IMPORTANT UPDATES INSIDE!

ADVANCE PROGRAM

2024 IEEE INTERNATIONAL SYMPOSIUM ON

AUGUST 5 - 9

EMC+SIPI

2024

PHOENIX, ARIZONA

ELECTROMAGNETIC COMPATIBILITY, SIGNAL & POWER INTEGRITY

KEYNOTE SPEAKER
Ed Godshalk
Ph.D., IEEE Fellow

EXHIBIT HALL

TECHNICAL PROGRAM DETAILS

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PARTICIPATE IN 200+ TECHNICAL SESSIONS,
Workshops & Tutorials, Hands-On Experiments & Demonstrations, and Special Sessions with the world's leading engineers in EMC and SIPI.

EXPAND YOUR EDUCATION
By attending the Clayton R. Paul Global EMC University and the NEW Global Signal Integrity and Power Integrity (SIPI) University.

ATTEND THE "ASK THE EXPERTS" PANELS.
Bring your questions or simply listen and learn from the experts!

PARTICIPATE IN LIVE DEMONSTRATIONS
Presented by industry experts to learn how to solve real-world problems.

LEARN ABOUT THE LATEST GLOBAL STANDARDS
Get updates, ask questions, and attend Working Group Meetings as part of the "Standards Week" special track.

JOIN OUR EXCITING TECHNICAL TOUR
Enjoy exclusive access to a leading university.

NETWORK WITH FRIENDS AND COLLEAGUES
During the Welcome Reception, Gala Dinner, and Young Professionals and Women in Engineering events.

BRING THE FAMILY
And Experience Phoenix, Arizona, in the stunning Southwest Sonoran Desert. Companions are invited to join the Social Events and fun area tours.

SOCIAL MEDIA TOOLKIT

PROMOTE EMC+SIPI 2024 ON YOUR SOCIAL CHANNELS!

We've created this content for your convenience to promote the 2024 EMC+SIPI Symposium via social media

Use our logos and sample text below to promote visitors to your booth, attendance at your presentation, or simply your brilliance in attending the world's premier gathering of EMC and SIPI professionals!

www.emc2024.org

CHAIR'S MESSAGE
WELCOME FROM VIGNESH RAJAMANI, THE 2024 EMC+SIPI GENERAL CHAIR

On behalf of the EMC Society, I am thrilled to invite you to join us in Phoenix, Arizona for the annual EMC+SIPI Symposium.

Without the hard work and the dedication of the Symposium committee, we could not have put together a stellar technical and social program that each attendee will be able to enjoy.

Just like the previous years, the Symposium features technical sessions, workshops and tutorials, technical, standard and working group meetings, experiments and demonstrations, "Ask the Expert" panels, an extensive technical exhibition in addition to the social events that serve as a catalyst for collaboration and networking.

The flagship offering like the Clayton R. Paul Global University program is offered again in Phoenix and in addition to that I am very happy to introduce the inaugural Global SIPI University. This course aims at bridging the existing gap that engineers face with SI and PI related topics. Such courses are only offered at a few academic institutions and research laboratories in the US and worldwide, and we are striving to establish it as a staple at our annual Symposium.

Regarding the social programs, the welcome reception will be held on the exhibit floor just like last year giving attendees extra time to look around the exhibit hall and interact with the exhibitors about their products and service offerings. The gala will be held on Wednesday evening, and new to this year will be a surprise theme for attendees to enjoy! More details on this to come soon.

Situated in downtown Phoenix, the Phoenix Convention Center offers modern amenities and a contemporary architectural style. Within walking distance, visitors can discover a diverse array of hotels, dining establishments, and entertainment options, creating a convenient and enjoyable experience. From cultural attractions like the Phoenix Art Museum to shopping at the Arizona Center Mall, the surrounding area complements the convention center, providing a well-rounded destination for attendees. The Arizona Science Center, the Children's Museum of Phoenix, and the Rosson House are all 5 minutes or less to walk from the Convention Center.

In summary, I am really looking forward to a packed week to reconnect with some old friends and new acquaintances. As I mentioned earlier in this message, none of this would be possible without the dedicated staff and volunteers that serve as committee members, and I am indebted and privileged to work with such a wonderful group of people.

Vignesh Rajamani
General Chair, 2024 IEEE International Symposium on Electromagnetic Compatibility, Signal & Power Integrity (EMC+SIPI).

LEARN ABOUT PHOENIX, ARIZONA

CLICK HERE TO WATCH THE 2024 EMC+SIPI WELCOME VIDEO

ABOUT PHOENIX
Welcome to Phoenix, Arizona – The Valley of the Sun. Downtown Phoenix is an exciting and bustling center of activity filled with a myriad of restaurants, micro-breweries, museums and more. Please **CLICK HERE** for resources to help plan out your trip.

THE PHOENIX CONVENTION CENTER
The facility is inspired by the red-rock walls and turquoise waters of the Grand Canyon and is one of the most beautiful and sophisticated convention centers in the United States. Its interconnected campus includes three ballrooms, 99 meeting/breakout rooms, a 2,300-seat performance hall and an Executive Conference Center. Conveniently located on the METRO Light Rail line and is within walking distance to hotels, entertainments & sports complexes, shopping and restaurants.
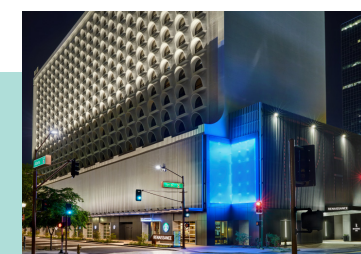
SHERATON PHOENIX DOWNTOWN
A revolutionized style and comfort, for both work and relaxation, creates so much more than just a hotel. Located just a block away from the Convention Center

RENAISSANCE PHOENIX DOWNTOWN HOTEL
Your chic hub in the heart of Central Phoenix, offering 4 star services and urban decor. Located just a block away from the Convention Center

These hotels both offer a special single/double group rate of US$169 per night for IEEE EMC+SIPI Symposium attendees. This group rate is exclusive of taxes (currently at 12.57%).

Reservations must be made by 5:00pm Mountain Time on Tuesday, July 9, 2024 in order to get the group rate. Once the room block is sold out, the hotel will offer rooms/rates based upon availability.

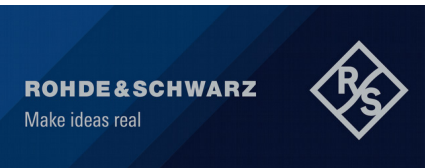## CLICK HERE TO RESERVE YOUR ROOM
EMC AND GOVERNMENT GROUP RATES AVAILABLE

THE 2024 EMC+SIPI COMMITTEE EXTENDS OUR GRATITUDE TO THIS YEAR'S SPONSORS FOR THEIR SUPPORT.

GENERAL INFORMATION

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EMC SOCIETY®

BRINGING COMPATIBILITY TO ENGINEERING INNOVATIONS SINCE 1957

The IEEE EMC Society has been at the pivot point of engineering technology for over a half-century. With a long history of developments in Electromagnetic Compatibility and Electromagnetic Environmental Effects, the Society brings sharp focus to methods and practices for proper performance of energy, electrical, communications, information technology and wireless systems. The Society promotes information sharing through regional chapters and international symposia. Collaboration across the research, design, test, regulatory and media industries has helped shape the world as we know it.

LEADING EDGE INFO

- EMC Measurements
- Signal & Power Integrity
- EMI Control
- EMC Management
- Low Frequency EMC
- Computational Electromagnetics
- High Power Electromagnetics
- Electromagnetic Environments
- Smart Grid EMC
- Regulatory Requirements for EMC, ESD, EMI, and SIPI

... AND MORE!

CALL FOR VOLUNTEERS

We are in need of volunteers to help make EMC+SIPI 2024 run as smoothly as possible. Previous year's volunteers have made the event a success.

We welcome new and past volunteers to help with the following positions:

- Help with Registration
- Collect tickets and direct traffic at the Welcome Reception, and Gala Events
- Host Poster Papers
- Monitor Exhibit Hall Demonstrations
- Monitor Technical Papers, Workshops, and Tutorials

Participating as a volunteer has some great perks!
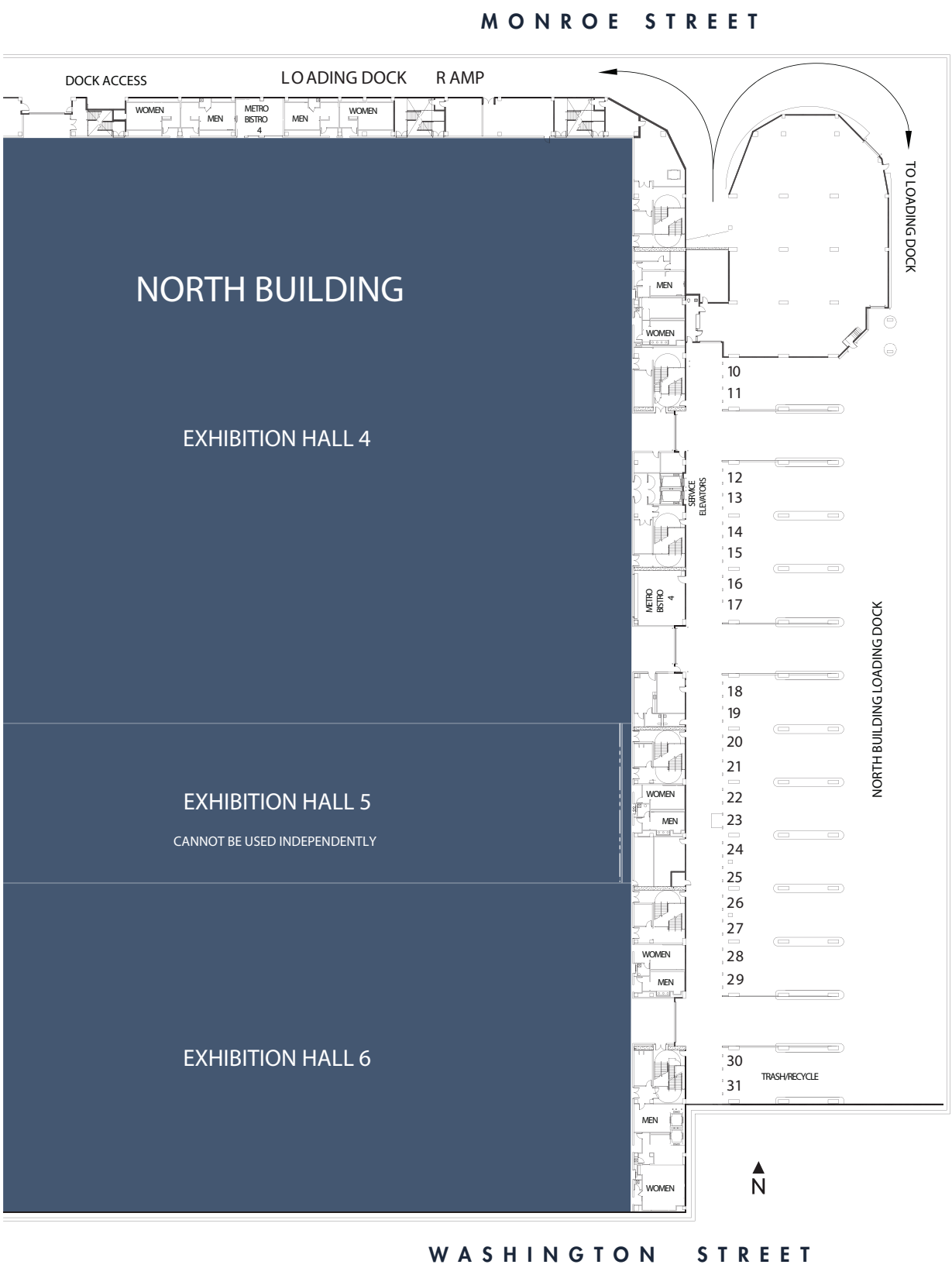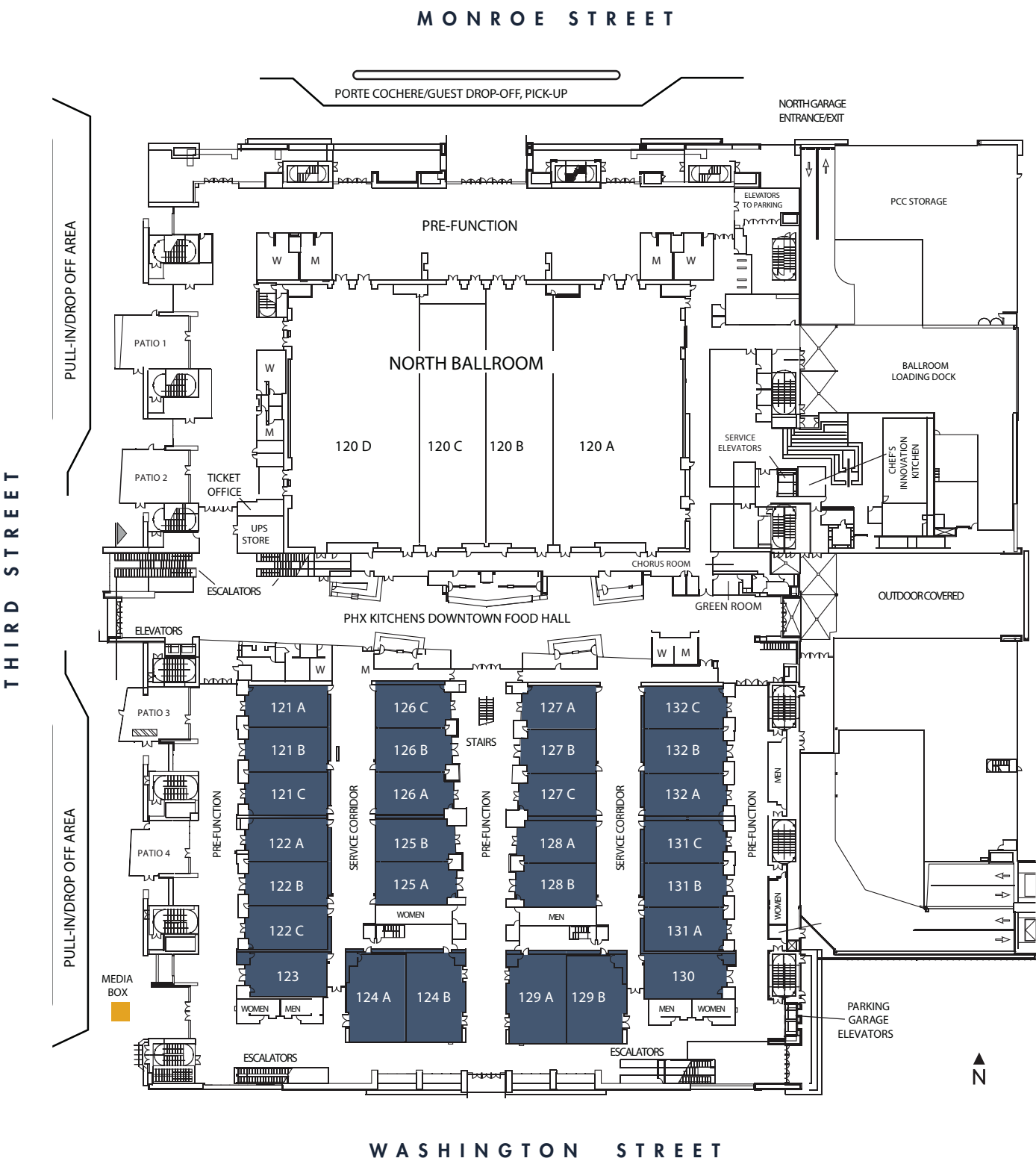Registered attendees contributing as a volunteer will receive:

- An opportunity to connect with other peers and industry professionals
- Food and beverages during your hours of service
- Free Symposium shirt

Local residents, who are not registered for the Symposium, will also receive these great benefits:

- Free one-day registration for every day you volunteer
- See what's happening in the EMC and SIPI fields
- Free parking pass for the day you volunteer

TO VOLUNTEER, PLEASE VISIT OUR WEBSITE AT: www.emc2024.org/programs/volunteer-info/

MEETING ROOMS MAP

NORTH BUILDING | 100 LEVEL

MONROE STREET

PORTE COCHERE/GUEST DROP-OFF, PICK-UP

NORTH GARAGE ENTRANCE/EXIT

THIRD STREET

PULL-IN/DROP OFF AREA

PATIO 1

PATIO 2

PRE-FUNCTION

W M

M W

ELEVATORS TO PARKING

PCC STORAGE

NORTH BALLROOM

W

M

120 D   120 C   120 B   120 A

BALLROOM LOADING DOCK

SERVICE ELEVATORS

CHEF'S INNOVATION KITCHEN

TICKET OFFICE

UPS STORE

ESCALATORS

CHORUS ROOM

GREEN ROOM

OUTDOOR COVERED

ELEVATORS

PHX KITCHENS DOWNTOWN FOOD HALL

W M

FIFTH STREET

PATIO 3

W

PATIO 4

PULL-IN/DROP OFF AREA

PRE-FUNCTION

SERVICE CORRIDOR

STAIRS

SERVICE CORRIDOR

PRE-FUNCTION

121 A	126 C	127 A	132 C
121 B	126 B	127 B	132 B
121 C	126 A	127 C	132 A
122 A	125 B	128 A	131 C
122 B	125 A	128 B	131 B
122 C			131 A
123	124 A 124 B	129 A 129 B	130

WOMEN

MEN

MEN

WOMEN

MEN

WOMEN

MEDIA BOX

WOMEN   MEN

WOMEN   MEN

ESCALATORS

ESCALATORS

PARKING GARAGE ELEVATORS

N

WASHINGTON STREET

EXHIBIT HALL MAP

MONROE STREET

DOCK ACCESS   LOADING DOCK   RAMP

WOMEN   MEN   METRO BISTRO 4   MEN   WOMEN

TO LOADING DOCK

NORTH BUILDING

MEN

WOMEN

EXHIBITION HALL 4

10
11

SERVICE ELEVATORS

12
13
14
15
16
17

METRO BISTRO 4

NORTH BUILDING LOADING DOCK

FIFTH STREET

18
19
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25
26
27
28
29

EXHIBITION HALL 5

CANNOT BE USED INDEPENDENTLY

WOMEN

MEN

WOMEN

MEN

EXHIBITION HALL 6

30
31

TRASH/RECYCLE

MEN

N

WOMEN

WASHINGTON STREET

TECHNICAL CHAIR'S MESSAGE
WELCOME FROM CHUCK BUNTING, THE 2024 TECHNICAL PROGRAM COMMITTEE CHAIR

WELCOME!

On behalf of the Technical Program Committee, welcome to the 2024 IEEE International Symposium on Electromagnetic Compatibility, Signal & Power Integrity (EMC+SIPI). I hope to meet you during this exciting week full of discussions, where we can share insights, ask questions, learn from the experts and innovators, as well as see new products.

The 2024 IEEE International Symposium on EMC and Signal & Power Integrity (EMC+SIPI) will be held in Phoenix, Arizona for the first time.

I encourage you to attend one of the many special sessions or traditional paper sessions – there is a lot to learn in the late-breaking developments of our colleagues. Attend and be challenged! If you're seeking in-depth discussions on a specific topic, consider participating in either a workshop or a tutorial. Tutorials typically involve one-directional communication directed at the audience, providing comprehensive information and guidance. In comparison, workshops offer a more interactive experience, fostering discussions and active engagement among participants. The popular experiments and demonstrations program provide hands-on learning opportunities to complement the technical presentations. These presentations often vividly demonstrate what makes the EMC/SIPI area so fascinating and always provoke new thoughts about our cool vocation. Stick around and discuss with the presenters and colleagues, and then reproduce the experiment or demonstrations to show your colleagues when you get back home. The "Ask the Expert" panel sessions will give another dimension to the Symposium where you can hear experts each respond to challenges that are happening in your industry or area. See the program for the details.

"Standards Week" is a combination of talks, tutorials, workshops, panel sessions, and demonstrations to update the engineering community about new developments in International EMC and Signal Integrity/Power Integrity (SIPI) standards. Standards Week includes a collection of what is going on in standards bodies, such as in the IC, CISPR, ANSI C63, etc. and what will affect us in the coming years. You can also attend one of the many standards committee meetings and/or working group meetings during the Symposium week to learn more about the standards process, and how you can get involved. These meetings are open to all interested in EMC and SIPI standards. Step up and serve your community and share your expertise!

Our Clayton R. Paul Global EMC University (CRPGU) features an overview of fundamental topics presented by expert instructors from universities and industries from around the globe. The Global University is larger and more extensive than ever before and will provide an excellent knowledge boost for everyone who already possesses a basic knowledge in the field of EMC and SIPI.

This extensive program will provide something for everyone. I hope you use this opportunity to catch up with old friends and make new ones.

Chuck Bunting
Technical Program Committee Chair, 2024 IEEE International Symposium on Electromagnetic Compatibility, Signal & Power Integrity (EMC+SIPI).

KEYNOTE PRESENTATION
TUESDAY, AUGUST 6, 2024 • 8:30 – 9:30 AM

THE STORY OF THE TRANSATLANTIC TELEGRAPH AND THE WORLD'S FIRST INTERNET
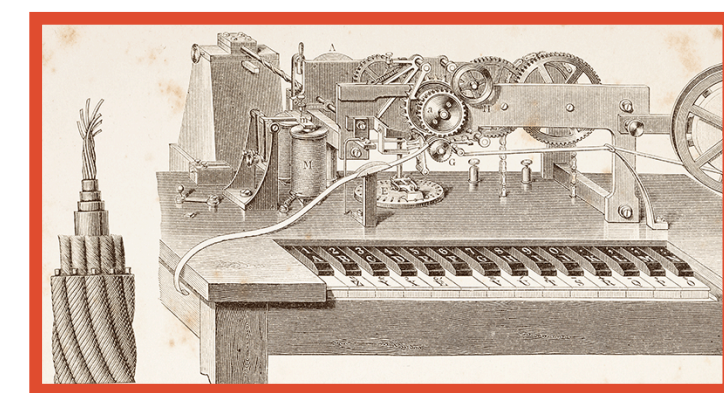
Electrical telegraphy can be considered to be the first example of electrical engineering. Electrical telegraphs were point-to-point text messaging systems that were first used around 1840. This presentation traces the formative years of electrical engineering and the evolution of transmission line engineering that enabled a global communications network over **180** years ago! The story begins with the invention of the "Victorian internet", the telegraph, generally regarded as the first practical use of electronics. This is followed by transatlantic telegraph cable in **1858**, which some historians equate as the 19th century equivalent of landing a man on the moon. These were a catalyst for technologies such as improved battery design, insulated wire, coaxial cable, modulation schemes, and using the earth as a conductor. The transatlantic cable taught engineers the concept of the RC time constant **while educating them on threats to undersea cables such as sharks, whales, sawfish, and species of shipworm.**

The presentation includes results of a replica of the original system that illustrates the data rate problem. Many great minds of the 19th century (**Samuel Morse, Hans Christian Orsted, Joseph Henry, Carl Friedrich Gauss, and many others**) worked to understand and solve this problem, resulting in the telegrapher's equations that enabled high-speed communication and long-distance telephone service. The culmination is the modern transoceanic fiber optic cable, which forms the backbone of the global communications network. **Presently 99% of the data traffic that is crossing oceans is carried by undersea cables. The total carrying capacity of a submarine cable is in the terabits per second range while satellites typically offer only 1 gigabit per second capability.**

PRESENTED BY: Ed Godshalk, *Ph.D., IEEE Fellow*

Ed has been an Electrical Engineer for over 40 years and worked at several startups, Tektronix and Maxim Integrated. While at Cascade Microtech (1989-94), he invented the world's first waveguide input wafer probe and later the Air Coplanar Probe (ACP), which has been widely imitated. During his 22 years at Maxim, from which he retired in 2019, he created the Electromagnetics Group. He is presently working with FJ Scaler on Coherent Optical Subassembly (COSA) development for high-speed optical communications. He has over a dozen issued patents.

