



ADVANCE PROGRAM

REGISTRATION FORM

The IEEE EMC Society

in cooperation with the

IEEE Phoenix Electromagnetic Compatibility Society Chapter

Proudly Present

The PHOENIX IEEE EMC Symposium



Wednesday, 26 April 2017

The Embassy Suites Hotel

Tempe, AZ

Program Agenda

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| 8:00 am | REGISTRATION & LIGHT BREAKFAST |
| 8:45 am | IEEE EMC Welcome <i>Glen Gassaway, Southwest EMI Consulting, EMCS Technical Coordinator & Phoenix Chapter Chair</i> <i>Daryl Gerke, Kimmel Gerke and Assoc, EMCS Co-Coordinator and Phoenix Chapter Vice-Chair</i> <i>Brett Gassaway, Compliance Testing, EMCS Co-Coordinator and Phoenix Chapter Vice Chair</i> |
| 9:00 am | EMC Design Review <i>By Daryl Gerke, EMC Consultant, Kimmel Gerke and Assoc</i> |
| 10:00 am | BREAK |
| 10:30 am | Smart Antennas: Technology Integrating Antennas, DSP, Communications and Networks <i>By Dr. Constantine Balanis, Regent's Professor, Department of Electrical Engineering, Arizona State University</i> |
| 11:30 am | LUNCH (Provided) |
| 12:30 am | Wireless Integration Interference Challenges <i>By Harry Skinner, Director and Senior Principal Engineer, Intel Labs</i> |
| 1:15 pm | Understanding Device Performance in a Crowded RF Environment: An Overview of ANSI C63.27 and Coexistence Testing <i>By Dr. William Young, Group Leader, Shared Spectrum Metrology, NIST</i> |
| 2:00 pm | BREAK |
| 2:30 pm | Anechoic Absorber Consideration in the W Band and Absorbers Under High Power Incident Field <i>By Zhong Chen, Director of RF Engineering, ETS-Lindgren</i> |
| 3:15 pm | IoT EMI <i>By Dr. Vignesh Rajamani, Senior Associate Electrical Engineering & Computer Science Practice, Exponent</i> <i>Mark Goldstein, President, International Research Center</i> |
| 4:00 pm | BREAK |
| 4:15 pm | Panel Discussion – EMC Across Industries <i>Directed by Vignesh Rajamani and Glen Gassaway</i> |
| 5:00 pm | CONCLUDING REMARKS <i>Glen Gassaway, Phoenix Chapter Chair</i> |
| 5:05 pm to 6:00 pm | RECEPTION WITH SPEAKERS AND EXHIBITORS Raffle Prize Drawings |

TECHNICAL PROGRAM

Presentation Abstracts

Circuit Board EMC Design Reviews

By Daryl Gerke, PE - EMI consultant at Kimmel Gerke Associates, Ltd.

Abstract: - Like vaccinations for children, an EMC design review can prevent serious problems later, such as a failed EMC test, or worse, a failed product in the field. This talk addresses ten EMC concerns at both the schematic and board construction levels. Daryl shares the methodology he has used for many years in his EMC consulting practice. As Daryl likes to say, "An ounce of prevention can be worth a pound of shielding."

Smart Antennas: Technology Integrating Antennas, DSP, Communications and Networks

By Prof. Constantine A. Balanis, Regents' Professor, Department of Electrical Engineering, Arizona State University

Abstract: As the demand for mobile communications is constantly increasing, the need for improved capacity, greater coverage and higher transmission quality rises. Therefore, a more efficient use of the radio spectrum is required. Smart antenna systems are capable of efficiently utilizing the radio spectrum, and they are a promise for an effective solution to meet the desired performance demands in network and communication systems. Smart antenna technology has been considered for mobile platforms such as automobiles, cellular phones (mobile units), and laptops.

Smart antennas integrate many technologies, including antennas, digital signal processing, communications and networks. The advancement and integration of the characteristics of each of these areas is critical to the efficiency and performance of a communication system channel, as measured by Bit-Error-Rate (BER) and network Throughput. This presentation reviews the basic principles of smart antennas, and it presents and compares the BER and Throughput of different antenna array geometries, such as the uniform rectangular array (URA).

