

# Effective Usage of EMC Antennas for Calibration and EMC Chamber Site Validation

## **ORGANIZERS:**

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## **ABSTRACT:**

There are some practical considerations for antennas used for EMC measurements; for example, EMC antennas are typically extremely broadband and low gain. At below 1 GHz, these antennas are typically used over a perfect electrical conductor (PEC) ground plane; however, the calibration method in the present standards are specified for “free-space antenna factor”, which seems paradoxical. As another example, distance between a hybrid antenna and EUT is not clearly defined, especially for 1 m range EMI measurements. Anechoic chamber performance is also an integral part of the antenna application. We will discuss the evaluation of chambers and their impact on measurement uncertainties. This workshop provides an introduction and discussion of the antenna fundamental parameters from an application point of view, especially on how these antenna parameters are characterized and applied in EMC applications. The impact on measurement uncertainty when using antennas to validate the performance of RF/EMC Chambers will be reviewed. Definitions of antenna factors are provided, and some practical measurement examples are introduced.

In the NIM presentation, the speaker notes that market competition tends to favor the usage of “good enough” absorbers for EMC anechoic chambers. At the same time, antennas are more precisely calibrated than ever before. Because the uncertainty estimations in both CISPR and ANSI C63 standards have not been updated in more than 10 years, it could impose a risk to both the validation labs and the anechoic chamber users. The NIM presentation provides a review of their research for the past 10 years, as well as the research project in CISPR / A WG1 started in 2014. Both the uncertainty sources, as well the uncertainty value will be updated for the reference site method and for the NSA method. The systematic errors in NSA method will also be addressed.

## **TALKS:**

### **Evolution of Test Site Validation Measurement Methods for Above 1 GHz Applications**

*Zhong Chen, ETS-Lindgren, Cedar Park, Texas, US*

### **Measurement Uncertainty Evaluation for Validating RF/EMC Chambers in the Frequency Range from 30 MHz to 1000 MHz**

*Donglin Meng, National Institute of Metrology, China*

### **Precision Dipole Antenna Measurement and Site Evaluation**

*Takehiro Morioka, National Institute of Advanced Industrial Science and Technology (AIST), Japan*

**BIOS OF ORGANIZERS & SPEAKERS**

**Zhong Chen** is the Director of RF Engineering at ETS-Lindgren, located in Cedar Park, Texas. He has over 25 years of experience in RF testing, anechoic chamber design, as well as EMC antenna and field probe design and measurements. He is an active member of the ANSC C63® committee and Chairman of Subcommittee 1 which is responsible for the antenna calibration (ANSI C63.5) and chamber/test site validation standards (ANSI C63.4 and the ANSI C63.25 series). Mr. Chen is chairman of the IEEE Standard 1309 committee responsible for developing calibration standards for field probes, and IEEE Standard 1128 for absorber evaluation. Currently he is a member of the Antenna Measurement Techniques Association (AMTA) Board of Directors. His research interests include measurement uncertainty, time domain measurements for site validation and antenna calibration, and development of novel RF absorber materials. Zhong Chen received his M.S.E.E. degree in Electromagnetics from the Ohio State University at Columbus. He may be reached at [zhong.chen@ets-lindgren.com](mailto:zhong.chen@ets-lindgren.com).



**Janet O'Neil** is a customer relations specialist with ETS-Lindgren. She has over 30 years of experience in the RF and Electromagnetic Compatibility (EMC) industries. She is a member of the Board of Directors of the IEEE EMC Society and a past member of the Antenna Measurement Techniques Association (AMTA) Board of Directors. Janet is a member of Subcommittee 1 (Techniques and Development) of ANSC C63®, and is chair of the 2022 IEEE International Symposium on EMC in Spokane, WA; was vice-chair of the 2011, 2018, and 2019 IEEE International Symposia on EMC; and a member of the organizing committee for the IEEE International Microwave Symposium (IMS) 2013 in Seattle, Washington - where she organized a Wireless Industry Day special session - as well as a member of the IMS 2020, 2022, and 2023 organizing committees. She contributed to the IEEE IMS 5G Summit in 2018/2019. Janet created the regional "tabletop show" for the IEEE EMC Society in 1990 and for the AMTA in 2005 to bring engineering education to the local community and link industry, academia, and government sectors. Janet is the EiC of the IEEE Electromagnetic Compatibility Magazine. Her education includes BA degrees in English and in Business Economics from the University of California, Santa Barbara.



**Donglin Meng**, Associate Professor, is with the National Institute of Metrology, China. Dr. Meng graduated from Beijing Jiaotong University in 2008. He has been with the National Institute of Metrology since then. He was a visiting scholar to NPL from December 2009 to June 2010. Currently, he is a registered expert of CISPR /A WG1 and WG2. He has focused his research interests on EMC antenna calibrations and EMC chamber validations for more than 10 years. He is currently responsible for the technology and calibration service from 30 MHz to 1000 MHz at NIM. He was also responsible for developing a spherical near field scanning system from 400 MHz to 110 GHz in 2016. He has authored and co-authored 40 papers.



**Takehiro Morioka** received a Ph.D. degree from the University of Tsukuba and has been working at the National Institute of Advanced Industrial Science and Technology (AIST) since 1998. His research areas at AIST includes antennas, EMC, and precision electromagnetic field measurements. He designed the open-area test site (OATS) of AIST for antenna calibration in 1999 and investigated the calibration methodology of the dipole antenna. The calibration capability of antennas was confirmed by the intercomparisons (CCEM.RF-21.F and CCEM.RF-S21.F) among the national metrology institutes in 2003. In 2006, he researched at the National Institute of Standards and Technology (NIST), Boulder CO, US as a guest researcher. The research topic at NIST was the field uniformity measurement of a TEM cell by using a passive scatterer. He participated in the intercomparison (CCEM.RF-K24.F) of the E-field strength in 2011, and the report of the comparison shows the excellent calibration capability developed by him. Dr. Morioka was appointed a group leader of Electromagnetic Fields Standard Group in April 2020. He is also a Senior Member of the Institute of Electrical and Electronics Engineers (IEEE) and a member of the Institute of Electronics, Information, and Communication Engineers (IEICE) of Japan.