In 2020 he was elevated to the grade of Fellow by the Institute of Electrical and Electronic Engineers (IEEE) "For the development of microwave on-wafer probing and measurement techniques" which helped to enable microwave integrated circuits for commercial use.

Ed finds great pleasure in mentoring students and helping them achieve success in engineering and life. Helping students understand the origin of technical ideas is important to him, since this helps them to have a deeper understanding of engineering.

He also restores vintage sports cars and enjoys backcountry skiing and being in the mountains. In his younger days he organized an expedition that successfully climbed Denali, the tallest peak in North America (20,310'). He also climbed Kilimanjaro (19,341') in Africa, and numerous other peaks in North America.

GLOBAL SIPI UNIVERSITY

The following information is preliminary and subject to change.

ANNOUNCING THE INAUGURAL COURSE
GLOBAL SIGNAL INTEGRITY AND POWER INTEGRITY (SIPI) UNIVERSITY
WEDNESDAY, AUGUST 7, 2024

Chair: Christian Schuster, *Hamburg University of Technology, Germany*
Co-Chair: Francesco de Paulis, *University of L'Aquila, L'Aquila, Italy*

COURSE OVERVIEW: Signal integrity (SI) and power integrity (PI) are gaining an ever-growing attention due to today's higher data rates and larger currents in high-speed digital systems. Industries call for skilled engineers with both basic and advanced background in these two disciplines. Courses dealing with SI and PI related topics at academic level are limited and offered by only a few institutions and research laboratories in the US and worldwide. The inaugural **"Global SIPI University"** aims at bridging this gap with a one-day introductory course at the Electromagnetic and Signal & Power Integrity Symposium to be held in Phoenix, Arizona, from August 5-9, 2024.

The mission of the **"Global SIPI University"** is to provide technicians and engineers the opportunity to acquire SI and PI concepts from experienced and well-known instructors from both industry and academia. The **"Global SIPI University"** offers a rigorous background directly linked with practical problems and solutions. Attendees will acquire application-oriented skills and knowledge about the need for signal and power integrity analysis as well as the tools and methods available for tackling SI and PI related problems. Basic and fundamental concepts involving limited but relevant theory will be offered to fully understand how practical problems can be approached using analytical methods, simulation tools, as well as measurements to validate simulations. Instructors will discuss design examples to provide a clear insight and processes for guiding the attendee towards problem solutions.

COURSE PRE-REQUISITES:

Electrical engineers with a professional background in EMC that want to dive into or broaden their skills in state-of-the-art signal integrity and power integrity.

Full symposium registration required in addition to the SIPI GU course fee.

RATES

Advanced Registration Price: $175

$225 (if registered after July 1, 2024)

Photo by Patrick Andre

Read the instructor bios and presentation abstracts:
www.emc2024.org/programs/technical-programs/global-sipi-university

SPEAKERS AND TOPICS

TIME	TOPIC	PRESENTER/INSTRUCTOR
08:00 – 8:30	**Registration / Introductions**	**Christian Schuster** and **Francesco de Paulis**
08:30 – 09:15	**Opening:** Progression of SIPI Modeling: A 50-Year Journey to Modern System Design Challenges	**Dr. Albert Ruehli** *(Missouri University of Science and Technology)* **Mr. Stephen Scearce** *(Cisco Systems)*
09:15 – 10:00	**Keynote:** Global industry trends and demands from a system and packaging perspective	**Dr. Kemal Aygün** *(Intel)*
10:00 – 10:30	**Coffee Break / Networking**	
10:30 – 11:15	**Signal Integrity I:** Passive interconnect design, lumped effects, transmission line effects	**Dr. Bhyrav Mutnury** *(Dell EMC)*
11:15 – 12:00	**Signal Integrity II:** Electrical Signaling — Modulation, Equalization, and Channel Design	**Dr. Wendem Beyene** *(Meta)*
12:00 – 13:30	**Lunch Break / Networking**	
13:30 – 14:15	**Signal Integrity III:** Signal integrity measurements and simulation	**Dr. Eric Bogatin** *(University of Colorado, Boulder)*
14:15 – 15:00	**Power Integrity I:** Fundamentals of power integrity with practical analysis techniques for current and emerging designs	**Dr. Ihsan Erdin** *(Celestica)*
15:00 – 15:30	**Coffee Break / Networking**	
15:30 – 16:15	**Power Integrity II:** VRM, package/IC-level PDN design	**Dr. Chulsoon Hwang** *(Missouri University of Science and Technology)*
16:15 – 17:30	**The Future of SI & PI Engineering:** Open discussion with all instructors and attendees	**Christian Schuster** and **Francesco de Paulis**

CHAIR:
Christian Schuster
Hamburg University of Technology, Germany

Christian Schuster (IEEE Senior Member) received a Diploma degree in Physics in 1996 and a Ph.D. degree in electrical engineering in 2000. Since 2006, he is a Full Professor at Hamburg University of Technology (TUHH), Germany. Prior to TUHH he was with the IBM T. J. Watson Research Center, Yorktown Heights, NY. His current interests include signal and power integrity of digital systems, multiport measurement and calibration techniques, and development of electromagnetic simulation methods for communication electronics. He serves as an Associate Editor for the IEEE Transactions on EMC as well as an Adjunct Associate Professor at the School of Electrical and Computer Engineering of the Georgia Institute of Technology.

CO-CHAIR:
Francesco de Paulis
University of L'Aquila, L'Aquila, Italy

Francesco de Paulis (Senior Member IEEE) received the M.S. degree in Electrical Engineering in May 2008 from Missouri University of Science and Technology (formerly University of Missouri-Rolla), USA, and the Ph.D. degree in Electrical and Information Engineering in 2012 from the University of L'Aquila, L'Aquila, Italy. He is currently an Associate Professor at the Electromagnetic Compatibility and Signal Integrity Laboratory at the University of L'Aquila. His main research interests are in signal and power integrity, high speed channel design and optimization, composite materials for shielding and absorption, RF interference in mixed-signal system, TSVs in silicon chips and interposers, antenna design and measurement techniques, remote fault detection in transmission lines, microwave design of electronic devices and systems for space applications.

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CLAYTON R. PAUL GLOBAL UNIVERSITY

The following information is preliminary and subject to change.

ADVANCE YOUR EMC KNOWLEDGE AND CAREER WITH IN-DEPTH CLASSES ON EMC AT THE IEEE EMC SOCIETY'S PREMIER EDUCATIONAL EVENT.

Chair: Arturo Mediano, *Professor, I3A, University of Zaragoza*

The topics for this year's Global University are those that have been proven to be valuable to participants in previous Symposia. The event for this year will provide the attendees with a great learning experience, due to the ability for interaction between instructors and attendees, as well as providing networking among attendees.

This year's Global University will truly be an event that honors Dr. Paul's efforts and dedication to the EMC Society as well as maintains his high standards in providing EMC educational opportunities!

Attendees may qualify for IEEE professional development hours (PDH) and continuing education units (CEU) certificates. Course size is limited and will be filled on first-come, first-served basis.

PLEASE NOTE: The Clayton R. Paul Global University course content is intended for engineers who have been working in EMC and/or SIPI for several years and wish to be able to deepen their understanding. It is suggested that those who would like to attend will have already participated in the "Fundamentals Tutorial" held on Monday during the annual IEEE EMC Society Symposium week.

RATES

Advanced Registration Price: $350

$400 (if registered after July 1, 2024)

Photo by Richard Georgerian

Read the instructor bios and presentation abstracts:
www.emc2024.org/programs/technical-programs/global-university

SPEAKERS AND TOPICS

The course begins with a short introduction followed by ten presentations that are designed to encourage attendees' questions. Attendees will have opportunities for discussions with the instructors.

SIGNAL SPECTRA
Dr. Flavia Grassi
Professor, Politecnico Milano

NON-IDEAL BEHAVIOR OF COMPONENTS
Dr. Anne Roc'h
Assistant Professor,
Eindhoven University of Technology

RADIATED EMISSIONS
Mr. Lee Hill
MSEE, Missouri University of Science & Technology
Founding Partner, SILENT Solutions LLC & GmbH
Adjunct Faculty, Worcester Polytechnic Institute (WPI)
Associate Tutor, University of Oxford

CONDUCTED EMISSIONS
Dr. Arturo Mediano
Professor, I3A, University of Zaragoza
Founder The HF Magic Lab
IEEE Senior Member. Chair EMC-S Spain Chapter.
Past Chair MTT-S MTT-17 Committee.

ELECTROSTATIC DISCHARGE (ESD)
Dr. Todd Hubing
Professor Emeritus, Clemson University
IEEE Fellow, ACES Fellow
Past President, IEEE EMC Society

PCB DESIGN FOR EMC
Dr. Bruce Archambeault
Adjunct Professor,
Missouri University of Science & Technology
IBM Distinguished Engineer Emeritus
Principal, Archambeault EMI/EMC Enterprises
IEEE Fellow, Past President, IEEE EMC Society

SHIELDING
Dr. Frank Leferink
Professor, University of Twente
Technical Authority, THALES Nederland
IEEE Fellow

SIGNAL INTEGRITY
John Golding
Mr. John Golding
Sr. Applications Engineer Consultant
Siemens EDA

CROSSTALK
Dr. Daryl G. Beetner
Professor, Missouri University of Science & Technology
Director, Missouri S&T Electromagnetic Compatibility Laboratory
Director, NSF Center for Electromagnetic Compatibility

POWER INTEGRITY
Dan Chirpich
MSEE at University of Kansas
Principal Engineer, AppliedLogix, LLC.
Signal and Power Integrity Lead

DATE & TIME	TITLE	LECTURER
TUES, AUG 6 • 8:00-10:00AM	Signal Spectra	Dr. Flavia Grassi *(Politecnico Milano)*
TUES, AUG 6 • 10:30AM-12:00PM	Non-Ideal Behavior of Components	Dr. Anne Roc'h *(Eindhoven University of Technology)*
TUES, AUG 6 • 1:00-3:00PM	Radiated Emissions	Lee Hill *(SILENT Solutions LLC & GmbH)*
TUES, AUG 6 • 3:30-5:15PM	Conducted Emissions	Prof. Dr. Arturo Mediano *(University of Zaragoza)*
WED, AUG 7 • 8:00-10:00AM	Electrostatic Discharge	Dr. Todd Hubing *(Clemson University)*
WED, AUG 7 • 10:30AM-12:00PM	PCB Design for EMC	Dr. Bruce Archambeault *(Missouri University of Science & Technology)*
WED, AUG 7 • 1:00-3:00PM	Shielding	Dr. Frank Leferink *(University of Twente)*
WED, AUG 7 • 3:30-5:15PM	Crosstalk	Dr. Daryl G. Beetner *(Missouri University of Science & Technology)*
THUR, AUG 8 • 8:00-10:00AM	Signal Integrity	John Golding *(Siemens EDA)*
THUR, AUG 8 • 10:30AM-12:00PM	Power Integrity	Dan Chirpich *(AppliedLogix, LLC)*

*Attendees participating in Clayton R. Paul Global University must attend all 20 hours of the instruction to receive a participation certificate. Other Symposium sessions and activities can be attended outside of these hours.

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MONDAY, AUGUST 5
The following information is preliminary and subject to change.

TUTORIAL

HENRY W. OTT FUNDAMENTALS OF ELECTROMAGNETIC COMPATIBILITY
8:30AM - 5:00PM
Room: 125AB

Co-Chairs:
   John McCloskey, *NASA, College Park, MD, USA*
   Jen Dimov, *NASA, Greenbelt, MD, USA*

This tutorial is an overview of many of the major topics that need to be considered when designing an electronic product or system to meet signal and power integrity (SIPI) and electromagnetic compatibility (EMC) requirements. The tutorial will present the foundational ideas from physics and mathematics and will demonstrate the engineering approaches to help the attendees to successfully design, evaluate, diagnose, and/or solve EMI problems. The main objective of this tutorial is to provide a learning opportunity for those that are new to EMC as well as provide a review of the basics to those who already have some experience in this area.

PLANNED SPEAKERS & TOPICS

Introduction to Electric and Magnetic Fields
John C. McCloskey
NASA, USA

Inductance and Capacitance
Bruce Archambeault[1,2]
[1]*Missouri University of Science and Technology, USA;*
[2]*IBM, USA*

Crosstalk
Eric Bogatin
University of Colorado Boulder, USA

Transmission Lines and Basic Signal Integrity
Xiaoning Ye
Intel Corp, Hillsboro, OR, USA

PCB Decoupling
Chulsoon Hwang
Missouri University of Science and Technology, USA

Grounding
Todd Hubing
LearnEMC, USA

Mitigation Strategies
Niek Moonen
Universiteit Twente, Netherlands

Conducted Emissions
Lee Hill
SILENT Solutions LLC & GmbH, USA

Radiated Emissions
Cheung-Wei Lam
Apple Inc, USA

MONDAY, AUGUST 5
The following information is preliminary and subject to change.

TUTORIAL

MILITARY EMC TUTORIAL
8:30AM - 5:00PM
Room: 127B
Sponsored by TC-3

STANDARDS WEEK

Co-Chairs:
   Robert Davis, *Lockheed Martin (Retired), Syracuse, NY USA*
   Carl Hager, *NSWC Dahlgren, Dahlgren, VA, USA*

The objective of this tutorial is to enhance our attendees' knowledge and understanding of key aspects of Military EMC that will help them in the performance of their jobs.

The tutorial will cover a broad range of Military EMC topics. The morning tutorial presentations will start with four talks updating the audience on the status and changes to MIL-STD-461, DoD E3 & Spectrum Directives/Instructions and Standards, Military HDBK-240 and NATO AECTP 250 & 500. This will be followed by a review of MIL-STD-464D Near Strike Lightning E-Field requirements, a discussion on the US Navy's HEMP E1 Test Range's existing and future operations and a talk on Surveying EMR Hazards on Army and Civilian vehicles.

The afternoon's tutorial presentations include a collaborative talk on ESD Indirect Effects on non-metallic ordnance, a presentation on EMI, N-EMP, L-EMP and TEMPEST Zoning and a discussion on the rising electromagnetic threat to military operations caused by civilian infrastructure. A Review of Spectrum Efficiency Solutions and Antenna Design Considerations for Efficient Spectrum and a discussion on Filters for Military EMC Applications, are also included in the afternoon presentations. The tutorial will conclude with a "Panel Discussion" with experts having a diverse background in Military EMC from the United States, Canada, Sweden, and the Netherlands.

PLANNED SPEAKERS & TOPICS

Updates to the Primary DOD Electromagnetic Environmental Effects and Spectrum Supportability Directives, Instructions and Standards
Mark Waller
US Army Redstone Test Center, USA

Updates on the Progress of MIL-STD-461H
Finbarr M. OConnor
Merrimack College, USA

Electromagnetic Environmental Effects to Ordnance Guide MIL-HDBK-240 with Updates
Mark Waller
US Army Redstone Test Center, USA

NATO Electrical and Electromagnetic Environmental Conditions AECTP 250 and Electromagnetic Environmental Effects Tests and Verification Methods AECTP 500 New Edition
Antonius J. van Bladel
Dutch Ministry of Defence, Netherlands

Review of Near Strike Lightning Electric Field Requirements in MIL-STD-464D
Tiffany Morisak
NAVAIR Patuxent Naval Air Station, USA

US NAVY HEMP-E1 Test Range Operations at Present and in the Future
John Howson
NAVAIR Patuxent Naval Air Station, USA

Indirect Effects of Helicopter-Borne ESD to Non-Metal Ordnance and Their Electronics
Phillip Melton, Jeffrey Clark
NSWC Indian Head, USA

EMI, N-EMP, L-EMP and TEMPEST Zoning: Differences and Commonalities
Frank Leferink
Thales Netherlands, Netherlands

Surveying for EMR Hazards on Army and Civilian Vehicles, a Real-World Application
Robert Tarrant
US Army ATC, USA

The Rising Electromagnetic Threat to Military Operations Caused by Civilian Infrastructure
Petter Gärdin
Swedish Armed Forces, Sweden

A Review of Spectrum Efficiency Solutions and Antenna Design Considerations for Efficient Spectrum
Sarah Seguin
Aerospace Corporation, USA

Filters for Military EMC Applications
Randy J. Jost
Utah State University, USA

MONDAY, AUGUST 5
The following information is preliminary and subject to change.

TUTORIAL

AMERICAN NATIONAL STANDARDS COMMITTEE C63 – ELECTROMAGNETIC COMPATIBILITY
UPDATE ON LATEST C63 STANDARDS
8:30AM - 12:00PM
Room: 128B
Sponsored by TC-1

STANDARDS WEEK

Chair:
   Daniel Hoolihan, *Hoolihan EMC Consulting, Lindstrom, MN, USA*

This tutorial will introduce the ANSC C63-EMC (C63 Committee) to conference attendees and highlight the latest status of key C63 Standards. Many C63 standards are Incorporated by Reference (IBR) by the United States Federal Communications Commission (FCC) and are mandatory for measuring electronic products for compliance with FCC Rules. A similar number of C63 standards are also used by Canada for showing compliance to their Regulations.

PLANNED SPEAKERS & TOPICS

C63.4 – Under Development – American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
Andrew Griffin
Consultant, USA

C63.25.3 – American National Standard Validation Methods for Radiated Emission Test Sites – 18 GHz to 40 GHz
Nicholas Abbondante
Intertek USA Inc, USA

C63.26 – 2015 – American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
William Elliott
Tuv Sud, USA

C63.9 – American National Standard for Laboratory Immunity Testing of Office Equipment Exposed to RF Sources
Jeffrey Evans
Consultant, USA

Far-Field Measurement Distance White Paper
Dave Case
Consultant, USA

C63.16 – American National Standard Guide for Electrostatic Discharge Test Methodologies and Acceptance Criteria for Electronic Equipment
Allen Crumm
Consultant, USA

TUTORIAL

ELECTROMAGNETIC WAVE INFORMATION SECURITY TO ENHANCE THE RELIABILITY OF THE INFORMATION INFRASTRUCTURE AS THE FOUNDATION OF SOCIETY
8:30AM - 12:00PM
Room: 127A
Sponsored by TC-5

Chair:
   Yuichi Hayashi, *Nara Sentan Kagaku Gijutsu Daigakuin Daigaku Joho Kagaku Kenkyuka, Ikoma, Japan*
Co-Chair:
   William Radasky, *Metatech Corporation, Goleta, CA, USA*

Nowadays, where valuable information such as personal data, health records, financial details, and even intellectual property, including AI learning models, are handled over networks, ensuring the security of information systems that support these network infrastructures has become one of the most critical social issues. It is desirable to appropriately secure information systems at various layers, including applications and networks. However, the security of the hardware, which is the foundation of trust in these systems, is especially crucial. Furthermore, among hardware security concerns, electromagnetic wave-based attacks are one of priority because they can degrade security without leaving evidence. Therefore, this tutorial session will focus on hardware security related to electromagnetic waves, introducing the latest research trends in threats and countermeasures. Additionally, for those not well-versed in hardware security, we will provide the fundamental knowledge necessary to understand this tutorial.

PLANNED SPEAKERS & TOPICS

Updates to the Primary DOD Electromagnetic Introduction to Electromagnetic Information Security
Yuichi Hayashi
Nara Sentan Kagaku Gijutsu Daigakuin Daigaku Joho Kagaku Kenkyuka, Japan

Inaudible Attack on Smart Speakers using IEMI
Chulsoon Hwang
Missouri University of Science and Technology, USA

Review of Research Trend on Side-Channel Leakage Simulation Method of Cryptographic Modules
Kengo Iokibe
Okayama Daigaku, Japan

Backscattered Side-Channel Attacks and Countermeasures
Shahin Tajik
Worcester Polytechnic Institute, USA

IEMI Attack Against PDN of RO based TRNG
Youngwoo Kim
Sejong University, Korea (the Republic of)

TUTORIAL

TODAY'S AUTOMOTIVE EMC/RF TESTING: IS IT ENOUGH?
8:30AM - 12:00PM
Room: 129A

Co-Chairs:
Garth D'Abreu, *ETS-Lindgren, Cedar Park, TX, USA*
Craig Fanning, *Elite Electronic Engineering, Inc., Downers Grove, IL, USA*

The automotive industry has been progressing at a rapid pace with the development and adoption of electric propulsion and advanced driver assistance (ADA) related systems. As a result, many new developments fall outside the scope or definitions described in the currently published automotive standards.

This tutorial will cover a broad range of topics addressing the design of vehicle components and subsystems related to communications, propulsion, and other elements. We will discuss traditional component design (which in the new paradigm presents challenging EMC problems), the design of high speed vehicle networks to mitigate signal integrity issues, and review some of the short comings of existing standards. We'll address the critical impact a vehicle structure can have on antenna design and communication performance. In conclusion, in lockstep with the rapid improvements in automotive technology, we'll review today's test environments to validate that automotive components and vehicles successfully perform as intended.

PLANNED SPEAKERS & TOPICS

Design Considerations of Automotive High Speed In-Vehicle Network Links from PCB to PCB
Rich Boyer
Aptiv, Warren, OH, USA

Common Design Practices in Automotive Component/Sub-System Integration and Their Negative Impact to EMC
Ronald Missier
Ford Motor Company, Dearborn, Michigan, USA

Amperes of Current at 100 kHz: Bulk Current Injection Measurement Artifact or Radiated EM Disturbance Reality?
Patrick DeRoy
Analog Devices, Norwood, MA, USA

Challenges in Automotive Antenna Design and Testing
Daniel Aloi
Oakland University, Rochester, MI, USA

Expanding Options for EMC Testing of Automotive Components and Full Vehicles
Garth D'Abreu
ETS-Lindgren, Cedar Park, TX, USA

WORKSHOP

UNDERSTANDING EMC REGULATIONS AND STANDARDS
8:30AM - 12:00PM
Room: 128A
Sponsored by IEEE SACCom

Chair:
Henry Benitez, *ElectroMagnetic Investigations, Beaverton, OR, USA*

This session is sponsored by the IEEE EMCS Standards Activities Coordination Committee (SACCom).

The session will include presentations from representatives for the FCC, FDA, NIST, former TCB Chair, CISPR Committees and test lab Accreditation Body.
The session will present some background into the history of EMC and the evolution resulting in the need for EMC regulations and standards. An overview of the IEC process for the development of EMC standards will be provided.

The speakers will form a panel for questions and answers at the end of the session.

