

ROOM 17A

MO-AM-1 (T) Basic EMC Measurements (TC2)

Chair: Don Heirman, Don HEIRMAN Consultants, New Jersey, U.S.A.

This tutorial will be an introduction to basic EMC measurements with a primary focus on emission testing. While intended for those new to these disciplines, the latest activity in national and international standards related to EMC measurements and standards will be presented. A special focus will be on measurements and associated issues above 1 GHz as well as measurement uncertainty. An open discussion will follow the presentations.

8:30 AM - 8:50 AM

Emissions Measurements for Tabletop Equipment

S. Koster, Washington Laboratories, Gaithersburg, Maryland, U.S.A.

8:50 AM - 9:10 AM

Basic Emission Measurements for Floor-Standing Equipment

H. R. Hofmann, Hofmann EMC Engineering, Naperville, Illinois, U.S.A.

9:10 AM - 9:30 AM

IEC Transient-Immunity Testing Overview

T. E. Braxton, Shure Incorporated, Niles, Illinois, U.S.A.

9:30 AM - 9:50 AM

Test Methods for Immunity to RF Electromagnetic Fields

J. S. Maas, IBM Corporation, Rochester, New York, U.S.A.

BREAK (10:00 AM - 10:30 AM)

10:30 AM - 11:00 AM

Basic Measurement Sites, Methods, and Associated Errors

D. N. Heirman, Don HEIRMAN Consultants, Lincroft, New Jersey, U.S.A.

11:00 AM - 11:30 AM

Selecting a Quality EMC Lab

D. D. Hoolihan, Hoolihan EMC Consulting, Lindstrom, Minnesota, U.S.A.

11:30 AM - 12:00 AM

Uncertainty Considerations in Stating Pass/Fail

D. N. Heirman, Don HEIRMAN Consultants, Lincroft, New Jersey, U.S.A.

ROOM 17B

MO-AM-2 (T) Introduction to EMI Modeling Techniques (TC9)

Chair: Chuck Bunting, Oklahoma State University, Oklahoma, U.S.A.

This tutorial will provide an introduction to all of the commonly used numerical EMC modeling techniques. It is intended to provide EMC engineers who are interested in learning the basics of these modeling techniques a fundamental understanding of all the different techniques, without the need for detailed math. Practicing modelers will also benefit from learning the fundamentals of modeling techniques they are currently not using. Each technique will be presented along with their strengths and weakness, so engineers can decide which techniques are appropriate for their types of problems.

8:30 AM - 9:00 AM

Overview of Electromagnetic Modeling Software

T. H. Hubing, Clemson University, Clemson, South Carolina, U.S.A.

9:00 AM - 9:30 AM

The Transmission Line Matrix Method (TLM)

D. P. Johns, CST of America, Framingham, Massachusetts, U.S.A.

9:30 AM - 10:00 AM

Introduction to the Partial Element Equivalent Circuit (PEEC) Technique

G. Antonini; and A. E. Ruehli, — University of L'Aquila, L'Aquila, Italy

BREAK (10:00 AM - 10:30 AM)

10:30 AM - 11:00 AM

Introduction to the Finite-Difference Time-Domain (FDTD) Technique

S. Connor; and B. Archambeault, — IBM Corp., Research Triangle Park, North Carolina, U.S.A.

11:00 AM - 11:30 AM

Introduction to the Finite Element Method

C. Bunting, Oklahoma State University, Stillwater, Oklahoma, U.S.A.

11:30 AM - 12:00 AM

Integral Equation Methods - Method of Moments (MoM) - in Numerical Modeling

J. Chen, University of Houston, Houston, Texas, U.S.A.; and J. Drowniak, Missouri University of Science and Technology, Rolla, Missouri, U.S.A.

ROOM 19A

MO-AM-3 (T) Protection Against Short Pulse, High Power, IEMI Threats (TC5 & TC7)

Chair: Dr. William Radasky, Metatech Corporation, California, U.S.A.

In recent years, growing attention has been paid to the threat posed by high-power electromagnetic (HPEM) environments against the normal operation of important electronic systems of the civil infrastructure. This use of EM weapons against the civil infrastructure has been categorized by the term Intentional EMI (IEMI). The main objective of this tutorial will be to introduce the participants to special aspects of protection against a particular kind of HPEM environment, the short pulse high power electromagnetic fields. Current studies have demonstrated that classical EMC protection is unable to handle these short pulse threats of high power.