Understanding Device Performance in a Crowded RF Environment: An Overview of ANSI C63.27 and Coexistence Testing

By William F. Young, Group Leader, Shared Spectrum Metrology at NIST

Abstract: With an abundance of wireless devices saturating daily life, the ability of devices to coexist among other devices is of increasing interest. Ideally, a manufacturer would like to understand how their wireless device will perform in a crowded spectrum environment (e.g., the 2.4 GHz ISM band). However, this question is often one that eludes traditional EMC testing which by design excludes the frequency bands where a device intends to communicate. Unlike traditional EMC testing, coexistence testing intentionally focuses on the band(s) in which the device under test uses for wireless communications.

This presentation will examine the fundamental goals of coexistence testing, methods for quantifying coexistence, and the new ANSI C63.27 standard for evaluating wireless coexistence. This standard outlines four coexistence measurement methods and provides some technology specific guidance for common scenarios (e.g., Wi-Fi and Bluetooth). Despite the release of the standard, many challenges related to coexistence metrology remain. These challenges will be discussed along with some of the intricacies of coexistence testing for medical devices.

Wireless Integration Interference Challenges (aka EMC for highly integrated wireless devices)

By Harry G. Skinner, Director and Senior Principal Engineer, Intel Labs

Abstract: Wireless communication on everything is fast becoming the norm. Unfortunately adding wireless functionality to devices has its own challenges. One of those challenges is the close proximity of intentional wireless transceivers with high speed digital circuitry. This talk is intended to introduce broad concepts related to what is widely known as radio frequency interference. Subject matter will include both platform and RF communications based interference sources and victims. It will cover foundational aspects related to differences between unintentional and intentional radiators including coexistence challenges. As well as addressing current challenges and possible solution paths, the talk will also look ahead at potential challenges related to future communications standards and devices.

The Internet of Things - Wireless Technologies & Utilization

By Dr. Vignesh Rajamani, Senior Associate Electrical Engineering & Computer Science Practice, Exponent and Mark Goldstein, President, International Research Center

Abstract: The next Internet wave, the Internet of Things (IoT), will connect tens of billions of new sensors and devices in the coming years driving sustainability while transforming home, business, government, industrial, medical, transportation, and other complex ecosystems. The presentation will examine IoT's evolving wireless protocols, their pro and cons, and deployment trends and prospects including the impact of 5G. It will also explore how IoT will be implemented and monetized across a various application spaces, creating new business models from pervasive sensor deployments and data gathering, accompanied by new privacy and security risks, as well as roadblocks and operational challenges, emerging standards and protocols, gateways and ecosystem integration, big data strategies, and analytic opportunities.

Anechoic Absorber Consideration in the W Band and Absorbers Under High Power Incident Field

By Zhong Chen, Director of RF Engineering, ETS-Lindgren

Abstract: This is a two-part presentation. The first presentation is on the absorber considerations for W-band (75 GHz – 110 GHz). The absorber performance data is typically only available only to 40 GHz, and higher frequency data is often extrapolated. This presentation shows the actual measured reflectivities of common microwave absorbers in the W band. It shows that the extrapolated data from lower frequencies might not be accurate. This presentation will also show how paint on the absorber surface might affect the absorber reflectivity, and if black-tip (leaving the tip of the absorbers unpainted) is an effective technique.

The second part of the presentation deals with the power handling of the absorbers, and provides analyses on the thermal behavior of the absorbers under high electromagnetic incident field. Data will be presented on internal and surface temperatures of typical absorbers under varying field strength, and some mitigating factors to lowering the temperatures are also discussed.