PLANNED SPEAKERS & TOPICS

Introductions to EMC Regulations and Standards
Henry Benitez
ElectroMagnetic Investigations, USA

USA FCC Overview
William Hurst
FCC, USA

TCB Overview
Bill Graff
ANAB, USA

NIST Role for EMC Mutual Recognition Agreements
Natalie Rioux
National Institute of Standards and Technology, USA

FDA
Yasaman Ardeshirpour
US Food and Drug Administration

Role of Accreditation Bodies
Megan McConnell
American Association for Laboratory Accreditation, USA

CISPR A/CISPR H
Andy Griffin
Cisco Systems Inc, USA

CISPR I – CISPR 32/35
Ghery Pettit
Pettit EMC Consulting, USA

CISPR D Automotive
Craig Fanning
Elite Electronic Engineering, Inc., USA

WORKSHOP

WIDE BANDGAP (WBG) POWER ELECTRONICS EMI AND SOLUTIONS
8:30AM - 12:00PM
Room: 127C
Sponsored by SC-5

Chair:
Shuo Wang, *University of Florida, Gainesville, FL, USA*

Wide bandgap (WBG) power semiconductors, such as SiC MOSFETs and GaN HEMTs, have higher switching speed and lower conduction power loss compared to conventional Si power semiconductor devices like IGBTs and MOSFETs. They are becoming more popular in modern power electronics applications, such as renewable energy, HVDC, aerospace, and power grid support because they can achieve higher energy efficiency with higher power densities. They are expected to replace conventional Si power devices in the future. However, their high switching frequencies and speeds cause high electromagnetic interference (EMI), which results in extra components for EMI filtering. This cancels the benefits of WBG devices. It is, therefore, important to investigate the EMI characteristics of WBG power electronics and the solutions to reduce the EMI without sacrificing performance, power density, and efficiency. Co-sponsored with IEEE Power Electronics Society, this workshop will focus on the recent advances in modeling, measurement, and suppression of EMI for WBG power electronics systems.

PLANNED SPEAKERS & TOPICS

WBG Power Electronics EMI Workshop Introduction and ONR Missions
LJ Petersen[2], Terry Ericsen[3], Shuo Wang[1]
[1]*University of Florida, USA; 2Office of Naval Research, USA; 3Office of Naval Research, USA*

Radiated EMI of WBG Power Electronics Systems
Shuo Wang
University of Florida, USA

Gate Driver Design with Improved Near-Field Noise Immunity for Medium-Voltage High-Power SiC-based Converters
Dushan Boroyevich[1], He Song[2]
[1]*Virginia Tech, USA;* [2]*Virginia Polytechnic Institute and State University, USA*

Common Mode Electromagnetic Interferences in Power Electronics Network
Seungdeog Choi
Mississippi State University, USA

Scalability of EMC Design and Approach Toward High Power and High-Frequency Power Electronics Systems
Dong Dong
Virginia Tech, USA

High Frequency Electro-Magnetic Signature and Its Inherent Health Information in Power Electronics Converters
Fang Luo
Stony Brook University, USA

EMI Propagation Study in a 10 kV SiC MOSFET based Power Electronics Building Block (PEBB)
Rolando Burgos
Virginia Tech, USA

Workshop Panel Discussion
Shuo Wang
University of Florida, USA

WORKSHOP

AUTOMOTIVE EMC – ELECTRIC VEHICLE – MEASUREMENT AND SIMULATION
1:30PM - 5:00PM
Room: 129A

Chair:
Martin Wiles, *MVG World, Haydock, United Kingdom*
Co-Chair:
Paul Duxbury, *MVG Industries UK Ltd., Haydock, United Kingdom*

This workshop focuses on EMC for Electric Vehicles (EVs) by looking at Simulation and Measurement aspects from the industry.

From a measurement perspective: Regulatory requirements in EMC Standards mean that manufacturers must test EV equipment to EMC including motors, chargers and batteries. Details of the tests and how they are practically implemented into EMC anechoic chambers will be discussed.

From a simulation perspective: It is well known that correlation between table and vehicle tests can differ significantly, and we will go through the different steps of the modelling and simulation of CE tests of EV on-board powertrain chargers to compare results on table/vehicle.

Methodology will be presented on how to generate models of HV devices and especially filters based on measurement reports that can be used in system level simulation in the car model.

Finally, numerical simulations will be presented for EMC problems related to eMobility, e.g. radiation, crosstalk at cable harnesses, emissions from electrical power trains. A digital twin for vehicle immunity tests is also presented to better understand the different exposure situations of EMC tests on a component at vehicle level. Simulation of CISPR test standards will also be presented.

PLANNED SPEAKERS & TOPICS

EMC and eMobility
Martin A. Wiles
MVG World, United Kingdom

Modeling of Conducted Emission Tests of EV On-Board Powertrain Chargers on Table and on Vehicle – Discussions on the Correlation Between Test Results (Draft)
Marco Klingler
Consultant EMC, France

Effect of Aging on the Transfer Impedance of Shielded Connectors and Their Impact on Different EV HV Shielded Cable Arrangements (Draft)
Marco Klingler
Consultant EMC, France

Holistic EMC Simulations for Power Electronics in Electric Vehicles (Draft)
Tyler Dodge
Dassault Systemes Simulia Corp, USA

Optimizing Filter Parameters for High Voltage Power Systems with CISPR-25 Measurements (Draft)
Roman Jobava
EMCoS ltd., Georgia

Advanced EMC Simulations for eMobility
C.J. Reddy
Altair, USA

MONDAY, AUGUST 5
The following information is preliminary and subject to change.

TUTORIAL

BASIC EMC MEASUREMENTS
1:30PM - 5:00PM
Room: 127A
Sponsored by TC-2

Chair:
Monrad Monsen, *Oracle, Broomfield, CO, USA*

There continues to be those entering the EMC field who are performing measurement activity for both emissions and immunity. In addition, there are practitioners who want to get a second opinion to support what they are doing. They are all at least familiar with basic EMC immunity measurements methods that cover a wide range of electromagnetic phenomena. This tutorial will cover both emissions and immunity by highlighting the latest amendment to a major multimedia emissions standard and a selection of immunity testing standards for transients that are more difficult to implement. The transient discussion will also delve into signals that are high power in a very short time. Also included: a description of emission and immunity test sites, the sites that are becoming popular and their validation requirements, as well as an overview of test setups in these facilities. Where appropriate and if time permits, attendees will be asked questions as to what they have learned and will be given an opportunity to question the speakers at a panel discussion at the end of the session.

PLANNED SPEAKERS & TOPICS

Use of Basic Measurement Facilities, Methods and Associated
Ghery Pettit
Pettit EMC Consulting, USA

CISPR 32 Emissions Testing
Ghery Pettit
Pettit EMC Consulting, USA

Performing Immunity Testing to Transient Signals
Tom Braxton
Elite Electronic Engineering Inc, USA

Continuous Wave Immunity
Ross Carlton
Gibbs and Cox Inc, USA

High Power Electromagnetics Test Facilities and Measurement Methods
William A. Radasky
Metatech Corporation, USA

EXHIBIT HOURS:
TUESDAY, AUGUST 6
Exhibits Open: 9:30 AM – 7:00 PM
Welcome Reception: 5:00 PM – 7:00 PM

WEDNESDAY, AUGUST 7
Exhibits Open: 10:00 AM – 5:00 PM

THURSDAY, AUGUST 8
Exhibits Open: 10:00 AM – 1:00 PM

Learn more about the EMC+SIPI 2024 Exhibit Hall on Pages 116 and 117

WORKSHOP

EMC TESTS PASSED, BUT EMI CAN STILL CAUSE FUNCTIONAL SAFETY RISKS. EM RESILIENCE IS NEEDED
1:30PM - 5:00PM
Room: 128B
Sponsored by TC-1

Chair:
Keith Armstrong, *Cherry Clough Consultants Ltd, Stafford, United Kingdom*
Co-Chair:
Davy Pissoort, *Katholieke Universiteit Leuven, Bruges, Belgium*

Rapid developments in electronics now means that safe-enough operation of most products, applications, systems and networks relies on managing the risks that can be caused by errors, malfunctions or failures in programmable digital systems.

Unfortunately: i) They have too many possible digital states to be thoroughly tested, even once. ii) They are non-linear, so we can't interpolate between tested states. E.g., even if 99% of their digital states had passed safety tests, we can't assume that their untested states would be safe. iii) Their inherent unpredictability means they cannot be shown to be safe enough by any practical test program.

EMI is continually being made more likely by the very rapid deployment of 'noisy' electronic technologies, including power conversion, wireless power transfer, and wireless datacoms. There is also very rapid deployment of Machine Learning (ML) and Artificial Intelligence (AI), in the operational control of aircraft, automobiles, trains, aircraft, ships, spacecraft, mining, healthcare, surgery, agriculture, industrial manufacturing, process control, public utilities, etc.

But experts in safety-critical systems say they do not yet know how to ensure the safety of systems that use ML and AI. EM Resilience, described in IEEE 1848-2020, is now vital for managing all kinds of risks, including: Functional safety, Essential Performance (i.e. risks caused by medical equipment), Finance and Reputation, Defense and Security, Mission-criticality. This tutorial introduces the concepts of EM Resilience, and how to start employing it in our work.

PLANNED SPEAKERS & TOPICS

Different Interpretations of "Risk".
Davy Pissoort
Katholieke Universiteit Leuven, Belgium

Why IEEE Standards published the First New Type of Safety Standard: IEEE 1848-2020
Davy Pissoort
Katholieke Universiteit Leuven, Belgium

The Concept of "EM Resilience" in IEEE 1848-2020
Keith Armstrong
Cherry Clough Consultants Ltd, United Kingdom

Reporting on Current and Planned Standardisation in this Important Topic
Keith Armstrong
Cherry Clough Consultants Ltd, United Kingdom

Reporting on Current and Planned Research in this Important Topic
Davy Pissoort
Katholieke Universiteit Leuven, Belgium

Overall Discussion, Q&A
Davy Pissoort
Katholieke Universiteit Leuven, Belgium

TECHNICAL PROGRAM

TECHNICAL PROGRAM

MONDAY, AUGUST 5
The following information is preliminary and subject to change.

MONDAY, AUGUST 5
The following information is preliminary and subject to change.

WORKSHOP

MODELING OF CABLES, CONNECTORS, SHIELDING AND HARNESSES
1:30PM - 5:00PM
Room: 127C
Sponsored by TC-4

Chair:
Charles Jullien, *Safran Electrical & Power, Blagnac, France*
Co-Chair:
Huadong Li, *Molex LLC, Naperville, IL, USA*

This workshop will give a general introduction to modelling of cable construction, termination and grounding for product EMC, present some numerical testing methods for cable and connector shielding, introduce some methods for cable and connector EMC modelling and analysis, demonstrate some examples on EMC simulation and design for cables and connectors. Indeed with the advent of electric transport and the generalization of electronic equipment throughout the world, the transport of energy and information has become a major issue. The multiplication of cabling networks is also a source of propagation of system disturbances. Mastery of EMC within cables requires knowledge of couplings and the ability to predict these couplings using simulation tools. Whether at the level of connectors, cables, shielding, each brick must be known to evaluate the protection solutions at the harness level and then subsequently integrated into its higher-rank system environment. This workshop will provide an update on knowledge and work in the community.

PLANNED SPEAKERS & TOPICS

High-Resolution FDTD Modeling of Braided Wire Shields for the Extraction of Transfer Impedance
Griffin Kowash
EMA 3D, USA

Modeling of Transfer Impedance Characterization Bench Up to 9GHz
Charles Jullien, Thomas Colleter, Danica Cvetkovic
Safran Electrical and Power, France

Measurands of Cable and Connector Shielding Effectiveness and Their Applications
Huadong Li
Molex LLC, USA

Radiation Losses and Crosstalk on Shielded Transmission Lines
Paul Bremner
Robust Physics, USA

Analysis of Parallel Transmission Plate Method for EMC
Gary Biddle
SAMTEC, USA

Simulations and Measurements of Shielding Effectiveness of Connectors in Low Intensity Magnetic Fields
Eugene Mayevksiy
TE Connectivity Ltd Berwyn, USA

Shielding Effectiveness Measurements of Cables with GTEM Cell
Furkan Sahin, Laurens A. Bronckers, Anne Roc'h
Technische Universiteit Eindhoven, Netherlands

WORKSHOP

SMART GRID AND EMC ISSUES
1:30PM - 5:00PM
Room: 128A
Sponsored by SC-1

Chair:
Michael McInerney, *Consultant, Champaign, IL, USA*
Co-Chair:
William Radasky, *Metatech Corporation, Goleta, CA, USA*

Smart Grids (as used in electric power systems) are an important topic worldwide. Smart Grid applications continue to increase, as do EMC issues with components, equipment, and standards. The workshop will begin with a review of the activities of the IEEE EMC Special Committee 1 (SC 1) which coordinates Smart Grid EMC activity within the IEEE EMC Society. Then a short presentation on residential solar power applications and interconnection with the local electrical power provider will be given.

The workshop will continue with a presentation on internal EMC issues in the low voltage grid when prosumers dominate network connections.

The workshop will conclude with two presentations on standards that address EMC issues in Smart Grids. Both existing standards and standards under development will be included. For example, three of four IEEE standards that address EMC testing requirements for smart grid equipment and components are now either completed or nearly complete. A review of the activities of the of the Smart Grid EMC working group in the United States (Smart Electric Power Alliance – SEPA). These activities focus on Smart Grid devices that are exposed to the electromagnetic environment that the grid traverses and where it terminates.

PLANNED SPEAKERS & TOPICS

Introduction to the IEEE EMC Society Special Committee 1 (SC 1) and Residential Solar, Real-World Examples
Michael McInerney
Consultant, USA

Internal EMC Issues in Low Voltage Grid with Significant Share of Prosumers
Robert Smolenski
Uniwersytet Zielonogorski, Poland

IEEE Standards Update: Four Revised EMC Standards for Utility Controls Testing
Gerald J. Ramie
Consultant, USA

SEPA (Smart Electric Power Alliance) Electromagnetic Interoperability Issues Sub-Group (EMIISG) – History, Achievements, and Status
William A. Radasky
Metatech Corporation, USA

TUESDAY, AUGUST 6
The following information is preliminary and subject to change.

TECHNICAL PAPERS

CROSSTALK, JITTER, NOISE COUPLING, BER ANALYSIS #1
10:30AM - 12:00PM
Room: 128B
Sponsored by TC-10

TECHNICAL PAPERS

EMC MEASUREMENTS FOR PCBS AND MEMORY COMPONENTS
10:30AM - 12:00PM
Room: 127B
Sponsored by TC-2

Chair:
Jianmin Zhang, *Google Inc., Mountain View, CA, USA*
Co-Chair:
Francesco de Paulis, *University of L'Aquila, L'Aquila, Italy*

There continues to be those entering the EMC field who are performing measurement activity for both emissions and immunity. In addition, there are practitioners who want to get a second opinion to support what they are doing. They are all at least familiar with basic EMC immunity measurements methods that cover a wide range of electromagnetic phenomena. This tutorial will cover both emissions and immunity by highlighting the latest amendment to a major multimedia emissions standard and a selection of immunity testing standards for transients that are more difficult to implement. The transient discussion will also delve into signals that are high power in a very short time. Also included: a description of emission and immunity test sites, the sites that are becoming popular and their validation requirements, as well as an overview of test setups in these facilities. Where appropriate and if time permits, attendees will be asked questions as to what they have learned and will be given an opportunity to question the speakers at a panel discussion at the end of the session.

PLANNED SPEAKERS & TOPICS

10:30AM
Modeling of Ground-Bounce Induced Jitter for Transition Edges in CMOS Inverters
Anuj Kumar, Jai N. Tripathi
Indian Institute of Technology Jodhpur, India

11:00AM
Modeling of Power Distribution Network (PDN) Noise Coupling Induced Clock Phase Noise
Zhekun Peng[1], Junyong Park[1], Chaofeng Li[1], Joey Stecher[1], Srinivas Venkataraman[2], Xu Wang[2], Granthana Rangaswamy[2], DongHyun (Bill) Kim[1]
[1]*Missouri University of Science and Technology College of Engineering and Computing, USA;* [2]*Meta Platforms Inc, USA*

11:30AM
Modeling of Variability-Aware Supply-Induced Jitter in VMD Circuit Driving Long Transmission Lines
Vinod K. Verma, Bhavani S. Challa, Jai N. Tripathi
[1]*Indian Institute of Technology Jodhpur, India;* [2]*Indian Institute of Technology Jodhpur, India*

Chair:
Ghery Pettit, *Pettit EMC Consulting, Olympia, WA, USA*
Co-Chair:
Ahalya Srikanth, *Ford Motor Company, Lasalle, ON, Canada*

PLANNED SPEAKERS & TOPICS

10:30AM
Octal-Input Zero-Span-Mode Analyzer using FPGA Boards
Satoru Hatsukade[1], Keiji Wada[2]
[1]*Koeki Zaidan Hojin Tetsudo Sogo Gijutsu Kenkyujo, Japan;* [2]*Tokyo Toritsu Daigaku, Japan*

11:00AM
Reactive Magnetic Near-Field to Far-Field Transformation based on Plane Wave Spectrum at PCB Level
Dong-Hao Han, Ming-Jie Pang, Xing-Chang Wei
Zhejiang University, China

11:30AM
Spectrum Analyzer Measurements for EMI Analysis of Memory Components
Praveen Gurrala, Todd Elson
Micron Technology Inc, USA

Photo by Richard Georgarian

TUESDAY, AUGUST 6
The following information is preliminary and subject to change.

TECHNICAL PAPERS

HIGH-SPEED INTERCONNECTS AND NOISE COUPLING
10:30AM - 12:00PM
Room: 128A
Sponsored by TC-10

Chair:
Hanfeng Wang, *Google Inc., Mountain View, CA, USA*
Co-Chair:
Chulsoon Hwang, *Missouri University of Science & Technology, Rolla, MO, USA*

PLANNED SPEAKERS & TOPICS

10:30AM
Vertical Interconnect Technology in Silicon, Package, and Printed Circuit Board (PCB) with Coaxial Structure
Junyong Park1, Chaofeng Li1, Eddie Mok2, Joe Dickson2, Joan Tourné3, DongHyun (Bill) Kim1
1Missouri University of Science and Technology College of Engineering and Computing, USA; 2Wus Printed Circuit (Kunshan) Co., Ltd, USA; 3NextGin Technology, Netherlands

11:00AM
Modeling of Power Distribution Network (PDN) Noise Channel Budget Assessment of ENRZ and PAM4
Francesco de Paulis1, Sherman S. Chen2, Tim Wang-Lee3, Luis Boluna3, Mike Resso3, Brandon Gore4
1University of L'Aquila, Italy; 2Kandou Bus, United Kingdom; 3Keysight Technologies, USA; 4Samtec Inc., South Carolina, USA

Photo by Richard Georgarian

SPECIAL SESSION

MACHINE LEARNING AIDED SI, PI, EMC AND EMI SESSION
10:30AM - 5:00PM
Room: 125AB
Sponsored by SC-3

Chair:
Lijun Jiang, *Missouri University of Science & Technology, Rolla, MO, USA*

Machine learning is having a profound effect on the landscape of every technology domain, including signal integrity, power integrity, EMC, and EMI engineering. This special session will present the state-of-the-art in our IEEE Society. It will focus on the paradigm shift of using machine learning to generate innovations in a way that's differentiate to traditional design and analysis approaches. The session will aim to draw deeper analysis and facilitate open discussions about the pros and cons of machine learning in EMC/EMI, SI and PI.

PLANNED SPEAKERS & TOPICS

10:30AM
Imitation Learning-Based Fast Optimization of SSD Interface for PCIe 6.0 Considering Signal Integrity
Seonguk Choi1, Jihun Kim1, Taein Shin1, Jungmin Ahn1, Keunwoo Kim2, Keeyoung Son3, Joonsang Park1, Jinwook Song4, Kyungsuk Kim4, Sunghoon Chun4, Joungho Kim2
1Korea Advanced Institute of Science and Technology, Korea (the Republic of); 2Korea Advanced Institute of Science and Technology (KAIST), Korea (the Republic of); 3Korea Advanced Institute of Science and Technology (KAIST), Korea (the Republic of);

11:00AM
High-Speed Link Transient Simulation based on Simple Recurrent Unit Method
Hanzhi Ma, Jiarui Qiu, Ling Zhang, Da Li, ErPing Li
Zhejiang University, China

11:30AM
High-Speed Channel Simulator using Neural Language Models
Hyunwook Park1, Yifan Ding2, Ling Zhang3, Natalia Bondarenko4, Hanqin Ye4, Brice Achkir5, Chulsoon Hwang6
1Missouri University of Science and Technology, USA; 2Missouri University of Science and Technology, USA; 3Zhejiang University, China; 4Cisco Systems Inc, USA; 5Cisco Systems, Inc., USA; 6Missouri University of Science and Technology, USA

1:30PM
Efficient Distribution-Based Process Corner Identification using Machine Learning
Andrew Page, Matteo Cocchini, Zhaoqing Chen
International Business Machines Corp, USA

2:00PM
Machine Learning Model for a Trace Referenced to Meshed Ground Planes
Jiyue Zhu, Xiaoyan Xiong, Gang Kang, Karthikeyan Mahadevan
Cadence Design Systems Inc, USA

2:30PM
A Hybrid Algorithm to Dual Sparse Sampling Measurement in Time-Resolved Electromagnetic Near-Field Scanning
Yanming Zhang1, Shichang Gao1, Lijun Jiang2
1The Chinese University of Hong Kong, Hong Kong; 2Missouri University of Science and Technology, USA

3:30PM
Active Machine Learning for Automatic High-Frequency EMI Source Localization
Jinghai Guo1,3, Ling Zhang1, Xin Yan2, Hanzhi Ma1, Da Li1, ErPing Li1
1Zhejiang University, China; 2Missouri University of Science and Technology, USA; 3National Key Laboratory of Intense Pulsed Radiation Simulation and Effect, China

4:00PM
A Fast Metalearning Algorithm for Neural Network Enabled Uncertainty Quantification of Graphene based Interconnects with Passive Shielding
Asha K. Jakhar, Dyuti Basu, Km Dimple, Surila Guglani, Avirup Dasgupta, Sourajeet Roy
Indian Institute of Technology Roorkee, India

4:30PM
Graph Convolutional Neural Network Assisted Genetic Algorithm for PDN Decap Optimization
Haran Manoharan1, Jack Juang1, Ling Zhang2, Hanfeng Wang3, Jingnan Pan3, Kelvin Qiu3, Xu Gao3, Chulsoon Hwang4
1Missouri University of Science and Technology, USA; 2Zhejiang University, China; 3Google LLC, USA; 4Missouri University of Science and Technology, USA

TUESDAY, AUGUST 6

The following information is preliminary and subject to change.

TECHNICAL PAPERS

MODELING TECHNIQUES FOR RADIATION
10:30AM - 12:00PM
Room: 127C
Sponsored by TC-9

Chair:
Shubhankar Marathe, *Amazon Lab126, Santa Clara, CA, USA*

PLANNED SPEAKERS & TOPICS

10:30AM
Effects of the Asynchronous Differential Signals on Radiated Emissions
Jaehoon Kim
Altair Engineering Inc, USA

11:00AM
Impact of Different Voltage Source Models on Radiated Field and Incident Power Density within the Boundary Element Method Formalism
Anna Šušnjara Nejašmić, Dragan Poljak
Sveuciliste u Splitu Fakultet elektrotehnike strojarstva i brodogradnje, Croatia

TUESDAY, AUGUST 6

The following information is preliminary and subject to change.