8:30 AM - 9:00 AM

Introduction to the Tutorial on Protection Against Short Pulse High Power IEMI Threats

F. Sabath, Bundeswehr Research Institute for Protective Technologies and NBC-Protection, Munster, Germany; and W. A. Radasky, Metatech Corporation, Goleta, California, U.S.A.

9:00 AM - 9:30 AM

Overview of Intentional Electromagnetic Interference (IEMI) Threats

W. A. Radasky, Metatech Corporation, Goleta, California, U.S.A.

9:30 AM - 10:00 AM

Observed Electromagnetic Effects and Classification of Effects

F. Sabath; and S. Potthast, — Bundeswehr Research Institute for Protective Technologies and NBC-Protection, Munster, Germany

BREAK (10:00 AM - 10:30 AM)

10:30 AM - 11:00 AM

Estimation of the Coupling of Short Pulse Fields into Electronic Systems

S. Fisahn; and H. Garbe, Gottfried Wilhelm Leibniz Universität Hannover, Hannover, Germany

11:00 AM - 11:30 AM

Protection Against Short Pulse High Power IEMI Threats; Protection Challenges, Possible Concepts, and Measurements

F. Brauer; and J. L. ter Haseborg, — Hamburg University of Technology, Hamburg, Germany

ROOM 19B
MO-AM-4 (T) MIL-STD-464
Updates

Chair: Kurt Sebacher, Naval Air Systems Command, Patuxent River, Maryland, U.S.A.

MIL-STD-464B Department of Defense (DoD) Interface Standard Electromagnetic Environmental Effects Requirements will be released in 2009. This standard is in use by all US DoD Agencies. The main objective of this tutorial will be to introduce the participants to changes in the Standard from previous versions to the proposed Version B, and subsequent impacts to E3 Test Facilities. The tutorial will start with an overview of the history of MIL-STD-464, followed by an overview of the proposed changes to MIL-STD-464B. Specific lectures will focus on updates to Electromagnetic Environments, an introduction of Directed Energy/High Powered Microwave test levels, new Aircraft EMP MIL-STD, and other changes to test levels and test techniques. This will be followed by a detailed discussion of this new version's impact to E3 Test Facilities. A brief discussion of future changes to MIL-STD-464 will conclude this tutorial.

8:30 AM - 9:00 AM
Historical Perspective on MIL-STD-464 and Updates to 464B
M. J. Rodriguez, Air Force Materiel Command, Wright-Patterson AFB, Ohio, U.S.A.

9:00 AM - 9:30 AM
Update to the Navy Shipboard Electromagnetic Environments
R. B. Bozarth, EG&G Technical Services, Dahlgren, Virginia, U.S.A.

9:30 AM - 10:00 AM
Directed Energy and High Power Microwave Test Requirements
K. K. Sebacher, Navair, Patuxent River, Maryland, U.S.A.

BREAK (10:00 AM - 10:30 AM)

10:30 AM - 11:00 AM
MIL-STD-464 Updates 5.2 Intra System EMC and 5.14 Unintentional Emission Part of MIL-STD-464 Updates
J. D. Craven, U.S. Army, Redstone Arsenal, Alabama, U.S.A.; and J. E. Douglas, U.S. Army, Ft. Huachuca, Arizona, U.S.A.

ROOM 18C
MO-AM-5 (T) Practical Radiated Measurements using Antennas and Field Probes; the Fundamentals
Chair: Zhong Chen, ETS-Lindgren, Texas U.S.A.

This tutorial is designed to be a full-day tutorial with the morning session covering the basic theory and applications of EMC radiated measurements using antennas and field probes, and the afternoon session covering more advanced topics. It will be helpful, but not necessary, to attend both sessions. Attendees should select one or both sessions depending upon their level of expertise.

This morning session will introduce the basic theory and terminologies. Applications according to U.S. and international standards will also be covered.

8:30 AM - 9:00 AM
Half Power Beamwidth and High Power Measurements: The Dangers of Using Far Field Approximations in the Near Field
V. Rodriguez, ETS-Lindgren, Cedar Park, Texas, U.S.A.

9:00 AM - 9:30 AM
Antennas and Field Probes
Z. Chen, ETS-Lindgren, Cedar Park, Texas, U.S.A.

9:30 AM - 10:00 AM
Test Equipment Fundamentals
W. J. Schaefer, Cisco Systems, San Jose, California, U.S.A.