SPEAKER BIOGRAPHIES



Mr. Daryl Gerke, PE is a co-founder of Kimmel Gerke Associates, an engineering consulting firm specializing in EMI/EMC design issues. Since 1987, Daryl and his late business partner (Bill Kimmel) solved or prevented hundreds of EMI problems across the electronics industry. They also trained over 10,000 students in their public and in-house seminars. Daryl has a BSEE from the University of Nebraska, and is a NARTE Certified EMC Engineer and a Registered Professional Engineer (PE.) www.emiguru.com



Dr. Constantine A. Balanis (S'62 - M'68 - SM'74 - F'86 – LF'04) received the BSEE degree from Virginia Tech, Blacksburg, VA, in 1964, the MEE degree from the University of Virginia, Charlottesville, VA, in 1966, and the Ph.D. degree in Electrical Engineering from Ohio State University, Columbus, OH, in 1969. From 1964-1970 he was with NASA Langley Research Center, Hampton VA, and from 1970-1983 he was with the Department of Electrical Engineering, West Virginia University, Morgantown, WV. Since 1983 he has been with the School of Electrical, Computer and Energy Engineering, Arizona State University, Tempe, AZ, where he is Regents' Professor. His research interests are in computational electromagnetics, flexible antennas and high impedance surfaces, smart antennas, and multipath propagation. He received in 2004 a Honorary Doctorate from the Aristotle University of Thessaloniki, the 2014 LAPC James R. James Lifetime Achievement Award (UK), the 2012 Distinguished Achievement Award of the IEEE Antennas and Propagation Society, the 2012 Distinguished Achievement Alumnus Award (College of Engineering, The Ohio State University), the 2005 Chen-To Tai Distinguished Educator Award of the IEEE Antennas and Propagation Society, the 2000 IEEE Millennium Award, the 1996 Graduate Mentor Award of Arizona State University, the 1992 Special Professionalism Award of the IEEE Phoenix Section, the 1989 Individual Achievement Award of the IEEE Region 6, and the 1987-1988 Graduate Teaching Excellence Award, School of Engineering, Arizona State University.

Dr. Balanis is a Life Fellow of the IEEE. He has served as Associate Editor of the IEEE Transactions on Antennas and Propagation (1974-1977) and the IEEE Transactions on Geoscience and Remote Sensing (1981-1984); as Editor of the Newsletter for the IEEE Geoscience and Remote Sensing Society (1982-1983); as Second Vice-President (1984) and member of the Administrative Committee (1984-85) of the IEEE Geoscience and Remote Sensing Society; and Distinguished Lecturer (2003-2005), Chair of the Distinguished Lecturer Program (1988-1991), member of the AdCom (1992-95, 1997-1999) and Chair of the Awards and Fellows Committee (2009-2011) all of the IEEE Antennas and Propagation Society. He is the author of *Antenna Theory: Analysis and Design* (Wiley, 2005, 1997, 1982), *Advanced Engineering Electromagnetics* (Wiley, 2012, 1989) and *Introduction to Smart Antennas* (Morgan and Claypool, 2007), and editor of *Modern Antenna Handbook* (Wiley, 2008) and for the Morgan & Claypool Publishers, series on Antennas and Propagation series, and series on Computational Electromagnetics.



Dr. William Young holds a Ph.D. from the University of Colorado in electrical engineering. He worked at Sandia National Laboratories from 1998 to 2010. He joined the Electromagnetics Division at the National Institute of Standards and Technology (NIST) in 2010 where he focused on a variety of wireless communication challenges. He currently heads up the Shared Spectrum Metrology Group in the Communications Technology Laboratory at NIST, which focuses on metrology research for quantifying the effects of spectrum sharing approaches, including coexistence testing and analysis. He also serves as a technical expert and technical lead for the National Advanced Spectrum and Communications Test Network (NASCTN).



Mr. Harry Skinner is a Director and Senior Principal Engineer in Intel Labs. Since joining Intel in 1996, Harry has held a variety of positions, all dealing with Electromagnetic Compatibility (EMC). For the vast majority of his tenure Harry has directed Intel's EMC/EMI Research and Development while driving industry EMC guideline development for initiatives such as PCI Express* and SATA. More recently Harry has been driving Intel's research for Radio Frequency Interference (RFI) and Antennas. Other noteworthy projects include dithered clocks for IA platforms (SSC), ATX SE EMI containment guidelines (u-seam and waveguide implementations), and EMI design of Intel's mobile modules. Before coming to Intel, Harry spent six years with IBM. He has been awarded greater than twenty patents, has multiple patents pending, and has published numerous papers at IEEE symposiums and other technical forums. Harry received a first-class honors Bachelor of Engineering (B.Eng) degree in electronics and electrical engineering from the University of Glasgow, Scotland.

