

AMTA/IEEE Workshop
Innovative Solutions to Real-World Measurement Challenges

Wednesday, April 12, 2023
8:00 am – 1:00 pm (includes continental breakfast and lunch)

The workshop will begin with an update provided on industry standards, including:

- IEEE 149 - Recommended Practice for Antenna Measurements
 - Reverb antenna efficiency
 - Chamber evaluation methods
- ANSC C63® - American National Standard Committee Validation Methods For Radiated Emission Test Sites, 1 GHz To 18 GHz (C63.25.1), 30 MHz to 1 GHz (C63.25.2), and (C63.25.3) 18 GHz to 40 GHz
 - Modal filtering techniques
 - Time domain measurement techniques
- IEEE 1309 - IEEE Standard for Calibration of Electromagnetic Field Sensors and Probes (Excluding Antennas) from 9 kHz to 40 GHz
 - Addition of reverb test method to next revision

An overview/comparison of test environments will be provided, including:

- Free space
- Reverberation chambers

Novel techniques to optimize data processing will be reviewed:

- With today's dramatically increased computational software and hardware capabilities, collecting measurement data has never been faster or easier. Thousands of data sets can be collected, but how does one manage this data realistically and evaluate it effectively? This has opened the door for new and novel techniques to evaluate the performance of the test environment as well as improve data post processing.

In this hands-on, interactive workshop, attendees will learn:

- Complex cavity evaluations (aircraft, rockets, satellites)
- Methods for evaluating paddles in chambers (with rigid and flexible walls), with a discussion on the challenges and solutions
- Standards update, including soon to be published/recently published standards
- Test environment evaluation/considerations
- Novel data post-processing techniques
- Uncertainty considerations to ensure accurate measurements

Live demonstrations following the workshop provide an opportunity for hands-on learning using test instrumentation and a novel test environment set up in the meeting room.

Workshop speakers include industry experts Zhong Chen of ETS-Lindgren, Dennis Lewis of Boeing, and John Ladbury of the National Institute of Standards and Technology (NIST). Together they have nearly 100 years of experience in EMC as well as antenna measurements and have published dozens of papers available on IEEE Xplore.

LIVE DEMONSTRATIONS

Title: Test Site Measurements using Orthogonal Time and Mode Domain Transformation

Abstract: Antenna or site validation measurements are conducted in frequency and spatial domains. Data post processing in their orthogonal domain often provides a great deal of insights. Two particular transformations and post processing prove to be especially useful – time domain and mode domain transform. Time domain transform and gating is an effective technique to isolate reflections in antenna measurements. This function is included in commercial vector network analyzers. Although its applications seem straightforward, the implementations and limitations can feel like a “black-box”. This demonstration provides an in-depth understanding of the method through the application of measuring the Voltage Standing Wave Ratio (VSWR) of a test site. Mode domain transform is to decompose the spatial response at a particular frequency to its mode coefficients representations. Here, we place an antenna at the edge of a turntable, and performing a single cut vector pattern measurement. The vector S_{21} is then transformed to the spectrum or cylindrical mode domain, where a filter can be applied to isolate the chamber effects. The VSWR is derived by comparing the original pattern in the chamber to the “clean” filtered pattern. The demonstrations aim to illustrate the post processing techniques using orthogonal transformations. Both time and spectrum domain processing offer unique insights, and produce highly correlated results to the traditional Site VSWR method. The techniques have been adopted or are under consideration for the ANSI C63.25 standards by the ANSC C63[®] committee for EMC test sites validations.

Presenter: Zhong Chen, ETS-Lindgren

Title: Reverberation Chamber Stirring Techniques and Antenna Effects

Abstract: Reverberation chambers have been used for many years in the Electromagnetic Compatibility Community (EMC) and more recently in the wireless industry. The statistical methods used to evaluate the fields inside these chamber require the collection of statistically independent samples. These samples can be generated by employing different stirring techniques such as mechanical mode stirring/tuning, spatial and frequency stirring. With the development of conductive fabric chambers and tents, another method of mechanical stirring is possible by movement of the fabric walls and is referred to in literature as a Vibrating Intrinsic Reverberation Chamber (VIRC). This demonstration will highlight the strengths and weaknesses of each of these techniques. Careful consideration must be given to the antenna placement inside the chamber. We will demonstrate the effects of direct and indirect antenna coupling as well as antenna gain on reverberation chamber measurements.

Presenters: Dennis Lewis, Boeing, and John Ladbury, NIST

NOTE: Immediately following this workshop, a Working Group meeting of the IEEE 1309 Probe Calibration Standard will be held at the Hyatt Regency Lake Washington. The revision to this standard is due to be completed this year. Workshop leaders will attend and invite anyone interested in this standard to attend as well. For more information, contact the Working Group Chair Zhong Chen at zhong.chen@ets-lindgren.com.