BREAK (10:00 AM - 10:30 AM)

10:30 AM - 11:00 AM
Anisotropy, Linearity, Multi-frequency Response, and Pulsed Field Response of Field Sensors
T. Kleine-Ostmann; T. Kotschy-Scholz; R. Pape; and T. Schrader, — Physikalisch-Technische Bundesanstalt, Braunschweig, Germany

11:00 AM - 11:30 AM
Basic Time-Domain Analysis of Antennas used for EMC
D. G. Camell, National Institute of Standards and Technology, Boulder, Colorado, U.S.A.

11:30 AM - 12:00 AM
Update on Antenna/Probe Standards and Applications
M. J. Windler, Underwriters Laboratories, Northbrook, Illinois, U.S.A.

ROOM 18B
MO-AM-6 (T) Fundamentals of EMC

Chair: Daryl Beetner, Missouri University of Science and Technology, Missouri, U.S.A.

Organized by the EMC Society Education and Student Activities Committee, this tutorial is designed to present the basics of EMC to those who are new to the field of EMC, those who are seeking information on an aspect of EMC that they have not previously encountered, or those who desire a refresher on the proposed EMC topics.

8:30 AM - 10:00 AM
Basic Electromagnetics
A. Marvin, University of York, York, United Kingdom

BREAK (10:00 AM - 10:30 AM)

10:30 AM - 12:00 AM
Transmission Line Fundamentals
E. Wheeler, Rose-Hulman Institute of Technology, Terre Haute, Indiana, U.S.A.

ROOM 17B
MO-PM-1 (W) How to Simplify Complex Systems into Realistic, Solvable, Accurate Models (TC9)
Chair: Bruce Archambeault, IBM Corporation, North Carolina, U.S.A.
Co-Chair: David Johns, CST, Massachusetts, U.S.A.

This workshop will introduce the audience to the techniques used to simplify real world complex systems into models for full wave simulation that are able to be solved with today's software tools, while maintaining the required accuracy to solve the problem of interest. Validation of these simplified models will also be discussed.

1:30 PM - 2:00 PM
Importance and Process of Validation for All Levels of Modeling Problems

B. Archambeault, IBM Corporation, Research Triangle Park, North Carolina, U.S.A.

2:00 PM - 2:30 PM
Model Partitioning for Solving Complex EMC Problems

C. E. Brench, Southwest Research Institute, San Antonio, Texas, U.S.A.

2:30 PM - 3:00 PM
Full-wave EM-modeling and Test Verification in Aerospace Applications

C. G. Baldwin, Lockheed Martin Missiles and Fire Control, Dallas, Texas, U.S.A.

BREAK (3:00 PM - 3:30 PM)

3:30 PM - 4:00 PM
Automotive Applications: Selection of Techniques for Modeling "Real World" Challenges

M. A. Steffka, University of Michigan-Dearborn, Dearborn, Michigan, U.S.A.

4:00 PM - 4:30 PM
Combining PCB, Enclosure, and Cable Modeling for EMC Assessment of an Automotive Module

D. P. Johns; and, S. W. Mee, — CST, Framingham, Massachusetts, U.S.A.

ROOM 19B
MO-PM-2 (T) MIL-STD-461 Updates

Chair: Kurt Sebacher, Naval Air Systems Command Patuxent River, Maryland, U.S.A.

MIL-STD-461F Department of Defense (DoD) Interface Standard Requirement for the control of Electromagnetic Interference Characteristics of Subsystems and Equipment was released on 10 December 2007. This standard is in use by all US Department of Defense Agencies. The main objective of this tutorial will be to introduce the participants to changes in the standard from Version E to Version F. The main focus will be on discussing changes to the standard and subsequent impacts to EMI Labs. The tutorial will start with an overview of the history of MIL-STD-461F. Specific lectures will focus on changes to specification limits, test set-ups, and the resurrection of past test requirements.

1:30 PM - 2:00 PM
History of MIL-STD-461

M. J. Rodriguez, Air Force Materiel Command, Wright-Patterson AFB, Ohio, U.S.A.

2:00 PM - 2:20 PM
An Insiders View of MIL STD 461F

F. M. O'Connor, Alion Science and Technology, W. Conshohocken, Pennsylvania, U.S.A.

2:20 PM - 2:50 PM
MIL-STD-461F Changes and Associated Impacts to Labs

D. R. Kempf; and K. A. Brezinski, — Naval Air Warfare Center, Patuxent River, Maryland, U.S.A.

BREAK (3:00 PM - 3:30 PM)

3:30 PM - 4:00 PM
Future EMI Concepts

K. B. Brezinski; and D. R. Kempf, — Naval Air Warfare Center, Patuxent River, Maryland, U.S.A.

4:00 PM - 4:30 PM
Potential Changes to MIL STD 461F

F. M. O'Connor, Alion Science and Technology, W. Conshohocken, Pennsylvania, U.S.A.

ROOM 18C
MO-PM-3 (T) Practical Radiated Measurements using Antennas and Field Probes; Advanced Topics

Chair: Zhong Chen, ETS-Lindgren, Texas U.S.A.