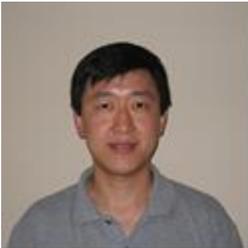


Dr. Vignesh Rajamani is an expert in the electromagnetic characterization and application of reverberation chambers and holds a position of Senior Associate Electrical Engineering & Computer Science Practice at Exponent. A main thrust of his research and project experience in the area of reverberation chambers has been towards increasing test accuracy. His expertise includes statistical electromagnetics, validation and optimization techniques for computational electromagnetics, communication system test in complex multipath environments, EMI/C Issues with Unmanned Aerial Systems, antenna systems and radio frequency (RF) design, and estimation probability of failure of electronic systems due to electromagnetic interference and compatibility.

Dr. Rajamani is the Vice President of Member Services for the IEEE Electromagnetic Compatibility (EMC) Society and involved with several technical committees and educational activities through the EMC Society. He is a Senior Member of IEEE and served as a distinguished lecturer for the IEEE EMC Society for term 2013-2014. He has lectured around the world on reverberation chamber test methodologies and has taught design engineering seminars for faculty and students at many universities focusing on challenges in engineering education and prepare the faculty to handle them by spreading a significant number of Project Based Learning (PBL) classes across the curriculum. Prior to joining Exponent, Dr. Rajamani was with Oklahoma State University as a Visiting Assistant Professor where he taught courses in engineering design and performed research in probability of failure of electronic systems in harsh electromagnetic environments.



Mark Goldstein is President of International Research Center and a technophile and technology visionary, activist, advisor, and entrepreneur with extensive experience and connections throughout myriad technology sectors. He has provided consulting, custom research, and strategic support for business, legal, and public policy clients across a variety of technology disciplines and arenas since 1992 following an engineering management career. He is involved with a number of policy, economic development, professional, and trade groups, and a frequent speaker and trainer.



Zhong Chen is the Director of RF Engineering at ETS-Lindgren, located in Cedar Park, Texas. He has over 20 years of experience in RF testing, anechoic chamber design, as well as EMC antenna and field probe design and measurement. He is an active member of the ANSI ASC 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). He is chairman of the IEEE Standard 1309 committee responsible for developing calibration standards for field probes. 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.

Event Overview

The Program

This program was designed to bring the latest technology related to electromagnetic compatibility (EMC) to the southwestern US region. Experts in industry, academia and government organizations will share practical information on various topics in an extended presentation format. This allows a thorough discussion of each topic and provides the opportunity for extended questions and answers.

The Exhibition & Reception

There will be an exhibition by vendors of test and measurement related products and services for antenna, wireless, and EMC applications near the technical presentation area. These products and services address the needs of the commercial, military, and aerospace industries. During the reception from 5:00 to 6:00 pm in the exhibit area, heavy appetizers and a hosted bar will be available. Phoenix EMC Chapter and IEEE members are welcome to attend the reception only at NO CHARGE, provided a registration form is completed and sent in advance. A badge will be available for the reception-only attendees upon arrival at 5:00 pm. *Thus, if you can't join us for the entire day, drop by for the reception and exhibition to network the event attendees. You can see new products, meet the speakers, and you might even win a raffle prize!*

Colloquium and Exhibition Location

THE EMBASSY SUITES PHOENIX -TEMPE
4400 S RURAL RD, TEMPE, AZ 85282
(480) 897-7444



The Embassy Suites Phoenix-Tempe offers a complimentary shuttle to Phoenix Sky Harbor Airport. Our hotel is minutes from the Arizona State University (ASU) campus and the shopping and nightlife of Mill Avenue. Relax in the sleek lobby, bar and lounge area plus expanded breakfast section.