TECHNICAL PAPERS

COMPUTATIONAL EM
1:30PM - 3:00PM
Room: 127C
Sponsored by TC-9

Chair:
Shaohui Yong, *Marvell Semiconductor Inc., San Jose, CA, USA*

PLANNED SPEAKERS & TOPICS

1:30PM
Efficient Crosstalk Evaluations for Electric Vehicles using FDTD and Transmission Line Simulations
Kyle T. Elsasser[2], Karen Burnham[1]
[1]*Electro Magnetic Applications, Inc., USA;* [2]*Electro Magnetic Applications, Inc, USA*

2:00PM
3D Full Wave Finite Element Method for Advanced IC Pattern-Dependent Effects Analysis
Baolong Li
Cadence Design Systems Inc, USA

2:30PM
A Modal Network Representation of Complex Electrical Structures Suitable for an Overall EMC System Analysis
Hannes Schreiber, Marco Leone
Otto von Guericke Universitat Magdeburg, Germany

ARIZONA FUN FACT

INTRODUCTION TO THE 5 C'S OF ARIZONA

Arizona is a state that is rich in resources which we call the five C's:

Copper
Cotton
Citrus
Cattle
Climate

Since 1910, the state has been the nation's leading source of copper, still producing 68% of the nation's copper today. The Arizona Pima Indians have been growing their luxury Pima cotton variety in this state since the early 1800's and in cooperation with the USDA developed Supima Cotton, which rivals Egyptian cotton in quality, is used as a replacement for silk, and is grown exclusively in the United States.

Arizona's citrus industry predates statehood by decades. The sun and soil are perfect for growing oranges, tangerines, lemons and grapefruit. Yuma County, AZ holds the title of winter lettuce capital of the world for their long growing season, rich soil, and endless sun.

Cattle ranching in Arizona has been a mainstay since the Spanish introduced cattle to the area in the 1600's. The federal government manages about 11.5 million acres of rangeland in Arizona which may be leased for livestock grazing and the state is home to over 900,000 head of cattle.

And of course, you can't talk about Arizona without mentioning the climate. The warm climate with mild winters and hot summers makes it an ideal place for outdoor activities.

TUESDAY, AUGUST 6
The following information is preliminary and subject to change.

TUESDAY, AUGUST 6

TECHNICAL PAPERS

EMC MEASUREMENTS FOR WIRELESS COMMUNICATIONS, PULSED INTERFERENCE AND TRANSISTORS
1:30PM - 3:00PM
Room: 127B
Sponsored by TC-2

Chair:
Tom Braxton, *Elite Electronic Engineering Inc., Bolingbrook, IL, USA*

PLANNED SPEAKERS & TOPICS

1:30PM
Assessing Time-Scale-Dependent Interference Vulnerabilities in Wireless Communications
Michelle Pirrone[1,2], Jordan Bernhardt[2], Adam Wunderlich[2]
[1]*University of Colorado Boulder, USA;* [2]*National Institute of Standards and Technology Communications Technology Laboratory, USA*

2:00PM
Cage-In-Cage Test Setup for Discontinuous Radiated Emissions from GaN Transistors in the 30 MHz–40 GHz Frequency Range
Krzysztof Sieczkarek
Lukasiewicz - Poznan Institute of Technology, Poland

2:30PM
A Device for the Detection of HPEM Interference based on an LPDA Antenna with Nonlinear Load
Robert Michels[1], Martin Schaarschmidt[2], Sven Fisahn[3], Frank Gronwald[4]
[1]*Universitat Siegen, Germany;* [2]*Wehrwissenschaftliches Institut fur Schutztechnologien ABC-Schutz, Germany;* [3]*Bundeswehr Research Institute for Protective Technologies and NBC Protection, Germany;* [4]*Universitat Siegen Fakultat IV Naturwissenschaftlic*

TECHNICAL PAPERS

MATERIAL CHARACTERIZATION FOR SI
1:30PM - 3:00PM
Room: 128B
Sponsored by TC-10

Chair:
Tao Wang, *Missouri University of Science & Technology, San Diego, CA, USA*

Co-Chair:
Baolong Li, *Cadence Design Systems Inc., San Jose, CA, USA*

PLANNED SPEAKERS & TOPICS

1:30PM
Dk and Df Characterization of Low-Loss Dielectric Liquid by Cylindrical Cavity Resonator
Chaofeng Li[1], Mehdi Mousavi[6], Reza Asadi[5], Seyedmostafa Mousavi[8], Reza Vahdani[7], Xiaoning Ye[2], Kai Wang[4], DongHyun (Bill) Kim[3]
[1]*Missouri University of Science and Technology College of Engineering and Computing, USA;* [2]*Intel Corp, Hillsboro, OR, USA;* [3]*Missouri University of Science and Technology College of Engineering and Computing, USA;* [4]*Intel Corporation Hawthorn Farm*

2:00PM
Design of the TM010 Mode Cylindrical Cavity Resonator for PCB Dielectric Characterization
Reza Asadi[1], Chaofeng Li[2], Seyedmostafa Mousavi[3], Mehdi Mousavi[4], Reza Vahdani[5], Xiaoning Ye[6], DongHyun (Bill) Kim[7]
[1]*Missouri University of Science and Technology, USA;* [2]*Missouri University of Science and Technology College of Engineering and Computing, USA;* [3]*Missouri University of Science and Technology, USA;* [4]*Missouri University of Science and Technology, USA*

2:30PM
Analytical Modeling of Partially-Filled TM010-Mode Dielectric Resonator for Accurate DK and DF Extraction
Mehdi Mousavi[1], Chaofeng Li[2], Reza Asadi[3], Seyedmostafa Mousavi[4], Reza Vahdani[5], Xiaoning Ye[6], Mina Esmaeelpour[1], DongHyun (Bill) Kim[7]
[1]*Missouri University of Science and Technology, USA;* [2]*Missouri University of Science and Technology College of Engineering and Computing, USA;* [3]*Missouri University of Science and Technology, USA;* [4]*Missouri University of Science and Technology, USA*

ARIZONA FUN FACT A DEEPER DIVE INTO COPPER

Copper is one of the most sought-after and prevalent resources in Arizona, and there is no question why it is one of the 5 C's. Copper found throughout the state was used by native Americans for tools, weapons, jewelry, and painting, but it later became a significant source of power. The dome of the State Capital is even cover in 2,500 pounds of copper.

Copper in Morenci, AZ was first discovered in 1863 during the civil war by General James Carleton and 1st Infantry California Volunteers. According to AZCentral, "Morenci was the fifth largest copper producer in the world, producing 550,000 tons of copper during 2016," (Nothaft, 2017). They remain the 5th largest copper producer in the world and the largest mine in North America.

Since 1910, the state has been the nation's leading source of copper, still producing 68% of the nation's copper today.

TUESDAY, AUGUST 6
The following information is preliminary and subject to change.

TECHNICAL PAPERS

POWER DISTRIBUTION NETWORKS AND DECOUPLING #1
1:30PM - 3:00PM
Room: 128A
Sponsored by TC-10

Chair:
Kinger Cai, *Intel Corporation, San Jose, CA, USA*

Co-Chair:
Jingook Kim, *Ulsan National Institute of Science & Technology (UNIST), Ulsan, Korea (the Republic of)*

PLANNED SPEAKERS & TOPICS

1:30PM
Innovatiave Decoupling Capacitor Solutions for Power Delivery Improvement on Advanced FPGA Packages
Wei Liu, Guang Chen, Jenny Xiaohong Jiang, Ed Milligan
Intel Corporation, USA

2:00PM
Experimental Study of PCB Vibration Induced by MLCC Assembly Orientation and Process Variations
Yifan Ding[1], Mingfeng Xue[2], Jianmin Zhang[3], Xin Hua[2], Benjamin Leung[2], Eric A. MacIntosh[2], Chulsoon Hwang[4]
[1]*Missouri University of Science and Technology, USA;* [2]*Google Inc, USA;* [3]*Google Inc., USA;* [4]*Missouri University of Science and Technology, USA*

2:30PM
Novel Interdigital Capacitor-type Power Distribution Network Design for Power Noise Suppression in Redistribution Layer Interposer
Haojie Wu[1], Xinglin Sun[1], Keeyoung Son[3], Jonghyun Hong[3], Yin Sun[2,4], Joungho Kim[3]
[1]*Zhejiang University, China;* [2]*Ningbo Detool Technology Co. Ltd, China;* [3]*Korea Advanced Institute of Science and Technology, Korea (the Republic of);* [4]*Missouri University of Science and Technology, USA*

TECHNICAL PAPERS

AEROSPACE EMC AND SHIELDING
3:30PM - 5:00PM
Room: 128A
Sponsored by TC-8

Chair:
Jen Dimov, *NASA, Greenbelt, MD, USA*

Co-Chairs:
Jim Lukash, *Lockheed Martin Space Systems, Palo Alto, CA, USA*
John Kraemer, *Rockwell Collins Inc., Marion, IA, USA*

PLANNED SPEAKERS & TOPICS

3:30PM
Dk and Df Characterization of Low-Loss Dielectric Chip Level Sneak Circuits in Space Avionics and Potential for EMC Problems
Reinaldo Perez
Jet Propulsion Laboratory, USA

4:00PM
HIRF Avoidance Approach for Advanced Air Mobility Vehicles
Truong X. Nguyen
NASA Langley Research Center, USA

4:30PM
Broad Band Measurement of the Shielding Effectiveness of Carbon Fiber Composite Panels for Aerospace Applications
Jinsoo Kim, Pablo Trejo, Jonathan Wang, Ju Hui Yoo, Jason Ehrich, Daniel Dijamco, Kattris Lee, Clifton Courtney, Leonardo Sierra
Lockheed Martin Corporation Aerospace and Defense, USA

HAVE YOU CONSIDERED TAKING YOUR IEEE MEMBERSHIP TO THE NEXT LEVEL?

SENIOR MEMBER AND FELLOW ELEVATION EVENT

TUESDAY, AUGUST 6, 2024

2:30 – 3:30 pm
Senior Member Discussion

3:30 – 4:00 pm:
Fellow Member Discussion

Join us at this informal meeting where you can quicky learn about elevating your current IEEE membership to the Senior or Fellow category.

Being a Senior or Fellow Member is a prestigious honor within the IEEE community. It signifies your accomplishments and expertise in your field. But how do you apply for these elevations in membership? Do you qualify for the next level?

Join us to find out the next steps needed to enhance your career with an elevated IEEE membership. We will have experts on hand to answer any question you may have on these membership elevations, but were afraid to ask, or didn't know who to ask.

TUESDAY, AUGUST 6
The following information is preliminary and subject to change.

EMC MEASUREMENTS – PROBES
3:30PM - 5:00PM
Room: 127B
Sponsored by TC-2

TECHNICAL PAPERS

Chair:
Ghery Pettit, *Pettit EMC Consulting, Olympia, WA, USA*
Co-Chair:
Monrad Monsen, *Oracle, Broomfield, CO, USA*

PLANNED SPEAKERS & TOPICS

3:30PM
On the Feasibility of a Direct Injection Probe with a Capacitively Coupled Return and Integrated Voltage Monitor
Aaron Harmon, Daniel Szanto, Victor Khilkevich, Daryl Beetner
Missouri University of Science and Technology, USA

4:00PM
Design of Waveguide Probe for EMI Characterization of DDR5 SODIMM
Xiangrui Su, Junho Joo, Chulsoon Hwang
Missouri University of Science and Technology, USA

4:30PM
Full Modal-Admittance Matrix In-Circuit Measurement by Multiple Inductive Probes
Simone Negri, Giordano Spadacini, Flavia Grassi, Sergio Pignari
Politecnico di Milano, Italy

Photo by Richard Georgarian

MULTI-PHYSICS MODELING
3:30PM - 5:00PM
Room: 127C
Sponsored by TC-9

TECHNICAL PAPERS

Chair:
Shaowu Huang, *Marvell Semiconductor Inc., Cupertino, CA, USA*

PLANNED SPEAKERS & TOPICS

3:30PM
The Study on How Model Selection Propagates in High Frequency Electromagnetic-Thermal Dosimetry
Mario Cvetković[1], Dragan Poljak[1], Hrvoje Dodig[2]
[1]*Sveuciliste u Splitu Fakultet elektrotehnike strojarstva i brodogradnje, Croatia;* [2]*Sveuciliste u Splitu Pomorski Fakultet, Croatia*

4:00PM
Modeling Non-Linearity in Laplace Domain
Naomi de Mejanes, Olivier Maurice
ArianeGroup SAS, France

SIMULATION AND MODELING TECHNIQUES #1
3:30PM - 5:00PM
Room: 128B
Sponsored by TC-10

TECHNICAL PAPERS

Chair:
Zhen Zhou, *Intel Corporation, Chandler, AZ, USA*

PLANNED SPEAKERS & TOPICS

3:30PM
Truncated Gaussian Monte Carlo Circuit Simulation using an Extracted Resistor Model With Random Power Loads
Jeffrey L. Cutcher
Ford Motor Company, USA

4:00PM
Far Power Referencing Impact on High-Speed Memory Interface
Rishik Bazaz, Yanjie Zhu
Intel Corp, USA

4:30PM
AMI DLL Hook: A Novel IBIS-AMI Simulation Debugging Method for Model Users
Chuanyu Li, Alaeddin A Aydiner, Sleiman Bou-sleiman, Xinjun Zhang
Intel Corporation, USA

WEDNESDAY, AUGUST 7
The following information is preliminary and subject to change.

TECHNICAL PAPERS

INTRODUCTION TO MODELING TECHNIQUES FOR EMC+SIPI PROBLEMS
8:30AM - 12:00PM
Room: 128A
Sponsored by TC-9

Co-Chairs:
Giulio Antonini, *Universita degli Studi dell'Aquila, L'Aquila, Italy*

Experts:
Chuck Bunting, *Oklahoma State University, Stillwater, OK, USA*

Lijun Jiang, *Missouri University of Science & Technology, Rolla, MO, USA*

Bruce Archambeault, *Missouri University of Science & Technology, Rolla, MO, USA*

Jonas Ekman, *Luleå University of Technology, Sweden*

This tutorial will provide an introduction to commonly used numerical modeling techniques for EMC+SIPI problems 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 its strengths and weaknesses, so engineers can decide which techniques are appropriate for their types of problems.

In this tutorial, the different areas of application of power electronics and the resulting requirements for electromagnetic compatibility as well as methods for controlling them are presented, explained and discussed.

PLANNED SPEAKERS & TOPICS

Introduction to the Finite Element Method
Chuck Bunting
Oklahoma State University, USA

Modeling with the Method of Moments
Lijun Jiang
Missouri University of Science and Technology, USA

Introduction to the Finite Difference Time Domain Technique
Bruce Archambeault
IBM, USA

Introduction to the Partial Element Equivalent Circuit (PEEC) Approach Applied to EMC+SI/PI Problems
Jonas Ekman
Luleå University of Technology, Sweden

Efficient and High-Fidelity Full Wave Methods for Large Platform EMC Analysis
Giulio Antonini
Universita degli Studi dell'Aquila, Italy

TECHNICAL PAPERS

EMC TESTING BASICS
8:30AM - 12:00PM
Room: 125AB
Sponsored by TC-2

Chair:
Jack McFadden, *ETS-Lindgren, Cedar Park, TX, USA*
Co-Chair:
Bob Mitchell, *TUV, Littleton, MA, USA*

Due to the popularity of this tutorial when it was presented in the IEEE EMC+SIPI Symposia held virtually in 2020 and 2021 as well as in person in 2022 and 2023, we have brought it back with many of the original topics and speakers! This tutorial will cover basic topics in EMC testing – from bench top analysis to designing a new laboratory/test capability. Presentations will provide practical information and real-world knowledge that can be implemented immediately. While the topics may be basic to EMC testing, we will also discuss nuances that can challenge even the most experienced EMC test practitioner. Speakers include experts who are actively involved in designing, managing, or supporting EMC test facilities. Attendees will quickly learn the best practices in each topic area.

PLANNED SPEAKERS & TOPICS

The Physics of EMC Emissions Measurements
Todd Hubing
LearnEMC, USA

Understanding and using EMC Antennas
Alistair Duffy
De Montfort University, United Kingdom

Calibration of EMC Test Equipment
Ross Carlton
Gibbs and Cox Inc, USA

EMC Test Planning
Jack McFadden
ETS-Lindgren, USA

EMC Lab Design: An Overview of the Process, Possibilities, and Issues
Bob Mitchell
TUV, USA

ARIZONA FUN FACT

CATTLE IN ARIZONA

In 1540, Francisco Vasquez de Coronad brought the first cattle over to Arizona from Mexico. The rest was history. Not until 1872 did Americans begin ranching in Arizona – the railroad industry a driving force.

Arizona railroads paved the way for ranching, making the land more accessible and available to purchase by early settlers: "that the railroads, the Atlantic & Pacific, now the Atchison, Topeka & Santa Fé, and the Southern Pacific were constructed across the territory, thus opening up millions of acres of rich grazing lands for settlement, and putting the great markets of the East within easy reach," explains author Bert Haskett (Haskett, 1935). Another important factor was the American Homestead act of 1862, which granted any adult U.S citizen 160 acres of surveyed government land with the agreement to improve it.

As more families and ranchers began settling in the west, the prairies began to develop into the resource-rich farming committees that we recognize today. The cattle industry continues to be an influential part of the Arizona economy, with over 7,500 farms and 980,000 head of cattle across the state.

TUTORIAL

ESD/EMC NEEDS IN AUTOMOTIVE HIGH-SPEED LINKS (INCLUDING ETHERNET): OPTIMIZING SEMICONDUCTOR ROBUSTNESS
8:30AM - 12:00PM
Room: 127B

Chair:
Sudhama Shastri, *Nexperia, Phoenix, AZ, USA*
Co-Chair:
Patrick DeRoy, *Analog Devices Inc., Norwood, MA, USA*

High-speed data-links are popular in automotive applications, with speeds ranging from 10 to 1000Mbps, and also into the 10Gbps range. Ethernet is preferred with its ease of bi-directional communication, a single pair of conductors, a standardized solution to prevent vendor lock-in, etc. At the same time, traditional CAN networks may be supplanted by 10-50Mbps protocols. One such emerging standard is the 10BaseT1S Ethernet, and another is the 100Mbps A2B 2.0. Automotive Ethernet enables zonal architecture with high-performance compute connections, on-board telematics, and sensor networks (LiDAR and RADAR). A2B is a high-bandwidth, bi-directional digital audio bus for next-gen audio/infotainment, also supporting applications such as road noise cancellation in which low latency is critical. ESD requirements in these applications are stringent and in the range of +/-25kV air discharge (and +/-15kV contact discharge) under certain OEM specifications, which reference the ISO 10605 standard (as well as IEC 61000-4-2).Another requirement is to maintain communication links and signal integrity when placed near other digital noise sources as well as the various antennas within the vehicle. The OPEN Alliance standardization effort has developed clear recommendations for implementing high-speed IVNs, while Tier1s and OEMs have the freedom to deviate from guidelines as desired.

We will present challenges of maintaining data/signal integrity while satisfying ESD/EMC standards. We will also present the idea of external ESD protection and how this can be an elegant solution to the signal-integrity + ESD requirement especially for UTP cables, and how system-level SEED models can be used to accurately simulate the ESD strike in a very non-linear system. Optimal placement of protection devices is explored, as well as alternative voltage ratings/needs.

PLANNED SPEAKERS & TOPICS

Introduction: Automotive ESD Standards and Requirements
Sudhama Shastri[1], Patrick DeRoy[2]
[1]*Nexperia, USA;* [2]*Analog Devices Inc, USA*

Networking EMC Needs and Challenges: A Car-Maker's Perspective
Ajeya Gupta
Ford Motor Corporation, USA

Taming the 3-Headed Dragon: Unpowered ESD Survivability, Powered ESD Resilience and RF/Transient Immunity Robustness
Patrick DeRoy[1], Abhishek Ramanujan[2]
[1]*Analog Devices Inc, USA;* [2]*Analog Devices International, Ireland*

Off-Chip (Standalone) ESD Protection Solutions for Maintaining Robustness and Signal-Integrity
Sudhama Shastri[1], Andreas Hardock[2], Taimoor Ahmed1, Sergej Bub[3]
[1]*Nexperia, USA;* [2]*Nexperia, Germany;* [3]*Nexperia BV, Netherlands*

WORKSHOP

INTRODUCTION TO MACHINE LEARNING FOR ELECTROMAGNETIC COMPATIBILITY AND SIGNAL INTEGRITY
8:30AM - 12:00PM
Room: 127C
Sponsored by SC-3

Chair:
Zhong Chen, *ETS-Lindgren, Cedar Park, TX, USA*
Co-Chair:
Janet O'Neil, *ETS-Lindgren, Cedar Park, TX, USA*

This workshop offers an accessible introduction to machine learning (ML) in the context of Electromagnetic Compatibility (EMC) and Signal Integrity (SI), with a special focus on various ML techniques, including compressed sensing. Tailored for newcomers, the workshop aims to provide an entry point for understanding how ML applies to EMC and SI.

Speakers will present basic concepts such as learning sparse representations and the principles of compressive sensing, as well as reinforcement learning and other ML techniques. Additionally, interactive and graph-based ML approaches will be introduced to demonstrate how they can address challenges in EMC and SI. While real-world examples will be used to illustrate concepts, the main goal is to foster a solid understanding of ML principles.

By the end of the workshop, participants will have been introduced to ML concepts relevant to EMC and SI, including techniques such as compressed sensing and reinforcement learning, and their potential applications. Further exploration may be needed, but attendees will have gained valuable insights to start exploring the application of ML in EMC and SI contexts.

PLANNED SPEAKERS & TOPICS

Compressed Sensing Applications in EMC Chamber Evaluations
Zhong Chen
ETS-Lindgren, USA

Learning Sparse Representations
Douglas Cochran
Arizona State University, USA

Reinforcement Learning for PDN Optimization
Chulsoon Hwang
Missouri University of Science and Technology, USA

Advancements in Artificial Intelligence for Antenna based EMC Measurement Optimization
Dennis Lewis
The Boeing Company, USA

Harnessing Interactive and Graph-Based Machine Learning for EMC
Gautam Dasarathy
Arizona State University, USA

WEDNESDAY, AUGUST 7
The following information is preliminary and subject to change.

TUTORIAL

SIPI CHALLENGES AND INNOVATIONS IN HIGH-SPEED SYSTEM AND DEVICE INTERCONNECTS
8:30AM - 12:00PM
Room: 128B
Sponsored by TC-10

Chair:
Thanh Tran, *Rice University, Houston, TX, USA*

Today's fastest serial digital interconnects of systems or devices run at data rates in multi-gigahertz range, and these fast switching signals can generate considerable noise and radiation which degrade and limit system performance. Maintaining good signal integrity of these signals is very challenging as interconnecting traces on a printed circuit board (PCB) or interconnecting cables in AI/cloud computing servers become very lossy which causes major issues related digital timing margin, clock recovery, inter-symbol interference, and electromagnetic radiation, etc.

This tutorial session consists of presentations from experts in different industries to discuss challenges and innovations in signal and power integrity to advance next generation compute such as AI servers, aerospace and defense electronics.

The main topics covered in this tutorial session are:

- Challenges in high-speed system and device interconnects
- Innovations in high-speed SERDES enabling data higher than 112Gbps

PLANNED SPEAKERS & TOPICS

Enabling High-Speed Interconnects for Future High Performance Computer Applications
Walker Turner
NVIDIA, USA

Methodology for Designing Accurate High-Speed Interconnects of ASICs/FPGAs on a Printed Circuit Board (PCB)
Wendel Williamson
Raytheon Technologies, USA

Printed Circuit Board Compensation Techniques for Wideband Analog Filter Designs
Thanh T. Tran
Rice University, USA

EMI Noise Mitigation in High-Frequency GaN-Based Converters
Qiang Li
Virginia Polytechnic Institute and State University, USA

WEDNESDAY, AUGUST 7
The following information is preliminary and subject to change.