This tutorial is Part II of a full-day tutorial and will cover more advanced topics on the theory and applications of EMC radiated measurements using antennas and field probes. In particular, this afternoon session will cover applications of antennas and field probes beyond those specified in typical manufacturer's data sheets. The discussions will concentrate on some specific aspects of antennas and probes in calibration and testing to EMC industry standards, such as background information and rationales for recent changes in the standards, and impact of these changes on daily EMC measurements.

1:30 PM - 2:00 PM
Advanced Topics on Field Probes

Z. Chen, ETS-Lindgren, Cedar Park, Texas, U.S.A.

2:00 PM - 2:30 PM
Implementation of Traceable Antenna Calibration

T. Schrader; and T. Kleine-Ostmann, — Physikalisch-Technische Bundesanstalt, Braunschweig, Germany

2:30 PM - 3:00 PM
Test Equipment Specifics

W. J. Schaefer, Cisco Systems, San Jose, California, U.S.A.

BREAK (3:00 PM - 3:30 PM)

3:30 PM - 4:00 PM
Time-Domain Analysis and Usage of Antennas for EMC

D. G. Camell, National Institute of Standards and Technology, Boulder, Colorado, U.S.A.

4:00 PM - 5:30 PM
Background on ANSI C63.5 Biconical Dipole Correction Factors

M. J. Windler, Underwriters Laboratories, Northbrook, Illinois, U.S.A.

ROOM 19A
**MO-PM-4 (W) Developing
EMC Standards**

*Chair: Qiubo Ye, Communications
Research Centre Canada, Canada*
*Co-Chair: Johan Catrysse, KHBO -
FMEC Laboratory for Global
Reliability, Belgium*

The purpose of this workshop is to acquaint the international EMC community with selected EMC standards and standards-related issues applicable to the design, test, and production of electrical and electronic equipment for the worldwide market. With speakers from the U.S.A. and Europe, this workshop will include an introduction and description of the activity of worldwide accepted EMC standards developers, shielding effectiveness measurements of "small" enclosures, a discussion on getting involved with standard working groups, state of the art in characterizing conductive gaskets, the development of high power electromagnetics standards in IEC, the loading effect to the shielding effectiveness of small boxes due to PCB boards, and a brief on the Standard for replaceable electronic module electromagnetic interference (EMI) testing.

1:30 PM - 2:00 PM
**Introduction and Activity of Major
EMC Standards Committees**
*D. N. Heirman, Don HEIRMAN
Consultants, Lincroft, New Jersey,
U.S.A.*

2:00 PM - 2:30 PM
**Getting Involved with Standards
Working Groups**
*K. O. Phipps, Electric Power Research
Institute, Knoxville, Tennessee, U.S.A.*

2:30 PM - 3:00 PM
**IEEE Std 1302: A Guidance
Document for the Characterization of
Shielding Gaskets**
J. Catrysse, KHBO, Oostende, Belgium

BREAK (3:00 PM - 3:30 PM)

3:30 PM - 4:00 PM
**Status of the Development of High
Power EM (HPEM) Standards**
*W. A. Radasky, Metatech Corporation,
Goleta, California, U.S.A.*

4:00 PM - 4:30 PM
**The Effects on the Shielding
Effectiveness of Small Enclosures
due to Dissipative Contents such as
PCBs - Implications for the
Measurement of SE**
*A. Marvin, University of York, York,
United Kingdom*

ROOM 18B
**MO-PM-5 (T) Fundamentals of
EMC**

*Chair: Daryl Beetner, Missouri
University of Science and Technology,
Missouri, U.S.A.*

Organized by the EMC Society Education and Student Activities Committee, this tutorial is designed to present the basics of EMC to those who are new to the field of EMC, those who are seeking information on an aspect of EMC that they have not previously encountered, or those who desire a refresher on the proposed EMC topics.

