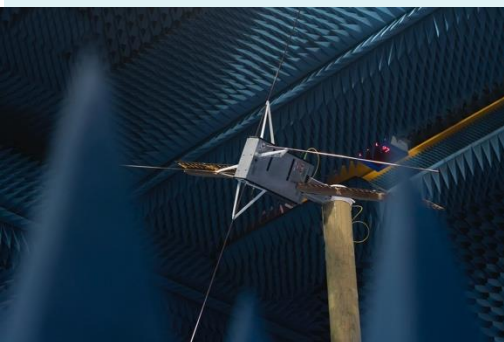


SC07 - Implementing IEEE Standards 1720 and 149 in Antenna Measurements: Principles, Practice, and Perspectives.



Abstract:

This short course provides an overview of antenna measurement practices in accordance with IEEE Standards 1720 and 149, as promoted by the IEEE Antennas and Propagation Society's Standards Committee. The course combines theoretical foundations with practical implementation guidance, emphasizing: Range and method selection, measurement goal, measurement accuracy, traceability, and uncertainty evaluation. Contributors involved in developing these standards will present key clauses and share insights on their rationale and best practices. Attendees will gain a deeper understanding of modern, state-of-the-art measurement techniques as outlined in the IEEE standards.

Recommended pre-requisites:

This course serves as an introductory opportunity for students and engineers interested in exploring the fascinating field of antenna measurements. At the same time, it is well suited for experienced engineers seeking an up-to-date overview of the latest developments and best practices as outlined in the IEEE antenna measurement standards. A basic understanding of electromagnetic theory and measurement principles is helpful but not required

Learning Objectives:

Attendees completing the course will gain a comprehensive understanding of key antenna measurement techniques, including near-field (NF) methods with both regular and non-regular scanning and transformation techniques, and far-field (FF) methods based on direct and indirect approaches such as CATR and PWG systems. The course will discuss the respective strengths, limitations, and areas of application of each method.

Participants will also receive a brief introduction to over-the-air (OTA) measurement techniques and Radar Cross Section (RCS) fundamentals, along with insights into anechoic chamber and absorber requirements, advanced post-processing methods for data correction, transformation, and imaging, and a solid foundation in uncertainty estimation and traceability as defined by the IEEE antenna measurement standards.

While the instructors will cover all major topics addressed in IEEE Std 1720 and IEEE Std 149, selected sections will be presented by invited experts who contributed as working group leaders to the development of these standards.

This course forms part of the IEEE APS Standards Committee (SC) outreach initiative to promote awareness and adoption of IEEE antenna measurement standards. A limited number of IEEE Std 149 copies will be donated by the APS SC and awarded to attendees through a lottery at the conclusion of the course

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Course Outline:

The short course will follow a structured program aligned with the outlines of IEEE Std 149 and IEEE Std 1720, providing both a theoretical and practical overview of antenna measurement principles and techniques. Attendees do not need to bring a laptop.

The first part of the course follows the organization of IEEE Std 149, covering antenna range design, instrumentation, and evaluation. Topics include anechoic and compact range configurations, quiet-zone characterization, gain, directivity, and polarization measurements, impedance and efficiency techniques, and special measurement methods such as plane wave generators, scale-model testing, and near-field probing with mathematical transformations. This section concludes with uncertainty evaluation, range operation, and safety considerations.

The second part of the course focuses on near-field (NF) measurement methodologies as described in IEEE Std 1720. This includes planar, cylindrical, and spherical scanning, non-regular scanning techniques, probe characterization, and gain determination. Advanced topics such as truncation mitigation, probe correction, time gating, phase retrieval, and back-projection diagnostics are also reviewed. The course concludes with a brief overview of antenna system testing, including over-the-air (OTA) measurements, and an introduction to Radar Cross Section (RCS) techniques as outlined in IEEE Std 1502, currently under review.

Selected sections will be presented by invited experts from the IEEE working groups who contributed to the development of specific clauses within these standards, offering unique insights into their rationale, implementation, and best practices. A limited number of IEEE Std 149 copies will be donated by the APS Standards Committee (SC) and awarded to attendees through a lottery at the end of the course.

Instructors



Lars Foged received his M.S. degree in Electrical Engineering from the California Institute of Technology (Caltech), USA, in 1990. He is currently Vice President of Research and Development at the Microwave Vision Group (MVG).

He has held several leadership positions within the IEEE Antennas and Propagation Society (AP-S), including Chair of the Industry Initiatives Committee (IIC) and current Chair of the Antenna Standards Committee (ASC). In 2023, he received the IEEE AP-S Industrial Innovation Award. He served as Vice-Chair of the European Conference on Antennas and Propagation (EuCAP) in both 2011 and 2022, and is course organizer, and board member of the European School of Antennas (ESoA).

He served as President of the Antenna Measurement Techniques Association (AMTA) in 2023 and is AMTA Fellow and Distinguished Achievement Award recipient. He is the author of two books and numerous scientific papers on antennas and measurement techniques. His work has earned multiple distinctions, including Best Technical Paper Awards at AMTA (2013) and EuCAP (2021).

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Dr. Vince Rodriguez attended The University of Mississippi (Ole Miss) and obtained his B.S.E.E. in 1994, and his M.S. and Ph.D degrees, both in engineering science with an emphasis in electromagnetics, in 1996 and 1999, respectively. He is currently manager of EM Analysis Group at NSI-MI Technologies.

Dr. Rodriguez is the author of more than 30 journal publications and over 70 conference papers. He is the author of a book on anechoic chamber design and has authored chapters in two other books. He is a senior member of the IEEE; an EMC Society member, where he served as distinguished lecturer from 2013 to 2014 and on the IEEE-EMC Board of Directors. Dr. Rodriguez also served as secretary in the IEEE AP-S Standards Committee and as secretary for the IEEE STD 149 and IEEE STD 1128 Working Groups and co-chair for the IEEE STD 1720 Working Group. Dr. Rodriguez is a fellow of the Applied Computational Electromagnetic Society (ACES). He is a Fellow of the Antenna Measurement Techniques Association (AMTA) and a distinguished achievement award winner of AMTA. He is currently distinguished speaker of AMTA. In 2025 he received the IEEE Standard's Association Medallion for contributions to the revisions of several standards related to antennas and propagation.



Key Bibliography

Std. 149-2021: IEEE Recommended Practice for Antenna Measurements

Std. 1502-2020: IEEE Recommended Practice for Radar Cross-Section Test Procedures

Std. 1720-2012: IEEE Recommended Practice for Near-Field Antenna Measurements

Rodriguez, V. Anechoic "Range Design for Electromagnetic Measurements", Artech House, 2019

Lars. J. Foged and M. Sierra Castañer, "Modern Automotive Antenna Measurements", Artech House, Boston, USA / London, United Kingdom, ISBN 978-1-630-81849-4

M. Sierra Castañer and Lars. J. Foged, "Post-processing Techniques in Antenna Measurement", SciTech Publishing, The Institution of Engineering and Technology, London, United Kingdom ISBN 978-1-78561-537-5 (hardback), ISBN 978-1-78561-538-2 (PDF)