WORKSHOP

STREAMLINED POWER INTEGRITY MODEL (SPIM) WORKSHOP
8:30AM - 12:00PM
Room: 127A

Sponsored by TC-10

Chair:
Kinger Cai, *Intel Corporation, San Jose, CA, USA*
Expert:
Chi-Te Chen, *Intel Corporation, San Jose, CA, USA*
Co-Chair:
Ji Zheng, *Aurora-System, San Jose, CA, USA*

IBIS Open Forum has approved BIRD223.1: Add Support SPIM in IBIS for platform power delivery network design review/sign-off and optimization, which uses the same philosophy as that for the invention of original IBIS for platform SI analysis, through providing minimum IP sensitivity information from chip vendors while sufficient for platform designs.

This workshop starts with an introduction to SPIM background, architecture, Tree structure in .spim file, and its linkage with .ibs.

It is followed by the SPIM creation cookbook, which includes major steps of (1) Pre-modeling setups; (2) AC S parameter model generation & correlation, (3) DC R-network model generation & Correlation; and (4) SPIM creation in BIRD223.1 syntax and validation in FastPI.

The workshop will have the demo of two SPIM model creations and applications in supporting platform PDN design review/sign-off and optimization, one for Package-less power rails in industry-standard LPDDR5X devices, and the other for chip (PKG) level power rails in a SOC design.

The workshop will wrap up with SPIM in FastPI Roadmap.

PLANNED SPEAKERS & TOPICS

Platform PI Design Status Quo
Baolong Li
Cadence Design Systems Inc, USA

IBIS-approved BIRD223.1: Add support SPIM in IBIS
Kinger Cai
Intel Corporation, USA

SPIM Cookbook and Demo
Chi-te Chen
Intel Corporation, USA

FastPI support SPIM and demo
Ji Zheng
Aurora-System, USA

WEDNESDAY, AUGUST 7
The following information is preliminary and subject to change.

TECHNICAL PAPERS

CONTROL OF ELECTROMAGNETIC INTERFERENCE: SHIELDING, FILTERING, MODELING, AND PREDICTION, PART I
1:30PM - 3:00PM
Room: 127A
Sponsored by TC-4

Chair:
Daryl Beetner, *Missouri University of Science & Technology, Rolla, MO, USA*

Co-Chairs:
Charles Jullien, *Safran Electrical & Power, Blagnac, France*
Victor Khilkevich, *Missouri University of Science & Technology, Rolla, MO, USA*

PLANNED SPEAKERS & TOPICS

1:30PM
Operation of the Bifilar Common-Mode Voltage Suppressor
James McLean
TDK R&D Corp., USA

2:00PM
Analysis of Common-Mode Filter Effect for Induced Voltage by Bulk Current Injection using Chain Parameter Matrix
Nobuo Kuwabara[1], Tohlu Matsushima[1], Yuki Fukumoto[2]
[1]*Kyushu Kogyo Daigaku, Japan;* [2]*Kyushu Institute of Technology, Japan*

2:30PM
EMC Modeling and Simulation of AFCI in Consumer Home
Yuanzhuo Liu[1], Qialoei Huang[2], Amrithaa Seshadri[2], Behrad Aria[2], Akshay Mohan[3], Rohit Sammeta[2], Jagan Rajagopalan[4]
[1]*Amazon.com Inc, USA;* [2]*Amazon Lab126, USA;* [3]*Amazon Lab126, USA;* [4]*Amazon Lab126, USA*

TECHNICAL PAPERS

ELECTROSTATIC DISCHARGE
1:30PM - 3:00PM
Room: 125AB
Sponsored by TC-5

Chair:
Michael McInerney, *Consultant, Champaign, IL, USA*
Co-Chair:
William Radasky, *Metatech Corporation, Goleta, CA, USA*

PLANNED SPEAKERS & TOPICS

1:30PM
A Model for Corona Streamer Propagation on Glass during an Air Discharge
Zhekun Peng[1], Jianchi Zhou[3], Darryl Kostka[3], David Pommerenke[2], Daryl Beetner[1]
[1]*EMC Laboratory, Missouri University of Science and Technology, USA;* [2]*Technische Universitat Graz, Austria;* [3]*Apple Inc, USA*

2:00PM
Metamaterial-Enabled Localization of Electrostatic Discharges using Time Reversal
Elias Le Boudec[1], David Martinez[2], Nicolas Mora[5], Marcos Rubinstein[3], Felix Vega[2], Islem Yahi[4]
[1]*Ecole Polytechnique Federale de Lausanne, Switzerland;* [2]*Technology Innovation Institute, United Arab Emirates;* [3]*University of Applied Sciences Western Switzerland, Switzerland;* [4]*Technology Innovation Institute, United Arab Emirates;* [5]*Universida*

2:30PM
Time-Dependent Resistance-Based Dynamic Behavior Model of Spark Gap Device under ESD Pulse
Mingming Yang[1], Guang-Xiao Luo[1], Jianfang Dang[1], Zhaolong Xue[1], Weidong Zhang[2]
[1]*North China Electric Power University, China;* [2]*North China Electric Power University, China*

Photo by Karthik Vepuri

WEDNESDAY, AUGUST 7
The following information is preliminary and subject to change.

TECHNICAL PAPERS

MODELING TECHNIQUES FOR RADIATED AND CONDUCTED SUSCEPTIBILITY
1:30PM - 3:00PM
Room: 127B
Sponsored by TC-9

TECHNICAL PAPERS

SI/PI/EMI CO-DESIGN
1:30PM - 3:00PM
Room: 128B
Sponsored by TC-10

Chair:
Ying Cao, *Apple Inc, Santa Clara, CA, USA*

PLANNED SPEAKERS & TOPICS

1:30PM
Radiated Susceptibility Simulations From 40-100 GHz (A New Frontier)
David Norte
Ball Aerospace, USA

2:00PM
RS103 Nonuniform Exposure of Shielded Cables
David Norte
BAE Systems, Inc., USA

2:30PM
The Impact of the CS115 Excitation on the Performance of Digital Interconnects – A Time and Frequency Domain Approach
David Norte
Ball Aerospace, USA

Chair:
Bumhee Bae, *Samsung Electronics, Suwon-si, Korea (the Republic of)*
Co-Chair:
Ling Zhang, *Zhejiang University, Hangzhou, China*

PLANNED SPEAKERS & TOPICS

1:30PM
Reducing EMI in Wire-Bond BGA IC-Chips through Magnetic Dipole Moment Control
Satoshi Tago, Keita Sasaki, Yasuhiro Ochiai
Sony Semiconductor Solutions Kabushiki Kaisha, Japan

2:00PM
Porous Absorber for Electromagnetic Radiation Suppression in Chip-Packages
Chaolong Lin, Jiaqi Xing, Da Li, Ling Zhang, Hanzhi Ma, ErPing Li
Zhejiang University, China

2:30PM
Novel DIE-PKG-PCB Co-Design Methodology for High Speed Interfaces for Complex Automotive SoCs
Rishi Bhooshan[1], Ajay K. Sharma[2], Swapnil Tiwari[1], Sachin Kumar[1], Sanamdeep Singh[1], Osvaldo Romero[3], Bihua He[3], Jesus Armando Sanchez Carranza[3]
[1]NXP Semiconductor India Pvt Ltd, India; [2]NXP Semiconductors India Pvt Ltd, Noida, U.P , INDIA, India; [3]NXP Semiconductors NV, Netherlands

Photo by Richard Georgarian

WEDNESDAY, AUGUST 7
The following information is preliminary and subject to change.

TECHNICAL PAPERS

SIMULATION AND MODELING TECHNIQUES #2
1:30PM - 3:00PM
Room: 128A
Sponsored by TC-10

Chair:
Yuandong Guo, *Missouri University of Science & Technology, Foster City, CA, USA*

Co-Chair:
Zhichao Zhang, *IEEE, Chandler, AZ, USA*

PLANNED SPEAKERS & TOPICS

1:30PM
The Worst-Case Eye Prediction Algorithm for MIPI C-PHY Signaling on Mobile Artificial Intelligence (AI) Chips
Yu-Ying Cheng[1], Suani-Kai Yang[2], Shih-Hsien Wu[2], Tzong-Lin Wu[3]
[1]*National Taiwan University, Taiwan;* [2]*Industrial Technology Research Institute, Taiwan;* [3]*National Taiwan University, Taiwan*

2:00PM
Modelling Weave Effect in PCBs using 2D Cross-Sectional Analysis
Victor Khilkevich[1], Scott Hinaga[2]
[1]*Missouri University of Science and Technology, USA;* [2]*Cisco Systems, USA*

2:30PM
A Sub-Channel based Chord Signaling Channel Analysis Method
Sherman S. Chen[1], Nithin VM[1], Brian Holden[1], Bob (Pushui) Xu[2], Francesco de Paulis[3]
[1]*Kandou Bus, United Kingdom;* [2]*Analogix semiconductor Inc., USA;* [3]*University of L'Aquila, Italy*

ARIZONA FUN FACT

COTTON IN ARIZONA

The Arizona Pima Indians have been growing their luxury Pima cotton variety in this state since the early 1800's – a technique so sophisticated that it rivals Egyptian Cotton in quality, and is used as a silk replacement.

In cooperation with the USDA, Supima brand cotton is grown exclusively in the United States and is used by countless U.S apparel companies.

WEDNESDAY, AUGUST 7
The following information is preliminary and subject to change.

TECHNICAL PAPERS

POSTER SESSION
1:30PM - 3:30PM
Room: Exhibit Floor

Dispensible Multi-Functional EMI Gap Filler for ADAS Applications
Bongjoon Lee, Michael Trebisovski, John Timmerman
Henkel Corporation, USA

Electromagnetic Shielding Analysis of Bent Slot Loaded with Absorbing Materials
Jong Hwa Kwon[1], Hyun Ho Park[2]
[1]*Electronics and Telecommunications Research Institute, Korea (the Republic of);* [2]*The University of Suwon, Korea (the Republic of)*

Advanced Electrically Conductive Silicones for EMI/EMC Applications
Shuangbing Han[1], Dan Zhao[1], Joe Sootsman[3], Brandon Crosby[1], Dan Marple[1], Julia Sunderland[4], Kyle McDonald[2], Scott Fleming[2], Alex Axtell1, Yanhu Wei[1], Tom Bekemeier[2], Bin Fan[2]
[1]*Dow Silicones Corporation, USA;* [2]*The Dow Chemical Company, USA;* [3]*Dow Chemical, USA;* [4]*The Dow Chemical Company, USA*

Innovative Immunity Testing Method of Train Detection Systems to MF from Rolling Stock
Krzysztof Sieczkarek
Lukasiewicz - Poznan Institute of Technology, Poland

A Novel System to Measure Composite Electromagnetic Fields in Underground Mines
Ronald D. Jacksha[1], Carl Sunderman[2], Chenming Zhou[3]
[1]*CDC NIOSH, USA;* [2]*National Institute for Occupational Safety and Health, USA;* [3]*National Institute for Occupational Safety and Health, USA*

Evaluation of the Common-Mode Current Propagation Paths in Motor Drive Systems
Andrea Zingariello, Gerd Griepentrog
Technische Universitat Darmstadt, Germany

The Design and Simulation of a Broadband Low RCS Radome
Xianben Liu[1,2], Shuangshuang Meng[1,2], Wenyuan Hao[1,2], Mingbin Hu[1,2], Shaozhong Fu[1,2], Cheng Zhu[1,2]
[1]*Xidian University School of Electronic Engineering, China;* [2]*Shaanxi Key Laboratory of Large-Scale Electromagnetic Computing, China*

PCB Parameter Extraction for Frequencies up to 120 GHz
Kaisheng Hu
Ciena, Canada

The Generation of Hybrid-Mode Orbital Angular Momentum Beams based on Holographic Metasurfaces
Shaozhong Fu[1,2], Shuangshuang Meng[1,2], Liangliang Hu[1,2], Xianben Liu[1,2], Mingbin Hu[1,2], Wenyuan Hao[1,2], Cheng Zhu[1,2]
[1]*Xidian University School of Electronic Engineering, China;* [2]*Shaanxi Key Laboratory of Large-Scale Electromagnetic Computing, China*

Research on Shielding Performance of the Secondary Cable Armor Layer in Smart Substation
Zhonglu Liu, Weidong Zhang, Guangxiao Luo
North China Electric Power University, China

PCI Express Package Level Interconnection for Chiplet Design
Yang Wu[1], Xiaofeng Li[1], Yi Zeng[1], Huichao Weng[2], Amer Samarah[1], Wenjuan Zhang[2]
[1]*Intel Corporation, USA;* [2]*Montage Technology Inc., China*

Switching Transient Immunity Analysis of Wireless Communication Unit in Smart Substation
Weidong Zhang
North China Electric Power University, China

New Lightning Channel-Base Current Functions
Nathan S. Roberts
NASA, USA

Dual-Band Dual-Circularly Polarized Transmitarray Antenna
Boxiang Yang[1], Yuanjun Shen[1], Lei Chen[1], Tianling Zhang[2]
[1]*Xidian University School of Electronic Engineering, China;* [2]*Xidian University Key Laboratory of Antennas and Microwave Technology, China*

A Dual-Port Antenna Integrated Co-Axial Filter for Port-Isolation Enhancement
Rui He, Yiqi Zhang, Yang Zhou, Jian Ren
Xidian University, China

Design of Wideband Phased Array Feed based on Low-profile Vivaldi Antenna
Tinglei Shi[2], Honghuan Zhu[2], Yuanjun Shen[2], Lei Chen[2], Tianling Zhang[1]
[1]*Xidian University Key Laboratory of Antennas and Microwave Technology, China;* [2]*Xidian University School of Electronic Engineering, China*

1-bit Amplifying Reconfigurable Intelligent Transmitarray Element Design
Yongji Chen[1], Xuenan Ren[1], Tao Yin[1], Shen Yin[1], Jian Ren[2], Yinzeng Yin[1]
[1]*Xidian University School of Electronic Engineering, China;* [2]*Xidian University, China*

Analytical Solution of the Lightning Transmission Line (TL) Model, at the Speed of Light
Nathan S. Roberts
NASA, USA

Analysis of Radiated Emission Due to the Wire-Wound Type Power Inductor in High Voltage DC to DC Converter
Jungrae Ha, Minho Kim, Sangwoo Kim, Hyewon Lee, Chuleui Park, Sangwon Yun
HL Mando Corp, Korea (the Republic of)

RFI Improvement of MIPI C-PHY CDR Signal for Stub Filter using Transmission Line Structure
Hyoseob Lee[1,2], SoYoung Kim[1]
[1]*Sungkyunkwan University College of Engineering, Korea (the Republic of);* [2]*Samsung Electronics, Korea (the Republic of)*

WEDNESDAY, AUGUST 7
The following information is preliminary and subject to change.

WORKSHOP

FUTURE EMC/EMI/SI/PI TECHNOLOGIES WITH MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE
1:30PM - 5:00PM
Room: 127C
Sponsored by SC-3

Chair:
Lijun Jiang, *Missouri University of Science & Technology, Rolla, MO, USA*
Co-Chair:
Alistair Duffy, *De Montfort University, Loughborough, United Kingdom*

Machine learning (ML) and artificial intelligence (AI) are heavily investigated with the good will to advance technologies into a new age. No matter if we like it or doubt it, ML and AI will be part of the future and EMC Society has to consider how to work with ML and AI technologies.

This workshop intends to picture the potential future that we could vision or would like to have for EMC/EMI/SI/PI technologies with the augmentation of ML and AI. Experts from industries and academia are invited to present their ideas and exchange opinions. Instead of focusing on technical details, this workshop focuses on visions. It does not applaud or criticize ML and AI. It presents possible merits and potential concerns to the EMC society.

This workshop is part of EMC SC3 "ML and AI in EMC and SIPI" initiatives. After all presentations, a discussion forum will be open to all audiences for opinion exchanges.

PLANNED SPEAKERS & TOPICS

EMC SC3 ML and AI in EMC and SIPI
Alistair Duffy
De Montfort University, United Kingdom

Large Language (LLM) and Machine Learning based Design for Signal Integrity and Power Integrity
Joungho Kim
Korea Advanced Institute of Science and Technology (KAIST), Korea (the Republic of)

Creating an SI/PI Database for ML Applications!?
Christian Schuster
Technische Universitat Hamburg Studiendekanat Elektrotechnik Informatik und Mathematik, Germany

AI for Integrated Chiplets Electromagnetic Integrity Design and Simulation
ErPing Li
Zhejiang University, China

Outlook of AI and ML Assisted Signal Integrity and Power Integrity Engineering
Matteo Cocchini
IBM, USA

Perspective and Challenges in the Integration and Co-Design of Brain-Inspired Systems for Artificial General Intelligence
Jose Schutt-Aine
University of Illinois at Urbana-Champaign, USA

AI/ML Augmentation of Hardware Compliance Processes
Samuel Connor
International Business Machines Corp, USA

Neural Network for the Prediction of Electric Field Intensity Applied to a Simple Scenario (Sebastian M. Salas Laurens, Anne Roc'h, TU/e)
Sebastian Salas Laurens[1], Anne Roc'h[2]
[1]*Eindhoven University of Technology, Netherlands;* [2]*Technische Universiteit Eindhoven, Netherlands*

LLM, ChatGPT, and GPT as the SI and PI Assistant
Lijun Jiang
Missouri University of Science and Technology, USA

Using AI/ML for Lightning Direct Effects
Philipp Boettcher
The Boeing Company, USA

WEDNESDAY, AUGUST 7

TECHNICAL PAPERS

CONTROL OF ELECTROMAGNETIC INTERFERENCE: SHIELDING, FILTERING, MODELING, AND PREDICTION, PART II
3:30PM - 5:00PM
Room: 127A
Sponsored by TC-4

Chair:
Daryl Beetner, *Missouri University of Science & Technology, Rolla, MO, USA*
Co-Chairs:
Charles Jullien, *Safran Electrical & Power, Blagnac, France*
Victor Khilkevich, *Missouri University of Science & Technology, Rolla, MO, USA*

PLANNED SPEAKERS & TOPICS

3:30PM
Evaluating Electromagnetic Interference Effects on GNSS Receivers
Giorgi Tsintsadze[1], Haran Manoharan[1], Arushi Sahai[1], Brian Booth[2], Daryl Beetner[3]
[1]*Missouri University of Science and Technology, USA;* [2]*Deere and Company, USA;* [3]*Missouri University of Science and Technology, USA*

4:00pm
Use of Embedded Ferrites for Routing Under Inductors in Compact Printed Circuit Boards.
Anil Kumar, Kari Mansukoski, Sami Heinisuo
Intel Corporation, USA

4:30pm
Feasibility of Coherent Perfect Absorption based on Spoof Surface Plasmon Polaritons
Jiaqi Xing, Da Li, Ling Zhang, ErPing Li
Zhejiang University, China

Photo by Richard Georgarian

WEDNESDAY, AUGUST 7
The following information is preliminary and subject to change.

SPECIAL SESSION

MEDICAL DEVICE EMC
3:30PM - 5:00PM
Room: 125AB

Chair:
Ji Chen, *University of Houston, Houston, TX, USA*

Co-Chair:
Ananda Kumar, *U.S. Food & Drug Administration, Silver Spring, MD, USA*

Moderator:
Jianfeng Zheng, *University of Houston, Houston, TX, USA*

With the continuous advancement of electrical and electronic medical instruments, there is an increasing prevalence of medical devices that can be implanted inside the human body or operated in close proximity to humans. However, the operation of these devices introduces the emission of electromagnetic signals, raising safety concerns for individuals. Moreover, the potential interaction of these devices with nearby medical equipment poses risks of device interference and malfunctions, especially in scenarios involving multiple electronic devices implanted within human bodies. Addressing these challenges requires the establishment of comprehensive scientific standards for both human safety and product safety assessment methodologies. Further advancements in computation and measurement techniques are crucial to achieve this objective. This special issue aims to delve into various critical aspects of Electromagnetic Compatibility (EMC) concerning electromagnetic safety and its application in biomedicine. The areas to be covered in this

Special Session include:
- Computational Methods for Interaction with Biological Bodies
- Human Exposure Safety and Compliance Assessment
- EMC in Biomedicine

This special issue aims to contribute to the ongoing discourse in the field by exploring these diverse and crucial topics in EMC, fostering the development of advanced scientific standards and methodologies for enhanced safety in the rapidly evolving landscape of medical electronics.

PLANNED SPEAKERS & TOPICS

3:30PM
A Measurement Method for Magnetic Field Characteristics of Inductive Wireless Power Transfer Chargers for Consumer Electronics
Yasaman Ardeshirpour, Joshua Guag, Jeffrey L. Silberberg, Seth Seidman
US Food and Drug Administration, USA

4:00PM
Compatibility Between Implanted Sacral Neuromodulation Devices and Pulsed Electromagnetic Field Therapies for Pelvic Floor Muscle Training
Xuechen Huang[1], Shanie Scoles[1], Paul Nguyen[1], Jeff Chen[1], Jeremie Wisniewski[2], Yuqing Wan[1], Guangqiang Jiang[1]
[1]*Axonics, Inc., USA;* [2]*CentraleSupelec, France*

4:30PM
The Effect of Lead Winding Near IPG on AIMD Models under MR RF Exposure
Ziyu Zuo[1], Qingyan Wang[1], Jianfeng Zheng[1], Hongbae Jeong[2], Ananda Kumar[2], Ji Chen[1]
[1]*University of Houston, USA;* [2]*US Food and Drug Administration, USA*

TECHNICAL PAPERS

POWER DISTRIBUTION NETWORKS AND DECOUPLING #2
3:30PM - 5:00PM
Room: 128B
Sponsored by TC-10

Chair:
Junyong Park, *Missouri University of Science & Technology, Rolla, MO, USA*

Co-Chairs:
Shaowu Huang, *Marvell Semiconductor Inc., Cupertino, CA, USA*

PLANNED SPEAKERS & TOPICS

3:30PM
Efficient Optimization of Decoupling Capacitors using Iterative Inversion Technique
Sriram Hariharan, Dinesh Junjariya, Jai N. Tripathi
Indian Institute of Technology Jodhpur, India

4:00PM
IBIS-Approved Streamlined Power Integrity Model (SPIM) for Platform Power Integrity Analysis
Kinger Cai, Chi-Te Chen, Ei jun Cheng
Intel Corporation, USA

4:30PM
Enhanced S-Parameter Rational Function (SRF) Model Revolutionizing Power Delivery Analysis
Mohammad Islam[1], Kinger Cai[2], Sophia Alvarez[2], You Zhang Tan[2], Yihong Yang[2], Vijay Govindarajan[1], Thim Khuen Wong[2], Julio Soto[2]
[1]*Intel Corporation, USA;* [2]*Intel Corporation, USA*

WEDNESDAY, AUGUST 7
The following information is preliminary and subject to change.