1:30 PM - 2:15 PM
**EMI-EMC Right the First Time:
Planning, Modeling, and Measurement
in Design and Development**
*R. G. Leventhal, Leventhal Design &
Communications, Arlington Heights,
Illinois, U.S.A.*

2:15 PM - 3:00 PM
The Current Return Path
*D. G. Beetner, Missouri University of
Science and Technology, Rolla, Missouri,
U.S.A.*

BREAK (3:00 PM - 3:30 PM)

3:30 PM - 4:15 PM
**Introduction to Numerical Methods in
Electromagnetics**
Q. Ye, CRC Canada, Ottawa, Canada

ROOM 17A
**MO-PM-6 (T) EMC and Medical
Devices**

*Chair: Dan Hoolihan,
Hoolihan EMC Consulting,
Minnesota, U.S.A.*

This tutorial will provide important information on the interaction of the EMC world with electronic medical devices. It will address the immunity of both implantable medical devices and medical devices external to the human body. The electromagnetic emission characteristics of non-implanted medical devices will be addressed through a discussion of IEC 60601-1-2 standard on EMC of Medical Devices. It will also look at the harsh EMC environment generated by a Magnetic Resonance Imaging (MRI) scanner and preview the activities taking place on the development of an International Technical Specification relative to Active Implantable Medical Devices and MRI.

1:30 PM - 2:15 PM
**ISO 14708-3:2008, Implantable
Neurostimulators**
*C. L. Sponberg, Medtronic, Inc., Minneapolis,
Minnesota, U.S.A.*

2:15 PM - 3:00 PM
**International EMC Standard for Electrical
Medical Devices**
*D. D. Hoolihan, Hoolihan EMC Consulting,
Lindstrom, Minnesota, U.S.A.*

BREAK (3:00 PM - 3:30 PM)

3:30 PM - 4:15 PM
**Active Implantable Medical Device
Interactions due to Magnetic Resonance
Imaging**
*J. Peltier, Medtronic Incorporated, Mounds
View, Minnesota, U.S.A.*

ROOM 17A

FR-AM-1 (T) EMC Leadership (TC1)

Chair: Kimball Williams, Past President IEEE EMC Society, Denso International America Inc., Michigan, U.S.A.

Sufficient training in the 'soft skills' is often lacking in the curricula of engineers. The industry approach of 'sink or swim' can be harsh. This session will provide opportunities to learn or brush up on critical communications and business skills necessary for career success as an engineer in today's market.

8:30 AM - 9:00 AM

Introduction to Leadership

E. B. Joffe, KTM Project Engineering, Hod Hasharon, Israel

9:00 AM - 9:30 AM

How to Give Effective Presentations

B. Archambeault, IBM, Research Triangle Park, North Carolina, U.S.A.

9:30 AM - 10:00 AM

IEEE Code of Ethics - Ethical Challenges in the Engineering Professions

E. B. Joffe, KTM Project Engineering, Hod Hasharon, Israel

BREAK (10:00 AM - 10:30 AM)

10:30 AM - 11:00 AM

EMC Leadership Tutorial "Effective Meetings"

K. M. Soohoo, IBM Corp., Poughkeepsie, New York, U.S.A.

11:00 AM - 11:30 AM

Effective Memos and Reports

R. Scully, NASA, Houston, Texas, U.S.A.

ROOM 17B

FR-AM-2 (W) EMC and Wireless Devices

Chair: Dan Hoolihan, Hoolihan EMC Consulting, Minnesota, U.S.A.

The overall workshop will provide key information on EMC concerns as they pertain to present and future wireless/cellular phone technologies and associated packaging issues. More specifically, this workshop will address the electromagnetic interference (EMI) aspects of the proliferation of modern wireless devices such as current radio and cell phone technologies. It will address both EMI from product to product such as cellular phones and lap-top computers, as well as intra-product interference issues.

8:30 AM - 9:15 AM

EMC and Wireless Devices, The Impact of Performance Trends

J. Raab, OakTree Wireless Consulting, Austin, Texas, U.S.A.

9:15 AM - 10:00 AM

Wireless and EMC Workshop - RF Interference: Problem and Scope

H. G. Skinner; and K. P. Slattery, — Intel Corporation, Hillsboro, Oregon, U.S.A.

BREAK (10:00 AM - 10:30 AM)

10:30 AM - 11:15 AM

Wireless and EMC Workshop: Analysis of Digital Display Frame Signals

K. P. Slattery; and H. G. Skinner, — Intel Corporation, Hillsboro, Oregon, U.S.A.

ROOM 18B

FR-AM-3 (T) Preparation for Above 1 GHz

Chair: Akihisa Sakurai, IBM Japan, Ltd./VCCI, Japan
Co-Chair: Hiroshi Yamane, NTT/VCCI, Japan

Radiated emission measurements above 1 GHz specified by CISPR 22 Ed.5.2 and Methods of radiated disturbance measurements specified by CISPR 16-2-3 Ed.2 have been published. Every country will need to prepare to include these new requirements within their own regulatory agencies. The VCCI Council in Japan has evaluated the radiated emission measurements and site validation by measurements of the site voltage standing-wave ratio above 1 GHz.

