenna measurements, computational techniques, and scattering - for applications in wireless communication and sensing technologies. He is the author or co-author of more than 75 journal papers, 250 conference papers, and 250 technical reports. Dr. Breinbjerg was a recipient of a U.S. Fulbright Research Award in 1995, the 2001 AEG Elektron Foundation's Award, the 2003 DTU Student Union's Teacher of the Year Award, the 2013 and 2015 European School of Antennas Teacher of the Year Awards, the 2020 Hans Christian Ørsted Award, and the 2023 AMTA Distinguished Achievement Award. Dr. Breinbjerg is Fellow of AMTA, Fellow of IEEE, Knight of the Order of Dannebrog, and the 2024-2025 AMTA Distinguished Speaker.