TECHNICAL PAPERS

SIMULATION AND MODELING TECHNIQUES #3
3:30PM - 5:00PM
Room: 128A
Sponsored by TC-10

TECHNICAL PAPERS

STATISTICAL AND SURROGATE MODELS
3:30PM - 5:00PM
Room: 127B
Sponsored by TC-9

Chair:
   Shaohui Yong, *Marvell Semiconductor Inc, San Jose, CA, USA*
Co-Chair:
   Victor Khilkevich, *Missouri University of Science & Technology, Rolla, MO, USA*

PLANNED SPEAKERS & TOPICS

3:30PM
Linear Equalizer Effect-included Worst Eye Diagram Estimation Method for PCIe 6.0
Seonghi Lee, Hyunwoong Kim, Seunghun Ryu, Seongho Woo, Jiseong Kim, Seungyoung Ahn
Korea Advanced Institute of Science and Technology, Korea (the Republic of)

4:00PM
SI Impact and Modeling Accuracy of Non-Ideal Signal Routing over GND Void
Sungjoo Kim, Benjamin Silva, Esha Kondapuram
Intel Corp, USA

4:30PM
COM Qualification of 100Gbps and 200Gbps High Speed Channels
Tao Wang
Teradyne Inc, USA

Chair:
   Yansheng Wang, Rivos Inc., *Santa Clara, CA, USA*

PLANNED SPEAKERS & TOPICS

3:30PM
Estimating Effects of Residual Physics with Machine Learning for Earbud Performance Prediction
Srinivasa Mohan[1], Jingchen Liang[1], Mingfeng Xue[2], Krishna Mellachervu[1], Pavani Gottipati[1], Jianmin Zhang[3]
[1]Ansys, Inc., USA; [2]Google Inc, USA; [3]Google Inc., USA

4:00PM
Fusion of Parameterized and Physics-Oriented Statistical Surrogate Models for EM Coupling on Wires in Complex Electronic Enclosures
Shen Lin[1], Sangrui Luo[1], Yang Shao[1], Bisrat Addissie[2], Zachary Drikas[2], Zhen Peng[1]
[1]University of Illinois Urbana-Champaign, USA; [2]Naval Research Laboratory, USA

Photo by Richard Georgarian

THURSDAY, AUGUST 8
The following information is preliminary and subject to change.

SPECIAL SESSION

EMC AND EMF SAFETY OF WIRELESS POWER TRANSFER SYSTEMS
8:30AM - 10:00AM
Room: 127C

TECHNICAL PAPERS

EMC MEASUREMENTS – VHF-LISN TERMINATION, CURRENT COUPLING AND CAPACITIVE COUPLING
8:30AM - 10:00AM
Room: 125AB
Sponsored by TC-2

Co-Chairs:
Francescaromana Maradei, *University of Rome La Sapeinza, Rome, Italy*
Mauro Feliziani, *Univerisity of Aquila, L'Aquila, Italy*

Wireless Power Transfer (WPT) technology is poised to revolutionize electric mobility in the near future. This technology facilitates the transmission of electrical energy from a power source to an electric vehicle (EV) without the need for physical connections, making it a crucial component for the advancement of electric transportation. Unlike traditional plug connections, WPT offers several advantages: it enhances safety by eliminating the need for cables that users must connect to the vehicle, and it improves convenience by automating the charging process. Both stationary and dynamic WPT systems, based on inductive coupling, are an intentional source of strong magnetic fields in the environment. These fields pose potential health risks to individuals exposed to them and may interfere with the operation of electronic systems in vehicle and on roads, including cardiac implanted electronic devices (CIEDs) worn by passengers and pedestrians. Addressing electromagnetic compatibility (EMC), electromagnetic fields (EMF) safety, and electromagnetic interference (EMI) in CIEDs is a critical challenge for the widespread deployment of WPT systems. This special session focuses on models, methods, technologies and applications for the characterization and mitigation of the electromagnetic field emission produced by stationary and dynamic WPT systems for e-mobility. The assessment of compliance with EMC, EMF safety, and CIED standards is also a central theme of the special session.

PLANNED SPEAKERS & TOPICS
8:30AM
Design of a Shielding Coil for Fiber Composite Electric Vehicles with a SAE J2954 WPT System
Tommaso Campi[3], Silvano Cruciani[4], Francescaromana Maradei[4], Mauro Feliziani[2]
[1]*University of Rome La Sapeinza, Italy;* [2]*University of Aquila, Italy;* [3]*University of L'Aquila, Italy;* [4]*University of Tor Vergata, Italy*

9:00AM
Determination of Optimal Current Phase Difference between Transmitter and Receiver Coils for Minimizing Leakage Magnetic Field in Wireless Power Transfer Systems
Seongho Woo[1], Yujun Shin[2], Sungryul Huh[1], Hyunsoo Lee1, Seungyoung Ahn[1]
[1]*Korea Advanced Institute of Science and Technology, Korea (the Republic of);* [2]*Keimyung University, Korea (the Republic of)*

9:30AM
Thermal-Aware Wireless Charging System Design and Optimization for Wearable Devices with Magnetic Shielding
Jingchen Liang, Kamyar Keikhosravy, Mehdi Abarham, Pavani Gottipati
Ansys, Inc., USA

Chair:
Monrad Monsen, *Oracle, Broomfield, CO, USA*
Co-Chair:
Ahalya Srikanth, *Ford Motor Company, Lasalle, ON, Canada*

PLANNED SPEAKERS & TOPICS
8:30AM
Justification and Background for Terminating AC Mains Cable with Balanced VHF-LISN to Radiated Emission Measurement
Kunihiro Osabe[1], Nobuo Kuwabara[2], Hidenori Muramatsu[1]
[1]*VCCI Council, Japan;* [2]*Kyushu Kogyo Daigaku, Japan*

9:00AM
Visualization of Common Mode Current Coupling to Attached Cables of Power Converters
Daniel L. Commerou[1], Kasper M. Paasch1, Morten Sørensen[2]
[1]*Syddansk Universitet, Denmark;* [2]*Force Technology, Denmark*

9:30AM
Industrial EFT Capactivie Coupling Analysis
Mohit Gopalraj, Sachinkumar Goudnoor, Michael Donaruma, Thane Sanford
Analog Devices Inc., Wilmington, USA

Photo by Karthik Vepuri

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THURSDAY, AUGUST 8
The following information is preliminary and subject to change.

TECHNICAL PAPERS

LOW FREQUENCY EMC
8:30AM - 10:00AM
Room: 127A
Sponsored by TC-7

Chair:
Flavia Grassi, *Politecnico di Milano, Milano, Italy*

PLANNED SPEAKERS & TOPICS

8:30AM
Identification of Internal Impedance of Brush Motor in Operation using AMN
Akito Mashino, Shohei Kan, Kengo Iokibe, Yoshitaka Toyota
Okayama University, Japan

9:00AM
Using the Wavelet Packet Transform to Evaluate Parameters of Harmonics Clustered in Quadruples using Linear Systems
Ileana Diana Nicolae1, Petre-Marian Nicolae2, Marian-Stefan Nicolae2
1University of Craiova, Romania; 2University of Craiova, Romania

9:30AM
Black-Box Model of a Single-Phase Industrial Variable Frequency Drive
Dusan V. Kostic2, Lu Wan5, Abduselam Hamid Beshir5, Lurie Nuca3, Petre-Marian Nicolae1, Flavia Grassi4
1University of Craiova, Romania; 2Universitatea din Craiova, Romania; 3Universitatea din Craiova Facultatea de Inginerie Electrica, Romania; 4Politecnico di Milano, Italy; 5AAU Energy Aalborg University, Denmark

THURSDAY, AUGUST 8
The following information is preliminary and subject to change.

TECHNICAL PAPERS

REGULAR SC3 SESSION: MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE TECHNOLOGIES SESSION #1
8:30AM - 10:00AM
Room: 128A
Sponsored by SC-3

Chair:
Ling Zhang, *Zhejiang University, Hangzhou, China*

PLANNED SPEAKERS & TOPICS

8:30AM
Unsupervised Anomaly Detection of a Home Appliance by Monitoring EMI Data
Hyeonwoo Yu[1], Sangyeong Jeong[1,2], Jingook Kim[1,2]
[1]Ulsan National Institute of Science and Technology (UNIST), Korea (the Republic of); [2]EMcoretech, Co., Korea (the Republic of)

9:00AM
Voice Quality Analysis Method in NR Cellular Network
Tong Liang[2], Weijia Wu[2], Yu Liu[1], Xu Wang[1], Zhiyong Liu2
[1]China Mobile Communications Group Co Ltd, China; [2]China Mobile Group Design Institute Co Ltd, China

9:30AM
Machine Learning based Radiation Source Reconstruction in Terms of Spherical Wave Expansion Coefficients
Carlo Olivieri[1], Lino Di Leonardo[1], Francesco de Paulis[2]
[1]University of L'Aquila, Italy; [2]University of L'Aquila, Italy

Photo by Karthik Vepuri

THURSDAY, AUGUST 8
The following information is preliminary and subject to change.

TECHNICAL PAPERS

SIMULATION AND MODELING TECHNIQUES #4
8:30AM - 10:00AM
Room: 128B
Sponsored by TC-10

Chair:
Jianquan Lou, *Cisco Systems (China) R&D Co., Ltd., Shanghai, China*

Co-Chair:
Di Hu, *General Motors Company, Sunnyvale, CA, USA*

PLANNED SPEAKERS & TOPICS

8:30AM
Novel Formulation for Generalization of Mixed-Mode S-Parameters for Coupled Differential High-Speed Digital Channels
Manish Kizhakkeveettil Mathew[1], Kevin Cai[2], Chaofeng Li[3], Mehdi Mousavi[5], Bidyut Sen[4], DongHyun (Bill) Kim5
[1]*Missouri University of Science and Technology, USA;* [2]*Cisco Systems, Inc, USA;* [3]*Missouri University of Science and Technology College of Engineering and Computing, USA;* [4]*Cisco Systems, Inc, USA;* [5]*Missouri University of Science and Technology Col*

9:00AM
Fast Macromodeling of Large-Scale Multiports with Guaranteed Stability
Tommaso Bradde[1], Stefano Grivet-Talocia[2], Ion Victor Gosea[3]
[1]*Politecnico di Torino, Italy;* [2]*Politecnico di Torino, Italy;* [3]*Max-Planck-Institut fur Dynamik Komplexer Technischer Systeme, Germany*

9:30AM
Reassessing the FER3 of the IEEE 370 Standard
Chiu-Chih Chou
National Central University, Taiwan

THURSDAY, AUGUST 8
The following information is preliminary and subject to change.

TECHNICAL PAPERS

EMC MEASUREMENTS: PULSED RFI IN MOTORS, MULTI-TONE SUSCEPTIBILITY IMPACT, AND BENCH TO ON-VEHICLE MISSIONS COMPARISONS
10:30AM - 12:00PM
Room: 125AB
Sponsored by TC-2

Chair:
Ahalya Srikanth, *Ford Motor Company, Lasalle, ON, Canada*

Co-Chair:
John Kraemer, *Rockwell Collins Inc., Marion, IA, USA*

PLANNED SPEAKERS & TOPICS

10:30AM
Unsupervised Anomaly Detection of a Home Appliance Pulsed-RFI Testing on Radio Telescope Motors
Antheun R. Botha
SKAO, SKA Observatory, Cheshire, Cheshire West and Chester, GB, govt/int, United Kingdom

11:00AM
Influence of Multi-Tone on the Susceptibility of Electronic Devices at the System Level
Alexis Gandon, Islem Yahi, David Martinez, Felix Vega, Chaouki Kasmi
Technology Innovation Institute, United Arab Emirates; Technology Innovation Institute, United Arab Emirates

11:30AM
CISPR 25 Bench to On-Vehicle Emissions
Chaudhary Umer Sajjad[1], John F. Dawson[1], Andy C. Marvin[1], Ayhan Gunsaya[2]
[1]*University of York, United Kingdom;* [2]*Ford Motor Company, England, United Kingdom*

ARIZONA FUN FACT   CITRUS IN ARIZONA

Arizona is one of the five citrus-producing states in the United States, dating back to 1887 when the first orange grove was planted near Camelback Mountain. Arizona Highways Magazine explains, "In 1935, more than 1.2 million boxes of grapefruits were produced in the state, and according to the U.S. Department of Agriculture, grapefruits reigned supreme until about 1942," (Ritchie). Water constraints have reduced Arizona's capacity for growing Citrus as a state, but citrus trees will always adorn houses and neighborhoods throughout the valley. It is a reminder of winter harvest and remains a staple in cocktails and recipes.

THURSDAY, AUGUST 8
The following information is preliminary and subject to change.

TECHNICAL PAPERS

PASSIVE COMPONENTS AND SEMICONDUCTOR DEVICES
10:30AM - 12:00PM
Room: 127A
Sponsored by SC-5

Chair:
  Shuo Wang, *University of Florida, Gainesville, FL, USA*
Co-Chair:
  Sebastian Koj, *Jade Hochschule, Wilhelmshaven, Germany*

PLANNED SPEAKERS & TOPICS

10:30AM
A New Method for Extracting Parasitic Capacitance of MOSFET in a Half-Bridge Configuration
Jaewon Rhee, Sanguk Lee, Hongseok Kim, Jiseong Kim, Seungyoung Ahn
Korea Advanced Institute of Science and Technology, Korea (the Republic of)

11:00AM
Comprehensive Surge Analysis: Shielding Cable Response and Power Port Protection Circuit Design
Jianquan Lou[1], David Tang[1], Haiwen Lu[1], Alpesh Bhobe[2], Xuxian Jiang[3]
[1]Cisco Systems (China) R&D Co., Ltd., China; [2]Cisco Systems, Inc., USA; [3]Shanghai University, China

11:30AM
Accurate Method for Extracting the Multi-Layered Ceramic Capacitor Impedance by Eliminating the Influence of Mounting Pads and Via-Hole
Sanguk Lee, Jaewon Rhee, Seunghun Ryu, Hongseok Kim, Seungyoung Ahn
Korea Advanced Institute of Science and Technology, Korea (the Republic of)

TECHNICAL PAPERS

POWER DISTRIBUTION NETWORKS AND DECOUPLING #3
10:30AM - 12:00PM
Room: 128B
Sponsored by TC-10

Chair:
  Ying Cao, *Apple Inc, Santa Clara, CA, USA*
Co-Chair:
  Kaisheng Hu, *Ciena, Ottawa, ON, Canada*

PLANNED SPEAKERS & TOPICS

10:30AM
Unsupervised Anomaly Detection of a Home Appliance Dual-Structure Genetic Algorithm-Based Optimization Method for PDN Design
SuHyoun Song, Ook Chung, Hogeun Yoo, Jaehoon Lee
Korea University, Korea (the Republic of)

11:00AM
PDN Noise-Jitter Co-Optimization using Physics-Assisted Genetic Algorithm
Li Jiang, Ling Zhang, ErPing Li
Zhejiang University, China

11:30AM
Behavior Model of a Multiphase Voltage Regulator Module with Rapid Voltage Drop Protection
Junho Joo[1], Hanyu Zhang[1], Hanfeng Wang[2], Wei Shen[2], Zhigang Liang[2], Lihui Cao[2], Seungtaek Jeong[2], Chulsoon Hwang[1]
[1]Missouri University of Science and Technology, USA; [2]Google Inc, USA

THURSDAY, AUGUST 8
The following information is preliminary and subject to change.

TECHNICAL PAPERS

RF INTERFERENCE AND DE-SENSE
10:30AM - 12:00PM
Room: 128A
Sponsored by TC-12

Chair:
Francesco de Paulis, *University of L'Aquila, L'Aquila, Italy*
Co-Chair:
DongHyun (Bill) Kim, *Missouri University of Science & Technology College of Engineering & Computing, Rolla, MO, USA*

PLANNED SPEAKERS & TOPICS

10:30AM
Return Ground Design Framework to Mitigate RF Desense Issues in the Post-Deployment Stage using Characteristic Mode Analysis
Haran Manoharan[1], Xu Wang[1], Matthew Wu[2], Jagan Rajagopalan[2], Akshay Mohan[2], Qialoei Huang[2], Chulsoon Hwang[3]
[1]*Missouri University of Science and Technology, USA;* [2]*Amazon Lab126, USA;* [3]*Missouri University of Science and Technology, USA*

11:00AM
Impact of Aging on PIM and DC Resistance of Fabric-Over-Foam Metallic Contacts
Kalkidan W. Anjajo[1], Seunghun Ryu[2], Shengxuan Xia[3], Gracie Boyer[5], Yuchu He[4], Haicheng Zhou[4], Hanfeng Wang[4], Jonghyun Park[5], Chulsoon Hwang[6]
[1]*Missouri University of Science and Technology, USA;* [2]*Korea Advanced Institute of Science and Technology, Korea (the Republic of);* [3]*Missouri University of Science and Technology, USA;* [4]*Google Inc, USA;* [5]*Missouri University of Science and Technol*

11:30AM
Design of Experiment Analysis on Multiple PIM Sources in an RF Antenna System
Shengxuan Xia[2], Yuchu He[1], Haicheng Zhou[1], Hanfeng Wang[1], Chulsoon Hwang[2]
[1]*Google Inc, USA;* [2]*Missouri University of Science and Technology, USA*

SPECIAL SESSION

STOCHASTIC ELECTROMAGNETICS – PART I
10:30AM - 12:00PM
Room: 127C
Sponsored by TC-4

Chair:
Paul Bremner, *Robust Physics, Del Mar, CA, USA*
Co-Chair:
Evelyn Dohme, *Sandia National Laboratories, Albuquerque, NM, USA*

Many design challenges in EMC and Signal Integrity involve complexity and uncertainty that can only be quantified statistically. Reverberation chamber testing in EMC; bit error rate (BER) metric for signal integrity (SI) and RMS delay spread in 5G/6G wireless are examples. Stochastic Electromagnetics encompasses both probabilistic simulation methods and supporting statistical testing methods that are rapidly evolving to reliably address these challenges. This special session will highlight new developments in emerging Stochastic Electromagnetics, such as stochastic power balance, random coupling modeling, and stochastic Green's function analysis. The scope of this session encompasses all aspects of stochastic EMC methods, including novel theoretical developments, practical implementation and complexity analysis, and experimental validation.

PLANNED SPEAKERS & TOPICS

10:30AM
Statistics of Electromagnetic Fields within Wire-Coupled, Nested Reverberant Enclosures
Marshall D. Sowell, Kyle Shea, Carl Hager
Naval Surface Warfare Center Dahlgren Division, USA

11:00am
On the Formulation of Stochastic Green's Function Method for Aperture Coupled Enclosures
Sangrui Luo, Shen Lin, Yang Shao, Zhen Peng
University of Illinois Urbana-Champaign, USA

11:30am
Experimental Validation of Model for Cavity Field Statistics when Q factor or Excitation Level are Uncertain
Paul Bremner[1], Reza Afra[1], James C. West[2], Chuck Bunting[3], Mazin Mustafa[4], Saif Mostafa[4]
[1]*Robust Physics, USA;* [2]*Oklahoma State University, USA;* [3]*Oklahoma State University, USA;* [4]*Oklahoma State University, USA*

ARIZONA FUN FACT   ARIZONA CLIMATE

Welcome to the Sunniest City on Earth and Sunniest State in the USA. The World Record Academy states that Yuma, Arizona receives 91 percent of daylight hours per year (an average of 4,055 hours per year out of 4,456 possible daylight hours). During summer there are up to 13 hours of sunlight and a total of 11 hours during the winter– earning Yuma a world record! As a state, Arizona collects average annual sunlight of 5,755 kJ/m^2 (Kilojoule per square meter), making us the sunniest state in the U.S.

Arizona is known for its low humidity, low altitude (in some areas), low average rainfall, and extremely diverse geographical makeup. In the late 1800s and early 1900s, settlers came to Arizona's hot, dry landscape seeking a remedy for tuberculosis, asthma, and other breathing conditions worsened by humid climates. In addition, Arizona is a favorable place to live for arthritis due to consistent humidity and barometric pressure levels.

THURSDAY, AUGUST 8
The following information is preliminary and subject to change.

TECHNICAL PAPERS

DATA ANALYSIS IN ELECTROMAGNETIC ENVIRONMENTS
1:30PM - 2:30PM
Room: 125AB
Sponsored by TC-3

Chair:
Robert Davis, *Rochester Institute of Technology, Rochester, NY, USA*

PLANNED SPEAKERS & TOPICS

1:30PM
Estimating Radiated Emissions from Device Cabling using Common-Mode Current Measured at a Single Point
Hamidreza Karami[1], Marcos Rubinstein[2], Melina Bouldi[3], Christophe Perrenoud[3], Pascal Kraehenbuehl[3]
[1]*Haute Ecole D'ingenierie et de Gestion du Canton de Vaud, Switzerland;* [2]*University of Applied Sciences Western Switzerland, Switzerland;* [3]*Federal Office of Communications Electromagnetic Compatibility Section, Switzerland*

2:00PM
Visual Space-Time Complexity Analysis of Big Signal Data
Jan Nemec, Stanislav Kovar, Jan Valouch, Milan Adamek
Univerzita Tomase Bati ve Zline Fakulta Aplikovane Informatiky, Czechia

TECHNICAL PAPERS

HIGH-SPEED INTERCONNECTS
1:30PM - 3:00PM
Room: 128B
Sponsored by TC-10

Chair:
Tao Wang, *Missouri University of Science & Technology, San Diego, CA, USA*
Co-Chair:
Thanh Tran, *Rice University, Houston, TX, USA*

PLANNED SPEAKERS & TOPICS

1:30PM
Signal Integrity comparison of Commercially Available Sockets for the 50Gbps Ethernet Channel
Nupur Basak, Oluwafemi Akinwale
Intel Corporation, USA

2:00PM
Mitigation of Fiber Weave Induced Intra-Pair Skew for Differential Signaling at 64Gbps and Above
Chenghai Yan
Intel Corporation, USA

2:30PM
Identification of Bandwidth Requirements for Channel Optimization at 200 Gbps
Rick Rabinovich[2], Richard Mellitz[4], Mike Resso[3], Francesco de Paulis[1]
[1]*University of L'Aquila, Italy;* [2]*Keysight Technologies, USA;* [3]*Keysight Technologies, USA;* [4]*Samtec Corporation, USA*

Photo by Patrick Andre

THURSDAY, AUGUST 8
The following information is preliminary and subject to change.

TECHNICAL PAPERS

MODELING OF WIRELESS POWER TRANSFER SYSTEMS
1:30PM - 3:00PM
Room: 127A
Sponsored by SC-5

SPECIAL SESSION

STOCHASTIC ELECTROMAGNETICS – PART II
1:30PM - 3:00PM
Room: 127C
Sponsored by TC-4

Chair:
  Shuo Wang, *University of Florida, Gainesville, FL, USA*
Co-Chair:
  Chulsoon Hwang, *Missouri University of Science & Technology, Rolla, MO, USA*

PLANNED SPEAKERS & TOPICS

1:30PM
Enhancing Efficiency and Robustness in Bi-Directional Wireless Power Transfer via CLLLC Resonant Networks
Babatunde Soyoye, Indranil Bhattacharya, Mary Vinolisha Antony Dhason
Tennessee Tech University, USA

2:00PM
An Equivalent Coil Model of a Wireless Power Transfer System Including Eddy Loss
Hanyu Zhang[1], Daryl Beetner[2]
[1]*Missouri University of Science and Technology, USA;*
[2]*Missouri University of Science and Technology, USA*

2:30pm
Radiated Emission Modeling of a Wireless Power Transfer System
Hanyu Zhang[1], Guanghua Li[3], Viswa Pilla[3], Chulsoon Hwang[2]
[1]*Missouri University of Science and Technology, USA;*
[2]*Missouri University of Science and Technology, USA;*
[3]*Apple Inc, USA*

Chair:
  Paul Bremner, *Robust Physics, Del Mar, CA, USA*
Co-Chair:
  Evelyn Dohme, *Sandia National Laboratories, Albuquerque, NM, USA*

Many design challenges in EMC and Signal Integrity involve complexity and uncertainty that can only be quantified statistically. Reverberation chamber testing in EMC; bit error rate (BER) metric for signal integrity (SI) and RMS delay spread in 5G/6G wireless are examples. Stochastic Electromagnetics encompasses both probabilistic simulation methods and supporting statistical testing methods that are rapidly evolving to reliably address these challenges. This special session will highlight new developments in emerging Stochastic Electromagnetics, such as stochastic power balance, random coupling modeling, and stochastic Green's function analysis. The scope of this session encompasses all aspects of stochastic EMC methods, including novel theoretical developments, practical implementation and complexity analysis, and experimental validation.