This tutorial will discuss various problems associated with EMI measurements and site VSWR evaluation methods above 1GHz that will be a new requirement to comply in Japan, Taiwan, and others in 2010, and also discuss the antennas EMI testing from 1 GHz to 6 GHz.

8:30 AM - 9:00 AM

Overview of International Standardization on EMI measurements above 1 GHz

D. N. Heirman, Don HEIRMAN Consultants, Lincroft, New Jersey, U.S.A.

9:00 AM - 9:30 AM

EMI Requirements above 1 GHz in BSMI, Taiwan

Y. Tang; C. Chen; J. Dong; J. Tsai; and H. Lai, — BSMI, Taipei, Taiwan

9:30 AM - 10:00 AM

Evaluation of Site Validation by the Site Voltage Standing-Wave Ratio above 1 GHz

H. Yamane, NTT/ VCCI Council, Musashino-Shi, Japan; C. Miyazaki, Mitsubishi Electric Corp./ VCCI Council, Kamakura-Shi, Japan; J. Kawano, VCCI Council, Minato-ku, Japan; and A. Sakurai, IBM Japan, Ltd. / VCCI Council, Yamato, Japan

BREAK (10:00 AM - 10:30 AM)

10:30 AM - 11:00 AM

Issues and Solutions on EMI Testing above 1GHz with Practical Experience

C. Miyazaki, Mitsubishi Electric Corporation, Kamakura, Japan; H. Yamane, NTT, Musashino, Japan; J. Kawano, VCCI Council, Minato, Japan; and A. Sakurai, IBM Japan, Ltd., Yamato, Japan

11:00 AM - 11:30 AM

Antenna Developed for Site Validation of EMI Measurements in the GHz Band

A. Maeda; and J. Kawano, — VCCI Council, Tokyo, Japan; C. Miyazaki, Mitsubishi Electric Corporation, Kamakura, Kanagawa-pref, Japan; S. Kobayashi; and K. Tanakajima, — Intertek Japan, Kamisu-shi, Japan

ROOM 18C

FR-AM-4 (T) EMC Issues in Hybrid and Electric-Propulsion Vehicles

Chair: Mark Steffka, General Motors and University of Michigan, Michigan, U.S.A.

Co-Chair: James Muccioli, Jastech EMC Consulting, LLC, Michigan, U.S.A.

The global shift towards the engineering of efficient and manufacturable electric drive vehicle propulsion systems will result in new challenges in meeting vehicle EMC requirements in order to assure customer satisfaction, meet legal requirements, or support mission performance goals. Much of the existing methods to address EMC of motor drives (primarily conducted and radiated emissions) are based upon "legacy" low voltage components and systems. The high voltage (typically 300 to 600 volts) and high current (hundreds of amps peak demand) in vehicle propulsion systems will require new analysis approaches, test methods, and effective use of simulation/modeling. This tutorial will discuss the development of electric motors from "small scale" to large drive motors, the mechanical constraints of motor EMC compliance, systems integration methods of today, and possible solutions for the future.

8:30 AM - 9:15 AM

Modeling and Simulation of Powertrains for Electric and Hybrid Vehicles

M. P. Klingler, Peugeot Citroen Automobiles, Velizy-Villacoublay, France

9:15 AM - 10:00 AM

EMC System Engineering of the Hybrid Vehicle Electric Motor and Battery Pack

J. Muccioli; and D. Sanders, — Jastech EMC Consulting LLC, Farmington Hills, Michigan, U.S.A.

BREAK (10:00 AM - 10:30 AM)

10:30 AM - 11:15 AM

Evaluating Multi-Line EMI Filters for Common Mode & Differential Mode
D. Sanders; and J. Muccioli, — Jastech EMC Consulting LLC, Farmington Hills, Michigan, U.S.A.

11:15 AM - 12:00 AM

Design, Engineering, and Manufacturing of Motors for Electric Vehicle Applications
M. A. Steffka, University of Michigan-Dearborn, Dearborn, Michigan, U.S.A.

ROOM 17A

FR-PM-1 (T) Application of Reverberation Chambers

Chair: Chuck Bunting, Oklahoma State University, Oklahoma, U.S.A.