Hotel Guest Room Information

Guest rooms: \$140.00 plus tax per night

In order to guarantee you receive the appropriate group rate please either call the hotel directly to make your reservation at 480-897-7444 and mention your group code IEEE or you may visit the hotel online via the Personalized Booking Page: <http://embassysuites.hilton.com/en/es/groups/personalized/P/PHXTPES-IEE-20170425/index.jhtml>

The group block has been made available until April 4, 2017 for incoming reservations. If you do not receive the group rate, please contact Janet O'Neil at 425-443-8106 immediately. A limited number of rooms are available and will be filled based on a first come/first served basis.

Organizing Committee

Technical Program

Glen Gassaway, Southwest EMI Consulting, glen@southwestemi.com
Vignesh Rajamani, Exponent Inc, vignesh@ieee.org
Daryl Gerke, Kimmel-Gerke Consulting, dgerke@emiguru.com

IEEE Phoenix Section Liaisons

EMC Chapter Chair: Glen Gassaway, glen@southwestemi.com, 480-725-9961
EMC Vice-Chair: Brett Gassaway, brettg@complianceesting.com, 480-926-1775 ext 105
EMC Vice-Chair and Godfather: Daryl Gerke, dgerke@emiguru.com, 480-755-0080
EMC Secretary: Greg Wilkins, gwilkins@comtechefdata.com, 480-333-2428
EMC Treasurer: Amanda Reed, amandar@complianceesting.com, 480-748-4448

Arrangements and Exhibits

Janet O'Neil, ETS-Lindgren
Office: 425-443-8106, Email: janet.oneil@ets-lindgren.com
Please contact Janet Directly if you would like to take advantage of exhibiting at this event.

Registration Info

Glen Gassaway, Southwest EMI Consulting
Office: 480-725-9961, Email: glen@southwestemi.com

Program Costs

- Early Bird, IEEE member by March 5: \$100.00
- Early Bird, non-IEEE member by March 5: \$150.00
- Standard, IEEE member March 5 - April 15: \$150.00
- Standard, non-IEEE member March 5 - April 15: \$200.00
- Last Minute/At-the-door, IEEE member after April 15 and at the door (space available): \$175.00
- Last Minute/At-the-door, non-IEEE member after April 15 and at the door (space available): \$225.00

STUDENTS: There is a special registration fee for students: The IEEE Student Member registration fee is \$25.00 and the NON-IEEE Student Member registration fee is \$35.00. Student registrations must be received by April 20 to guarantee a seat. Student registrations received after this date will be offered on a SPACE AVAILABLE basis. Students must present a valid student ID that documents they are a student on site at the registration counter upon arrival.

NOTE: *The registration fee includes a digital copy of the colloquium record, light breakfast, lunch, refreshment breaks, and the reception. The organizing committee reserves the right to substitute speakers, restrict size, or to cancel the colloquium and exhibition. In the event the organizing committee cancels this event, registration fees only will be fully refunded. Individuals canceling their registration prior to April 15 will receive a full refund, less 10% credit card fee. No refunds will be made to individuals who cancel their registration after April 15. Substitutions are allowed. Attendance is limited; registration will be confirmed on a first come, first served basis.*

On-Line Registration Information

Please visit our Eventbrite Invitation at:

<https://www.eventbrite.com/e/phoenix-ieee-emc-symposium-tickets-31361950438>

Mail-In Registration Information

Please print clearly

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| Name: | _____ | | | | |
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| E-mail Address: | _____ | | | | |
| IEEE Member: | Y ___ N ___ | | | | |
| IEEE #: | _____ | | | | |

Registration Total per Fees Above

Check Enclosed in Amount of: \$ _____

(Checks payable to: IEEE Phoenix EMC Chapter)

Mail to: **IEEE Phoenix Event Registration**
Attention: Amanda Reed
Phoenix EMC Chapter Treasurer
Compliance Testing
1724 S. Nevada Way, Mesa, AZ 85204