PLANNED SPEAKERS & TOPICS

1:30PM
Statistical Analysis of Electromagnetic Coupling to Printed Circuit Boards
Shengxuan Xia, Victor Khilkevich, Daryl Beetner
Missouri University of Science and Technology, USA

2:00PM
Statistical Modeling of Distributed Ports in Resonant Cavities
Evelyn A. Dohme[1,2], Thomas W. Hussey[5], Zhen Peng[3], Paul Bremner[4], Edl Schamiloglu[5]
[1]*Sandia National Laboratories, USA;* [2]*The University of New Mexico, USA;* [3]*University of Illinois at Urbana-Champaign, USA;* [4]*Robust Physics, USA;* [5]*University of New Mexico, USA*

2:30PM
Extended Resistance Matrix Formulation for Radiation Coupling of a Multi-Conductor Transmission Line
Weitao Dai[1], Paul Bremner[2]
[1]*Robust Physics, USA;* [2]*Robust Physics, USA*

Photo by Richard Georgarian

THURSDAY, AUGUST 8
The following information is preliminary and subject to change.

TECHNICAL PAPERS

WIRELESS COEXISTENCE
1:30PM - 3:00PM
Room: 128A
Sponsored by TC-12

Chair:
DongHyun (Bill) Kim, *Missouri University of Science & Technology College of Engineering & Computing, Rolla, MO, USA*

PLANNED SPEAKERS & TOPICS

1:30PM
Analysis of Infra Red Sensor's Immunity to Closely Located Intentional Radios in Consumer IoT Devices
Ze Sun, Naman Barmecha, Jagan Rajagopalan, Sriram Srinivasan, Sai Ananthanarayanan
Amazon Lab126, USA

2:00pm
On Comparing Interference Impacts
Aric Sanders[1], Michelle Pirrone[1,2], Keith Forsyth[1], Adam Wunderlich[1]
[1]*National Institute of Standards and Technology, USA;*
[2]*University of Colorado Boulder, USA*

2:30pm
Coexistence Testing: Comparing Conducted and Radiated Test Results
Susanna Mosleh[1], Nadia Yoza-Mitsuishi[1], Jason Coder[2], Carl Sunderman[3]
[1]*National Institute of Standards and Technology, USA;*
[2]*National Institute of Standards and Technology, USA;*
[3]*National Institute for Occupational Safety and Health, USA*

THURSDAY, AUGUST 8
The following information is preliminary and subject to change.

TECHNICAL PAPERS

NANOTECHNOLOGY AND ADVANCED MATERIALS
2:30PM - 3:00PM
Room: 125AB
Sponsored by TC-11

Chair:
Marina Koledintseva, *Boeing Defense Space & Security, St. Charles, MO, USA*

PLANNED SPEAKERS & TOPICS

2:30PM
Design and Manufacture of Periodic Metastructure Materials with Broadband EM Absorption
Dandan Zhang[1], Steven Mamolo[2], Kanat Anurakparaorn[1,3], Eric Michielssen[4], Alan Taub[1,5]
[1]*University of Michigan, USA;* [2]*University of Michigan, USA;* [3]*King Mongkut's Institute of Technology Ladkrabang, Thailand;* [4]*University of Michigan, USA;* [5]*University of Michigan, USA*

Photo by Richard Georgerian

THURSDAY, AUGUST 8
The following information is preliminary and subject to change.

TECHNICAL PAPERS

EMI MITIGATION IN WEARABLE DEVICES AND EV DRIVES
3:30PM - 4:30PM
Room: 127A
Sponsored by SC-5

Chair:
Chulsoon Hwang, *Missouri University of Science & Technology, Rolla, MO, USA*
Co-Chair:
Sebastian Koj, *Jade Hochschule, Wilhelmshaven, Germany*

PLANNED SPEAKERS & TOPICS

3:30PM
A Study on Audio-Frequency Near-Field Electromagnetic Interference System in Wearable Audio Devices
Min Zhang, Xiaolong Yue
Xiaomi Communications Co Ltd, Xiaomi Communications Co Ltd, Beijing, CN, corporate/tech, China

4:00PM
EMI Mitigation with Non-Zero Vector PWM In EV Drive Units for Battery Pre-Conditioning
Zefan Yang, Le Yang, Dick Biskup, Harsh Shah, Rambabu Surada
Lucid USA Inc, USA

SPECIAL SESSION

STOCHASTIC ELECTROMAGNETICS – PART III
3:30PM - 4:30PM
Room: 127C
Sponsored by TC-4

Chair:
Paul Bremner, *Robust Physics, Del Mar, CA, USA*
Co-Chair:
Evelyn Dohme, *Sandia National Laboratories, Albuquerque, NM, USA*

Many design challenges in EMC and Signal Integrity involve complexity and uncertainty that can only be quantified statistically. Reverberation chamber testing in EMC; bit error rate (BER) metric for signal integrity (SI) and RMS delay spread in 5G/6G wireless are examples. Stochastic Electromagnetics encompasses both probabilistic simulation methods and supporting statistical testing methods that are rapidly evolving to reliably address these challenges. This special session will highlight new developments in emerging Stochastic Electromagnetics, such as stochastic power balance, random coupling modeling, and stochastic Green's function analysis. The scope of this session encompasses all aspects of stochastic EMC methods, including novel theoretical developments, practical implementation and complexity analysis, and experimental validation.

PLANNED SPEAKERS & TOPICS

3:30PM
Chassis-Integrated Mode Stirring for Statistical Shielding Effectiveness Characterization
Jon Wallace, Evelyn Dohme
Sandia National Laboratories, USA

4:00PM
Statistical Comparison of Time- and Frequency-Domain Measurements for Cylindrical Cavities
Saif Mostafa[1], James C. West[2], Chuck Bunting[3], Mazin Mustafa[1], Mostafa Ibrahim[5], Paul Bremner[4], Reza Afra[4]
[1]*Oklahoma State University, USA;* [2]*Oklahoma State University, USA;* [3]*Oklahoma State University, USA;* [4]*Robust Physics, USA;* [5]*Texas A&M University System, USA*

THURSDAY, AUGUST 8
The following information is preliminary and subject to change.

TECHNICAL PAPERS

APPLICATIONS OF AI AND OPTIMIZATION ALGORITHMS
3:30PM - 5:00PM
Room: 125AB
Sponsored by TC-10

Chair:
Hanfeng Wang, *Google Inc, Mountain View, CA, USA*

PLANNED SPEAKERS & TOPICS

3:30PM
A Study on Audio-Frequency Near-Field 5G Base Station Electromagnetic Field Strength Estimation Method in Complex Hotspot Area using Deep Learning
Dongryul Park[1], Seunghun Ryu[1], Yangbae Chun[1], Seonghi Lee[2], Namwoo Kang[2], Seongsin Kim[4], Kihwea Kim[5], Donggeun choi[5], Seungyoung Ahn[3]
[1]Korea Advanced Institute of Science and Technology, Korea (the Republic of); [2]Korea Advanced Institute of Science and Technology, Korea (the Republic of); [3]Korea Advanced Institute of Science and Technology, Korea (the Republic of); [4]Seongsill Un

4:00PM
Reinforcement Learning-Based Power/Ground Ball Map Design Optimization for Multi-Power Domain in 3D-ICs Package
Seunghun Ryu, Dongryul Park, Hyunwoong Kim, Seonghi Lee, Sanguk Lee, Seungyoung Ahn
Korea Advanced Institute of Science and Technology, Korea (the Republic of)

THURSDAY, AUGUST 8
The following information is preliminary and subject to change.

TECHNICAL PAPERS

CROSSTALK, JITTER, NOISE COUPLING, BER ANALYSIS #2
3:30PM - 5:00PM
Room: 128B
Sponsored by TC-10

Chair:
Songping Wu, *Rivos Inc., Mountain View, CA, USA*
Co-Chair:
DongHyun (Bill) Kim, *Missouri University of Science & Technology College of Engineering & Computing, Rolla, MO, USA*

PLANNED SPEAKERS & TOPICS

3:30PM
B-KBNN based Approach for PSIJ Analysis with a Comparative Study of Energy Models
Ahsan M. Javaid[1], Ramachandra Achar[1], Jai N. Tripathi[2]
[1]Carleton University, Canada; [2]Indian Institute of Technology Jodhpur, India

4:00PM
Nonparametric Crosstalk Evaluation Method using the Kolmogorov-Smirnov Test
Beatrice Jiang[1], Ping Li[2]
[1]Westlake High School, USA; [2]Shanghai Jiao Tong University, China

4:30PM
Novel Coupled Via (CV) Feature for Far-End Crosstalk Reduction
Zhichao Zhang, Yidnekachew Mekonnen, Saikat Mondal
IEEE, USA

ARIZONA FUN FACT
HOW DID PHOENIX GET ITS NAME?

Phoenix exists thanks to the sophisticated irrigation system created and maintained by the Hohokam tribe. The indigenous prehistoric Hohokam people had a thriving metropolis in the region from around 800 A.D. to 1450 A.D. The advanced canal system they built supplied water throughout the Sonoran Desert.

When the early pioneers settled in Phoenix, they realized they needed to find just the right name for the city. Darrel Duppa, one of the pioneers in the group, was familiar with the Greek myth of the Phoenix — an immortal Phoenix bird burns and then rises from the ashes ad infinitum. Aware that there was once a flourishing community of Hohokam in the area, Duppa suggested naming the city "Phoenix" because they were building a new community on top of an ancient community that had built and then abandoned a complex canal system that set the foundation for the city of Phoenix.

The pioneers believed Phoenix was going to "boom" and they needed a name that represented a sign of renewal and rebirth. Phoenix officially was recognized on May 4, 1868.

THURSDAY, AUGUST 8
The following information is preliminary and subject to change.

TECHNICAL PAPERS

WIRELESS SYSTEM MEASUREMENT / TESTING
3:30PM - 5:00PM
Room: 128A
Sponsored by TC-12

Chair:
Lie Liu, *Xidian University, Shenzhen, China*
Co-Chair:
Gang Feng, *Christie Digital Systems Canada Inc., Waterloo, ON, Canada*

PLANNED SPEAKERS & TOPICS

3:30PM
A Method for Eliminating the Phantom Shell Effect using Negative Permittivity Material in Absorbed Power Density Measurement
Changmin Lee[1], Jaewon Rhee[1], Seonghi Lee[2], Hyukchoon Kwon[3], Yongho Park[3], Seungyoung Ahn[1]
[1]*Korea Advanced Institute of Science and Technology, Korea (the Republic of);* [2]*Korea Advanced Institute of Science and Technology, Korea (the Republic of);* [3]*Samsung Electronics, Korea (the Republic of)*

4:00PM
OTA Measurement of UWB Handhold Devices
Xi Wang[4], Lie Liu[1,2], Dan Shang[4], Chao Ma[2], Jiyu Wu[3,4], Yihong Qi[3,5]
[1]*Xidian University, China;* [2]*General Test Systems, China;* [3]*Hunan University, China;* [4]*General Test Systems Inc., China;* [5]*DBJ Technologies (Zhuhai) Co., Ltd., Canada*

4:30PM
Low Noise Wireless Sensing in Termite Detection
Wei Zhang[1], Xiangshu Qi[1], Yunlong Luo[2], Alex Qi[3], Yihong Qi[4]
[1]*Changsha University, China;* [2]*Southwest Jiaotong University, China;* [3]*Pontosense Inc., Canada;* [4]*DBJ Technologies (Zhuhai) Co., Ltd., Canada*

THURSDAY, AUGUST 8
The following information is preliminary and subject to change.

TECHNICAL PAPERS

IMMUNITY AND EM INFO LEAKAGE
4:30PM - 5:30PM
Room: 127A
Sponsored by TC-5

Chair:
Yuichi Hayashi, *Nara Sentan Kagaku Gijutsu Daigakuin Daigaku Joho Kagaku Kenkyuka, Ikoma, Japan*
Co-Chair:
William Radasky, *Metatech Corporation, Goleta, CA, USA*

PLANNED SPEAKERS & TOPICS

4:30PM
B-KBNN based Approach for PSIJ Analysis with a Experimental Study of Radiated Immunity Impact Analysis due to Conventional and Broadband Signal Sources
GyeongRyun Choi[1], Younggi Hong[1], Taewook Kwon[1], Hongsik Keum[2], Se-eun Park[3], Wansoo Nah[1]
[1]*Sungkyunkwan University - Natural Sciences Campus, Korea (the Republic of);* [2]*E&R, Korea (the Republic of);* [3]*National Radio Research Agency, Korea (the Republic of)*

5:00PM
Side-Channel Attack on a Quantum Receiver based on Polarization of EM Radiated Emissions
John J. Pantoja, Dimitris E. Anagnostou, Ross Donaldson
Heriot-Watt University, United Kingdom

Photo by Karthik Vepuri

FRIDAY, AUGUST 9
The following information is preliminary and subject to change.

TECHNICAL PAPERS

EMC IN POWER ELECTRONICS: ELECTRICAL SYSTEMS AND ELECTRICAL TRANSPORT
8:30AM - 12:00PM
Room: 125AB
Sponsored by TC-7

TUTORIAL

HETEROGENOUS INTEGRATED CHIPLET SYSTEM
8:30AM - 12:00PM
Room: 129A
Sponsored by TC-10

Co-Chairs:
Niek Moonen, *Universiteit Twente, Enschede, Netherlands*

Sebastian Koj, *Jade Hochschule, Wilhelmshaven, Germany*

Before electrical energy can be made available at the point of use, it must be distributed, converted, and regulated. This is the task of power electronics. Their importance will continue to increase because the share of electrical energy in primary energy consumption will increase massively due to the energy transition and growing digitalization. Regardless of the area of application - automotive, aerospace, electrical energy supply - power electronics always brings challenges with regard to electromagnetic compatibility.

In this tutorial, the different areas of application of power electronics and the resulting requirements for electromagnetic compatibility as well as methods for controlling them are presented, explained and discussed.

PLANNED SPEAKERS & TOPICS

Introduction to EMC in Power Electronics and Systems
Niek Moonen
Universiteit Twente, Netherlands

DC-DC Converter as Educational and Research Platform
Sebastian Koj
Jade Hochschule, Germany

Power Electronics in the Automotive Industry, a Design for EMC
Qian (Michelle) Liu
Tesla Inc., USA

EMI Modeling and Suppression for Wide Bandgap Power Electronics
Shuo Wang
University of Florida, USA

Modelling of Power Converters for EMC Analyses
Flavia Grassi
Politecnico di Milano, Italy

Aerospace HV Electrical System EMC Challenges and Solutions
Cong Li
GE Global Research, USA

Co-Chairs:
Zhen Zhou, *Intel Corporation, Chandler, AZ, USA*

To continue the journey driven by Moore's law for higher integration, other avenues than further shrinking down the dimension of the transition must be explored. One of these new paradigms would be chiplets built on the advanced package technology. While chiplet architecture offers many benefits, it introduces manifold challenges including thermal, physical, signal integrity, and power integrity. To succeed in chiplet integrated system era, the system codesign on electrical, packaging, thermal will be essential.

In the tutorial, the system codesign will be advocated and demonstrated through illustration and demonstration. Two topics can be covered by the tutorial including:

1. Advanced Packaging for Heterogenous Integration
2. Interconnects for Chiplet System and its design challenges for SI/PI

PLANNED SPEAKERS & TOPICS

Advanced Packaging for Heterogeneous Integration
Lesley A. Polka
Intel Corporation, USA

Power Supply Layout Design Best Practice to Reduce EMI
Di Hu
GM Cruise LLC, USA

Chiplet and Package Codesign EDA Development
Vivek Rajan
Intel, USA

ARIZONA FUN FACT

ARIZONA ILLUMINATES THE PATH TO A GREENER FUTURE WITH SOLAR RESEARCH

Arizona, known for its sunny skies and desert landscapes, isn't just a hotspot for tourism; it's also a leader in solar technology development! With over 300 days of sunshine per year, Arizona boasts ideal conditions for harnessing the power of solar energy. In fact, the state is home to some of the largest solar installations in the country, including the Solana Generating Station near Gila Bend, which can power over 70,000 homes.

Arizona isn't just content with traditional solar panels. The state is at the forefront of pioneering solar technology development, with research institutions and companies collaborating to push the boundaries of innovation. One exciting example of Arizona's solar innovation is reasearch in transparent solar panels. Imagine windows that not only let in natural light but also generate electricity! Researchers at Arizona State University and the University of Arizona are working on transparent solar materials that could revolutionize building design and energy production, turning every window into a power source.

So, the next time you soak up the Arizona sun, remember that it's not just warming your skin—it's also powering the future of technology and innovation! From cutting-edge solar cell designs to breakthroughs in energy storage and grid integration, Arizona is a melting pot of creativity and ingenuity in the realm of solar energy.

FRIDAY, AUGUST 9
The following information is preliminary and subject to change.

TUTORIAL
APPLICATION OF REVERB CHAMBERS
8:30AM - 12:00PM
Room: 127C

Chair:
Vignesh Rajamani, *Rohde & Schwarz USA, Inc., Phoenix, AZ, USA*

This 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.

This half-day tutorial provides a brief overview of Reverb Chamber (RC) theory, followed by recent applications of RCs. The tutorial material will be updated to reflect recent research results and implications. The format will be a conference presentation style (lecture) followed by questions moderated by the chairman. It is designed for both academics and people from industry who will be involved in radiated emission or immunity testing of commercial or military systems using reverberation chambers and will be valuable to personnel evaluating the use of reverberation chambers as a complement to or replacement for other types of radiated test facilities and for personnel who are trying to use statistical methods to characterize the electromagnetic environments.

PLANNED SPEAKERS & TOPICS
Introduction and Overview of Reverberation Chamber Theory
Vignesh Rajamani
Rohde & Schwarz USA, Inc., Phoenix, AZ, USA

Absorber Effectiveness Assessment in Reverberation Chambers
Chuck Bunting
Oklahoma State University, USA

Electromagnetic Probability-of-Effect Assessment Tool for High-Power HERO/EMV Testing
Carl Hager
NSWC Dahlgren, USA

Reverb Chamber Challenges
Garth D'Abreu
ETS-Lindgren, USA

Flexible testing – shaken, not stirred
Frank Leferink
University of Twente, Netherlands

Current and Future Applications of Reverberation Chambers
John Ladbury
National Institute of Standards and Technology, USA

TUTORIAL
LESSONS LEARNED CREATING RELIABLE COMPUTATIONAL MODELS FOR SI, PI AND EMC APPLICATIONS
8:30AM - 12:00PM
Room: 128B
Sponsored by TC 9

Chair:
Patrick DeRoy, *Analog Devices Inc, Norwood, MA, USA*

Co-Chairs:
Bruce Archambeault, *Missouri University of Science & Technology, Rolla, MO, USA*

Davy Pissoort, *Katholieke Universiteit Leuven, Bruges, Belgium*

This tutorial will expose the attendees to the lessons learned by a number of industry experts over the years. The goal being that the attendees will benefit from the, sometimes painful, learning experiences of the presenters. Computational tools are very powerful and simulation is invaluable to the modern design engineer but there is still an art to using these tools effectively. In all disciplines, hindsight is perfect and the opportunity to learn from others is a valuable resource. This tutorial will not only show lessons learned but also expose the attendees to fundamental ways of thinking through their models to better ensure success. Examples relevant for Signal Integrity, Power Integrity and Electromagnetic Compatibility design will be shared.

PLANNED SPEAKERS & TOPICS
Model Validation
Bruce Archambeault
International Business Machines Corp, USA

What I Wish I Knew About EMC Simulation When I First Started
Scott Piper
General Motors Corp, USA

What Did I Learn and Why Did I Learn It?
Colin Brench
IEEE, USA

Best Simulation Practices for High Accuracy Results
Eric Bogatin
University of Colorado Boulder, USA

Leveraging Simulation Tools for Deeper Insights into Real-Life Shielding Challenges
Davy Pissoort
Katholieke Universiteit Leuven, Belgium

EXHIBIT HOURS:
TUESDAY, AUGUST 6
Exhibits Open: 9:30 AM – 7:00 PM
Welcome Reception: 5:00 PM – 7:00 PM

WEDNESDAY, AUGUST 7
Exhibits Open: 10:00 AM – 5:00 PM

THURSDAY, AUGUST 8
Exhibits Open: 10:00 AM – 1:00 PM

Learn more about the EMC+SIPI 2024 Exhibit Hall on Pages 116 and 117

FRIDAY, AUGUST 9
The following information is preliminary and subject to change.

TUTORIAL

PRODUCT SAFETY COMPLIANCE AND GLOBAL MARKET ACCESS
8:30AM - 12:00PM
Room: 127A

STANDARDS WEEK
WORKSHOP FROM IEEE
PSES
Product Safety Engineering Society
SISTER SOCIETY OF IEEE EMCS

Chair:
Grant Schmidbauer, *British Columbia Institute of Technology, Carlsbad, CA, USA*

Co-Chairs:
Ken Kapur, *Thermo Fisher Scientific Inc., Waltham, MA, USA*

John Allen, *Product Safety Consulting, Inc., Bensenville, IL, USA*

The goal of most companies is not to only design products to be safe, perform according to customer demands, and to meet regulatory requirements, it is to sell those products globally. While your product must comply with the EMC and SIPI requirements, there are a myriad of other technical requirements that must also be considered to facilitate the sale of the product.

The plan for this tutorial is to delve into some of the "other technical requirements" that products must comply with, including product safety requirements (ie, concepts such as fire, shock, mechanical, temperature, and radiation); and then once your products are compliant, we will discuss the commercialization of the product through obtaining the many country approvals that are needed in order to legally sell the product around the world.

This tutorial should be attended by product realization managers, design engineers, test technicians, product regulatory personnel, project managers, marketing personnel, and others interested in learning more about product safety and global market access requirements.

PLANNED SPEAKERS & TOPICS
Overview of Product Safety Requirements, 'Compliance 101'
Ken Kapur
Thermo Fisher Scientific Inc, USA

Deeper Dive into Product Safety Requirements, 'Compliance 201'
John Allen
Southern Illinois University, USA

Overview of Global Market Access (GMA)
Grant Schmidbauer
British Columbia Institute of Technology, Canada

Panel Discussion, Q&A and Wrap-Up
Grant Schmidbauer
British Columbia Institute of Technology, Canada

WORKSHOP

WHEN OPEN SOURCE MEETS SIPI
8:30AM - 12:00PM
Room: 127C
Sponsored by TC-10

Chair:
Yansheng Wang, *Rivos Inc., Santa Clara, CA, USA*

Co-Chair:
Giorgi Maghlakelidze, *Cisco Systems Inc., San Jose, CA, USA*

Open source is attracting more and more attention these days. You must have heard of some open source big names like Linux, RISC-V etc. But how can the SIPI community contribute to and benefit from the "open source rush"? Join us in this workshop to learn about more details. This workshop will introduce several open source projects and tools that are being developed for the SIPI community. The invited speakers will also share insights as a maintainer, a contributor, or a user of an open source project. We hope all the audience after attending this workshop can be inspired and motivated by the presented ideas and eventually get involved in open source projects.