This half-day tutorial will provide an introduction to recent applications of reverberation chambers. It is intended to provide EMC engineers who are interested in applying reverberation chambers to various measurement issues and the extension of reverberation chambers to solve a variety of EMC problems. The tutorial will also provide a brief overview of RC theory, followed by recent applications of RC's. The format will be a conference presentation style (lecture) followed by questions moderated by the chairman.

1:30 PM - 2:00 PM

Introduction - Rationale for RC Testing

V. Rajamani, Oklahoma State University, Stillwater, OK, U.S.A.; G. J. Freyer, Consultant, Monument, CO, U.S.A.; and C. F. Bunting, Oklahoma State University, Stillwater, OK, U.S.A.

2:00 PM - 2:30 PM

EM Characterization of Environments - Using RC Techniques

V. Rajamani; and C. F. Bunting, — Oklahoma State University, Stillwater, OK, U.S.A.; and G. J. Freyer, Consultant, Monument, CO, U.S.A.

2:30 PM - 3:00 PM

Overview of Reverberation Chamber Theory

C. Bunting, Oklahoma State University, Stillwater, OK, U.S.A.; G. Freyer, Consultant, Monument, CO, U.S.A.; and V. Rajamani, Oklahoma State University, Stillwater, OK, U.S.A.

BREAK (3:00 PM - 3:30 PM)

3:30 PM - 4:00 PM

Wireless Channel Modeling and Simulation in a Reverberation Chamber

J. M. Ladbury; G. H. Koepke; C. L. Holloway; and K. Remley, — National Institute of Standards and Technology, Boulder, Colorado, U.S.A.

4:00 PM - 4:30 PM

Probe Calibration and Antenna Evaluation in a Reverberation Chamber

J. M. Ladbury; G. H. Koepke; and C. L. Holloway, — National Institute of Standards and Technology, Boulder, Colorado, U.S.A.

ROOM 17B

FR-PM-2 (T) Commercial Off-the-Shelf (COTS) E3 Risk Assessment Process

Chair: Mark Johnson, Naval Sea Systems Command, Washington DC, U.S.A.

This DoD COTS E3 Risk Assessment tutorial will describe the process that the DoD uses to develop an assessment of the EMC risk associated with using commercial items in military applications. The goal of this tutorial will be to establish a dialogue with the commercial technical EMC community on the validity, pros, cons, and pitfalls of such a risk assessment process. The session may be of particular interest to symposium attendees that develop and integrate large communications electronics (CE) equipment for the U.S. DoD.

The current DoD acquisition trend toward capabilities based solutions (vice use of MIL SPECS or specific performance) and ongoing budget and schedule pressures have led to an increased use of commercial equipment and systems that create some of today's operational problems in the DoD Electromagnetic Environmental Effects (E3) and Spectrum Management communities.

1:30 PM - 2:00 PM

COTS and the DoD Acquisition Process

M. Z. Grenis, DISA, Annapolis, Maryland, U.S.A.

2:00 PM - 2:30 PM

DoD Commercial off-the-Shelf (COTS) Equipment E3 Risk Assessment Process

B. Farmer; and P. Marti, — EMC Management Concepts, Sterling, Virginia, U.S.A.

2:30 PM - 3:00 PM

A Comparison of Commercial Standards to MIL-STD-461

P. Marti, EMC Management Concepts, Sterling, Virginia, U.S.A.

BREAK (3:00 PM - 3:30 PM)

3:30 PM - 4:00 PM

Wireless Electromagnetic Environmental Effects/Spectrum Challenges

D. M. Johnson, Naval Sea Systems Command, Washington Navy Yard, D.C., U.S.A.

4:00 PM - 4:30 PM

Shipboard Wireless Installation Issues/Test Results

D. R. Hilton; D. Southworth; and C. Dilay, — SSC Pacific, San Diego, California, U.S.A.

ROOM 18B

FR-PM-3 (T) Fundamentals of Signal Integrity

Chair: Prof. Tzong-Lin Wu, National Taiwan University, Taiwan

Co-Chair: Prof. James Drewniak, Missouri University of Science and Technology, Missouri, U.S.A.

The focus of this tutorial will be on the fundamental modeling and design concepts of signal and power integrity (SI and PI) for high-speed circuit systems. Several important topics will be highlighted, including the models of the active devices for SI and PI simulation, modeling and analysis of the high-speed signal link path in PCB and packages, jitter in high-speed signals, modeling and design for the power distribution network, and the measurement techniques for SI.

1:30 PM - 2:15 PM

High-Speed Signal Link Path and Jitter: Models and Analysis

J. Fan, Missouri University of Science and Technology, Rolla, Missouri, U.S.A.

2:15 PM - 3:00 PM

Measurements for Signal Integrity

V. Ricchiuti, Technolabs, L'Aquila, Italy

BREAK (3:00 PM - 3:30 PM)

3:30 PM - 4:15 PM

Fundamental of Power Distribution Networks and Power Integrity Design

T. Wu, National Taiwan University, Taipei, Taiwan

4:15 PM - 5:00 PM

Block-by-Block Link-Path Analysis and Design with Physics-Based Models

J. Drewniak, Missouri University of Science and Technology, Rolla, Missouri, U.S.A.

ROOM 18C

FR-PM-4 (W) Wireless Propagation Measurements and Analysis of Electrically Very Large Structures

Chair: Perry Wilson, National Institute of Standards and Technology, Colorado, U.S.A.

Co-Chair: Dennis Lewis, The Boeing Company, Washington, U.S.A.

With the proliferation of wireless electronic devices such as RFID, WLAN, In-flight Entertainment (IFE), and Personal Electronic Devices (PED), it is important to understand how they interact with their environment and with other devices and systems. This workshop will address the measurement and evaluation of radio wave propagation inside large structures such as buildings, ships, and aircraft.

1:30 PM - 2:15 PM

Random Walk Technique: Measuring EME in Below-Deck Complex Cavities

G. Tait, and M. Slocum, — Naval Surface Warfare Center, Dahlgren, Virginia, U.S.A.

2:15 PM - 3:00 PM

Measurements of Wireless Propagation in a Large Factory and Implications for Wireless Connectivity in Robots

K. A. Remley, NIST, Boulder, Colorado, U.S.A.

BREAK (3:00 PM - 3:30 PM)

3:30 PM - 4:15 PM

Propagation and Detection of Signals Before, During, and After the Collapse of Large Structures

C. L. Holloway, NIST, Boulder, Colorado, U.S.A.

4:15 PM - 5:00 PM

Advancements in RF Propagation Measurements and Analysis of Large Aircraft

N. T. Horton, The Boeing Company, Seattle, Washington, U.S.A.

ROOM 19A

FR-PM-5 (T) Advances in Site Validation Techniques and Related Measurement Activity above 1 GHz

Chair: Dr. Vince Rodriguez, ETS-Lindgren, Texas, U.S.A.

For some time now, the American National Standards Institute (ANSI) Accredited Subcommittee (ASC) C63@ (EMC) has had a working group tasked with developing new procedures for validating EMC radiated emission test sites above 1 GHz. IEC/CISPR is addressing this topic as well as other associated topics such as measurement methods and test instrumentation in this frequency range. This tutorial is intended to bring a number of contributors together to detail the progress to date and look at options available for such EMC testing at higher frequencies in the future. This tutorial will provide an introduction to the validation techniques that are likely to be required in the near future, a discussion of the difficulties likely to be faced, and will include the status of associated test instrumentation and measurement methods above 1 GHz. It is an ideal opportunity for attendees to obtain valuable information about upcoming requirements in an informal atmosphere.

1:30 PM - 2:00 PM

Absorber Placement to Achieve "Free-Space" Test Conditions

W. J. Schaefer, Cisco Systems, San Jose, California, U.S.A.

2:00 PM - 2:30 PM

Introduction to Antennas above 1 GHz

V. Rodriguez, ETS-Lindgren, Cedar Park, Texas, U.S.A.

2:30 PM - 3:00 PM

High-Resolution Site Attenuation Measurements using Ordinary EMC Antennas

R. T. Johnk; and J. D. Ewan, — Institute for Telecommunication Sciences (NTIA/ITS), Boulder, Colorado, U.S.A.

BREAK (3:00 PM - 3:30 PM)

3:30 PM - 4:00 PM

Twenty First Century EMI Detectors: CISPR-Average and RMS-Average

J. Young, Rohde & Schwarz, Columbia, Maryland, U.S.A.

4:00 PM - 4:30 PM

Comparison of VSWR and TDR Methods for Chamber Validation Above 1 GHz

T. O'Shea, Northwest EMC, Inc., Brooklyn Park, Minnesota, U.S.A.

4:30 PM - 5:00 PM

Site Qualification 1 GHz: A Comparison of Intrinsic Uncertainty of the CISPR Site VSWR and ANSI Time Domain Methods

M. J. Windler, Underwriters Laboratories, Northbrook, Illinois, U.S.A.