PLANNED SPEAKERS & TOPICS
The Open Circuit: Advancing Signal and Power Integrity with Open Source
Giorgi Maghlakelidze
Cisco Systems Inc, USA

My Five Favorite SIPI Free Tools
Eric Bogatin
University of Colorado Boulder, USA

Open-Source PDN Modeling and Optimization with AI Techniques
Ling Zhang
Zhejiang University, China

IEEE P370 Briefcase: Integrating IEEE 370 Open Source MATLAB Scripts
Se-Jung Moon
Amazon Inc, USA

OpenSIPI: An Open Source Platform to Renovate the S-Para Extraction
Yansheng Wang
Rivos Inc., USA

CircuitOps and OpenROAD: An ML EDA Infrastructure for Research and Education
Vidya Chhabria
Arizona State University, USA

From Toy to Tool, How a Silly Python First Project Became a Serious Link Design Tool
David Banas
Keysight, USA

Panel Discussions
Yansheng Wang[1], Eric Bogatin[2]
[1]*Rivos Inc., USA;* [2]*University of Colorado Boulder, USA*

FRIDAY, AUGUST 9
The following information is preliminary and subject to change.

WORKSHOP

EFFECTIVELY NAVIGATING MEASUREMENT UNCERTAINTIES IN THE REAL WORLD
1:30 – 5:00 PM
Room: 127A
Sponsored by TC-2

Co-Chairs:
Janet O'Neil, *ETS-Lindgren, Cedar Park, TX, USA*

Dennis Lewis, *The Boeing Company, Seattle, WA, USA*

This workshop provides insights into methods for assessing measurement uncertainty in electromagnetic compatibility (EMC) and antenna characterization. Presentations will cover practical techniques like polynomial chaos for sensitivity analysis, offering applicable insights. Additionally, speakers will discuss the evolution of uncertainty analysis in reverberation chambers and share practical insights into managing EMC measurement uncertainty in laboratory settings. Evaluations of complex uncertainties in robotic antenna test systems will also be presented, providing valuable perspectives on addressing real-world challenges. Attendees will gain practical tools and insights to enhance the accuracy of electromagnetic field measurements in their respective fields. This workshop aims to facilitate discussion and collaboration, empowering participants to navigate measurement uncertainties effectively in their work.

PLANNED SPEAKERS & TOPICS

Assessment of Uncertainties and Sensitivity Analysis using Polynomial Chaos
Karol Niewiadomski
University of Twente, Netherlands

Uncertainty Analysis from the Early Days of Reverberation Chambers – The Impact on Today's Test Methods
John Ladbury
National Institute of Standards and Technology, USA

Estimating Uncertainty for Antenna Measurements in Accordance with the Guide to Uncertainty in Measurements
Zhong Chen
ETS-Lindgren, USA

Evaluation of Complex Measurement Uncertainties in a Multipurpose Robotic Antenna Test System
Dennis Lewis
The Boeing Company, USA

Measurement Uncertainty of HEMP and HPEM Testing Methods
Sven Fisahn
Bundeswehr Research Institute for Protective Technologies and CBRN Protection, Munster, Germany

The Known Unknown – Measurement Uncertainty for EMC
Nicholas Abbondante
Intertek USA Inc, USA

TUTORIAL

ELECTROMAGNETIC COMPATIBILITY OF SWITCHED-MODE POWER SUPPLIES
1:30PM - 3:00PM
Room: 127C

Chair:
Günter Keller, *Technische Hochschule Deggendorf, Deggendorf, Germany*

The tutorial is subdivided into several sections. Starting with a brief overview of legal regulations, like CE mark and Declaration of Conformity, a selection of emission and immunity standards is presented. This includes the description of test set-ups, for example for measuring conducted emissions using conventional or STFFT based test receivers and their detector circuits, as well as test parameters, like frequency ranges, based on European and International standards. Than four coupling mechanisms (impedance, capacitive, magnetic and radiated) are discussed, based on components and PCB structures. Subsequently basic countermeasures are proposed and evaluated according meaningful applicability to switched-mode power supplies. The section signals and characteristics explains common-mode and differential-mode interferences as well as the Fourier Transform in detail with a number of waveforms, like rectangular, triangular and trapezoidal waveforms, which are typically for switched-mode power supplies. In particular switching transients are discussed against the background of wide band gap devices like GaN transistors. One large section discusses the origin of electromagnetic interferences referring to the previous sections. This section addresses some widely used circuits, their operating modes, like continuous conduction mode, discontinuous conduction mode and boundary conduction mode, and also parasitics of passive components, using high frequency equivalent circuits of capacitors, inductors and transformers, and parasitics of active components, like junction capacitances and terminal inductances. A large number of examples is presented in form of results of measurements, simulations or calculations.

The second half of the tutorial/workshop deals with EMC design of switched-mode power supplies, also evaluating efficiency and control issues. This section is subdivided into a number of subsections. Firstly the power factor correction is briefly presented. A large subsection addresses EMC filters, which is subdivided into pre filters and post filters. The filter structure is discussed according common-mode and differential-mode attenuation and source and load impedance. Problem solving approaches of the gap between measurements according standards and filter effectiveness are presented. Additionally an outlook to active EMI filters is given. Also design aspects of magnetic components are discussed. Followed by suitable components, which presents for example the impact of start of winding of a magnetic component, suitable circuits with soft-switching principles are compared to hard-switching circuits. After that shielding basics are presented, in particular the impact of holes for cooling purposes on electromagnetic shielding effectiveness. Finally PCB layout structures are evaluated and recommendations are presented. These investigations also address grounding, one of the most discussed topics in PCB design among engineers, as well as component placing and component selection, e. g. based on integrated circuit pin out and return current paths.

Most aspects are explained by measured, simulated or calculated examples. Many examples are discussed against the background of electromagnetic compatibility as well as their impact on efficiency, lifetime and costs of the power supply. The tutorial contains on the one hand practical examples and uses on the other hand the basic physics of Maxwell for a principle understanding. Many principles can be transferred to other electronic circuits.

PLANNED SPEAKERS & TOPICS

Electromagnetic Compatibility of Switched-Mode Power Supplies
Günter Keller
Technische Hochschule Deggendorf, Germany

FRIDAY, AUGUST 9
The following information is preliminary and subject to change.

TUTORIAL

AMATEUR RADIO – AVOCATION AND VOCATION
1:30PM - 5:00PM
Room: 128B
Sponsored by TC-1

TUTORIAL

NANOTECHNOLOGY AND ADVANCED MATERIALS FOR EMI CONTROL AND EMC – TC11/TC4 WORKSHOP
1:30PM - 5:00PM
Room: 125AB
Sponsored by TC-11

Chair:
  Kimball Williams, *IEEE, Dearborn, MI, USA*

We will be exploring some of the many aspects of Amateur Radio, often described as 'The hobby of a thousand hobbies'. We will touch on those features where Hams (Amateur Radio Operators) interact with the public in accordance with the five primary provisions of an Amateur Radio license governed by the FCC Part 97: Emergency Communications, Advancing the radio art, Advancing skills in both the communication and technical phases of the art, Providing trained operators and RF experts and "the Amateur's unique ability to enhance international good will."

PLANNED SPEAKERS & TOPICS

Community and Traditions:
Kimball Williams
IEEE, USA

Slaying Power Line Interference
Gary Bishop
ARRL, USA

SOTA / POTA – Experiences from the Field
Chuck Bunting
Oklahoma State University, USA

How to Teach a HAM Class
Constance A. Kelly
Illinois Institute of Technology, USA

Chair:
  Marina Koledintseva, *Boeing Defense Space & Security, St. Charles, MO, USA*

Co-Chair:
  Daryl Beetner, *Missouri University of Science & Technology, Rolla, MO, USA*

The scope of this Workshop is research, design, development, characterization, and applications of various nanomaterials and advanced materials for EMI control and solving various practical EMC problems, e.g., absorbers and filters with outstanding performance and capabilities, nanostructures shields, innovative gaskets, advanced interconnects, nanowires for high-speed interconnects and high-density integrated systems, etc.

PLANNED SPEAKERS & TOPICS

Thin Films and Nanomaterials for EMI and EMC
Fabrizio Marra[1], Alessandro Giuseppe D'Aloia[2], Alessio Tamburrano[2]
[1]Sapienza University of Rome, Italy; 2DIAEE - Sapienza University of Rome, Italy

EMC Applications of 3D Printable Materials
Victor Khilkevich
Missouri University of Science and Technology, USA

EMI Shielding Solution Covering Physical Pre-Shaped and Dispensable Materials
Julia Sunderland
The Dow Chemical Company, USA

Magneto-Dielectric Absorbers for EMI and EMC
Marina Y. Koledintseva
Boeing Defense Space and Security, USA

Application of Ferrites to MRI Safety
Md Zahidul Islam[1], Ji Chen[1], Ran Guo[2], Ananda Kumar[1], Jianfeng Zheng[3]
[1]University of Houston, USA; [2]University of Houston, USA; [3]University of Houston, USA

Using an Absorber Sheet for Terminating Non-Measurement Ports during Crosstalk Measurement
Seyedmostafa Mousavi
Missouri S&T, USA

Photo by Karthik Vepuri

FRIDAY, AUGUST 9
The following information is preliminary and subject to change.

TUTORIAL

PROGRESS IN IEC SC 77C STANDARDS REGARDING HEMP AND IEMI ENVIRONMENTS, TEST METHODS AND PROTECTION METHODS
1:30PM - 5:00PM
Room: 128A
Sponsored by TC-5

STANDARDS WEEK

Chair:
William Radasky, *Metatech Corporation, Goleta, CA, USA*

The session will start with an introductory presentation summarizing all of the 22 publications of IEC SC 77C (EMC: High Power Transient Phenomena) and their status. The introduction will then indicate the recent work underway and will introduce the papers to be discussed in detail following the introduction.

PLANNED SPEAKERS & TOPICS

Introduction to IEC SC 77C Publications
Edl Schamiloglu
University of New Mexico, USA

Updates of IEC 61000-2-9 (Radiated HEMP Environment) and IEC 61000-2-10 (Conducted HEMP Environment)
William A. Radasky
Metatech Corporation, USA

Update of IEC 61000-4-24 (Conducted Test Methods)
Sergio Longoria
ETS-Lindgren, USA

Update of IEC 61000-4-23 (Radiated Test Methods)
William A. Radasky
Metatech Corporation, USA

Update of IEC 61000-5-6 (Mitagation of High Power EM Transients)
William A. Radasky
Metatech Corporation, USA

ASK THE EXPERTS PANELS
The following information is preliminary and subject to change.

AUTOMOTIVE HYBRID, ELECTRIC AND AUTONOMOUS – ADDRESSING THE COMPLEXITY OF MODERN VEHICLES
Exhibit Hall

Organizer:
Janet O'Neil, *ETS-Lindgren*

Today's complex vehicle platforms include propulsion, entertainment and safety related systems all having to function reliably without impacting safety or the legacy communications infrastructure. The increased interest in autonomous vehicles is also driving the need for more sophisticated automotive EMC design and test scenarios, such as those addressing EMC, sensors (including radar) and wireless considerations. This impacts both component level and full-vehicle level emissions and immunity.

Our Automotive "Ask the Experts" panelists represent a diversity of automotive related organizations, including full vehicle manufacturers, an integrated circuit (IC) test specialist, members of the ISO/CISPR D Automotive EMC Committees, an automotive test chamber and instrumentation manufacturer, and a commercial automotive EMC test lab. These experts will share their knowledge on current and future automotive EMC design and test considerations. Bring your questions or simply listen and learn.

Planned Panelists Include:
Bob Mitchell, *TUV Rheinland, Littleton, MA, USA*
Garth D'Abreu, *ETS-Lindgren, Cedar Park, TX, USA*
Keith Frazier, *Ford Motor Company, Dearborn, MI, USA*
Jens Medler, *Rohde & Schwarz, Munich, Germany*
Cheyne Scoby, *Rivian Automotive, Long Beach, CA, USA*
Rich Boyer, *Aptiv, Warren, OH, USA*

STEP, STIR, OR SHAKE: WHAT'S BEST FOR A REVERBERATION CHAMBER?
Exhibit Hall

Organizer:
Vignesh Rajamani, *Rohde and Schwarz North America*

Reverberation chambers provide a versatile and efficient means of testing the electromagnetic characteristics of electronic devices in a controlled environment. Closely mimicking the real-world environment in which they operate, reverberation chambers are an essential tool in product development and certification processes. Testing in reverberation chambers is often done to ensure that electronic devices comply with regulatory standards for EMC and EMI. Although mode stirring, mode tuning, and "shaking of the walls" can be used to achieve a statistically uniform distribution in terms of amplitude, phase, and polarization, the natural debate is which is the best technique to use for a specific application.

Our "Ask the Experts" panelists represent a diversity of industry practitioners, academics, metrologists, and members of standard bodies. These experts will share their knowledge on current and future reverberation chamber test considerations. Bring your questions or simply listen and learn.

Planned Panelists Include:
Frank Leferink, *Thales and University of Twente, The Netherlands*
Garth D'Abreu, *ETS-Lindgren, Cedar Park, TX, USA*
John Ladbury, *National Institute of Standards and Technology, Boulder, CO, USA*
Craig Fanning, *Elite Electronic Engineering, Downers Grove, IL, USA*

Photo by Patrick Andre

ASK THE EXPERTS PANELS
The following information is preliminary and subject to change.

MODERN SOLUTIONS TO THE INCREASING DEMAND FOR SMALLER, HIGHER PERFORMANCE PCB/IC/CHIP PACKAGES
Exhibit Hall

Organizer:
Anil Kumar, *Principal Engineer, Intel*

This panel will focus on "Modern Solutions to the Increasing Demand for Smaller, Higher Performance PCB/IC/Chip Packages." As the demand for smaller and higher performing electronic devices continues to grow, it presents unique challenges for Electromagnetic Compatibility (EMC), Signal Integrity (SI) and Power Integrity (PI) engineers.

The panel will explore the complexities and advancements in PCB/IC/Chip packages that enable smaller form factors while maintaining high performance. Our esteemed panelists, who are experts in the field, will share their insights and experiences in addressing these challenges.

Join us as we delve into topics such as miniaturization techniques, advanced packaging technologies, design considerations, and simulation and test methodologies. Discover the latest trends and innovative solutions that are revolutionizing the industry. Don't miss this opportunity to engage with industry leaders, gain valuable knowledge, and network with professionals in the field. Whether you have burning questions or simply want to expand your understanding, this panel is a must-attend event for anyone involved in EMC and SI/PI for PCB/IC/Chip packages.

Planned Panelists Include:
Harry Skinner, *Intel, OR, USA*
Kendall Hiles, *Siemens Digital Industries Software, NC, USA*
Lijun Jiang, *Missouri University of Science and Technology, MO, USA*
Ken Willis, *Cadence, CA, USA*
Michael Leddige, *Intel, OR, USA*

Photo by Karthik Vepuri

2025 IEEE INTERNATIONAL SYMPOSIUM ON ELECTROMAGNETIC COMPATIBILITY, SIGNAL & POWER INTEGRITY

The Raleigh Convention Center is a bustling hub for the culture, commerce and technologies that make the area one of the most admired and sought-after places in the United States. Surrounded by quality hotels, world-class performance facilities and scores of restaurants, downtown Raleigh offers everything an attendee will enjoy.

Incorporated in 1792, Raleigh, the capital of North Carolina, is known as the "City of Oaks" for its many oak trees, which line the streets in the heart of the city. Often described as a "park with a city in it," an oak canopy practically covers the area, and there are also lakes for water activities, parks and greenways.

Research Triangle Park (RTP) near the "Triangle" cities, Raleigh, Durham, and Chapel Hill, is a hot-spot of extensive, high-tech research in the fields of science and technology. In addition, Raleigh has a vibrant arts and culinary culture. From dynamic local troupes to nationally acclaimed touring companies, theatre and symphony concerts, there's always something to see on stage. The North Carolina Museum of Art, CAM Raleigh and numerous galleries offer visual arts for the viewer.

JOIN YOUR COLLEGUES
RALEIGH, NORTH CAROLINA
AUGUST 18 – 22, 2025

EMC+SIPI 2025 leads the industry in providing state-of-the-art education on EMC and Signal Integrity and Power Integrity techniques. The Symposium features five full days of innovative sessions, interactive workshops & tutorials, "Ask the Experts" panel discussions, experiments and demonstrations, and social networking events.

BENEFITS & FEATURES
- Learn EMC, Signal Integrity and Power Integrity (SIPI) techniques
- Three days of expert technical papers
- Two full days of practical EMC & SIPI workshops and tutorials
- Experiments and demonstrations of fundamental and advanced topics
- Add-on educational courses to expand your knowledge of EMC and SIPI.
- Find out the latest development in IEEE EMC and SIPI standards
- Exhibits! New Technologies, Instrumentation and Solutions
- Social gathering, connecting, and the Southern hospitality of in Raleigh, NC

IEEE | EMC SOCIETY

EXPERIMENTS & DEMONSTRATIONS
The following information is preliminary and subject to change.

EXPERIMENTS & DEMONSTRATIONS
The following information is preliminary and subject to change.

EXPERIMENTS & DEMONSTRATIONS

You will not want to miss the popular Experiments and Demonstrations program that will be held in the Exhibition Hall. This hands-on activity provides a unique learning experience that complements the technical presentations at the symposium. It is traditionally one of the educational highlights of the annual symposium!

Automated SI Verification Methods for Optimal Design of DDR Systems
Presenter: Junesang Lee, *Altair*

This software demo presents the automatic SI verification method for DDR systems and provides background knowledge on the proposed approach. In this demo, the verification method consists of two parts. The first utilizes numerical analysis-related solvers for simulations, including transmission line analysis, characteristic impedance analysis, and crosstalk analysis. It particularly explains how automatic DDR compliance simulation for high-speed DDR systems is structured. The second part is an SI design rule checker based on geometric algorithms. These rules are developed through iterative simulation results and expert knowledge, representing a type of site-dependent Intellectual Property (IP). This enables SI engineers to detect design faults/defects that may violate electrical issues at the early design stage.

While conventional DDR system SI verification methods heavily rely on CAE engineering teams, the proposed approach allows circuit designers to directly detect electrical problems in high-speed DDR designs without the need for prior simulation setup or specialized knowledge of its standard. This helps reduce design iterations caused by SI problems during the development period.

For this demo, Altair PollEx simulation tools are used to analyze high-speed signal waveform data of LPDDR buses and present a methodology to find the optimal net topology. The results showed that compliant waveforms satisfying the signal integrity criteria were found within the simulation run time reduced by up to 60%, demonstrating that the proposed method was valid for automated SI verification. A live demo of the software will be shown during the presentation.

Bulk Current Injection Technical Demonstration
Presenter: Sean Lynch, *Rohde & Schwarz*

The purpose of this demonstration titled "BCI Demo" is to show how to calculate and a achieve test levels with a BCI system for ISO 11451, MIL-STD-461G, and IEC 61000-4-6 test standards. We will work backwards given a test level, known transfer impedance from industry probes and equipment and then follow good practices to size generators and amplifiers accordingly (following an 80% rule).

The ease of setting up a test like this when there is a fully automated software that can control all instrumentation will also be highlighted during this demo. The goal is to see how close we can get to the reach measurements given the constraints we operate under.

Common Mode – Where Does it Come From and How Can it Go Away?
Presenter: Patrick Andre, *Andre Consulting, Inc.*

We hear about common mode currents. The question becomes how are they generated, and why are they a problem? If they exist in a product, how do we control it? What works and what does not work? Through both teaching and demonstration, Mr. Andre will demonstrate each of these points.

Common-Impedance Coupling
Presenter: Bogdan Adamczyk, *Grand Valley State University*

This hardware experiment demonstrates the impact of the return path impedance and the return current level on common-impedance coupling between circuits. The measurements are performed on a custom PCB, containing audio, video, and high current circuitry where the return paths for each circuit can be selectively shared with other circuits.

Computational EMC/EMI
Presenter: Shahid Ahmed, *Ansys*

The relentless evolution of electronic systems and the pervasive integration of wireless technologies have presented unprecedented challenges in the domains of Electromagnetic Compatibility (EMC) and Electromagnetic Interference (EMI). As these challenges become increasingly intricate, integrating computational methods has emerged as a pivotal approach to understanding, mitigating, and managing EMC and EMI issues. This workshop seeks to provide a comprehensive exploration of EMC/EMI challenges. Tailored for researchers, engineers, and practitioners involved in EMC, EMI, RF design, and related fields, the workshop aims to bridge the gap between theoretical concepts and practical applications in the context of computational EMC and EMI.

Cracking the Shield: Noise Suppression Sheets (NSS) and Board Level Shielding (BLS) for your PCB
Presenter: Victor Martinez Garcia, *Wurth Elektronik*

Knowing which Noise Suppression Sheets has to be selected for your application in electromagnetic compatibility (EMC) and signal integrity, can be a tricky matter. Join our session for studying in focus on NSS, examining their composition, magnetic characteristics, the effect of different thicknesses. We will also provide a practical insights into the integration shielding solution for improving the board level shielding from your application with shielding cans or shielding cabinets, discussing the trade-offs between possible solutions.

Don't miss our session where we unveil the cutting-edge wonders of Noise Suppression Sheet and Board Level Shielding

EMC Pre-Compliance Test – Do I Need It?
Presenter: Steve Narciso, *Keysight*

To ensure safe operation, and to guarantee quality and accuracy, compliance testing is necessary to sell your device. A compliance test failure can delay product introduction and add unplanned development expense. Pre-compliance testing allows you to cost-effectively reduce your time to market by maximizing the success your product passing final compliance testing

EMC Society PCB Experiments Kit
Presenter: Karen Burnham, *Electro Magnetic Applications, Inc.*

The EMC Society has created a set of nine PCBs that are each constructed to illustrate a particular principle of EMC engineering. At this demonstration we will put them through their paces, demonstrating the boards (and the Nano VNA that comes with them). In addition we will be showing how simulations of each board can help with demonstrations and education.

EMC Workshop for Power Supply Designers
Presenter: Jared Quenzer, *Würth Elektronik*

This presentation will show a portable conducted emissions test setup that utilizes low voltage (<60VDC) to demonstrate fundamental EMC troubleshooting in a practical way by using a lecture style that includes first the explanation of theory, then the simulation, then a live test to prove empirically how the theory holds true on a real design. This test board separates out common mode and differential mode noise so that the exact source of the EMI can be understood more fully and therefore, a better solution can be implemented. It is common to see engineers using a guess and check method by just grabbing whatever components are available nearby, testing and then deciding what the next step is based on the test results. Although this iterative method sometimes works, as engineers, we should strive to better understand the underlying phenomena to be able to implement a more precise solution and resolve EMC issues with less time and effort. This will be accomplished in this session by focusing on practical tips and tricks. Topics include CMC selection, Xcap, and Ycap selection.

Photo by Patrick Andre

EXPERIMENTS & DEMONSTRATIONS
The following information is preliminary and subject to change.

Experimental Demonstration of the Noise Attenuation Performance of an Active EMI Filter with EMC
Presenter: Jingook Kim, *Ulsan National Institute of Science and Technology (UNIST)*

Electromagnetic interference (EMI) from power converters during switching operations has become a significant problem due to increased demand for high-power products. EMI filters are commonly implemented on AC powerlines in power systems to suppress conducted emissions (CE) noise. A conventional passive EMI filter typically consists of a low-pass L-C topology with Y-capacitors, common-mode (CM) chokes, and X-capacitors. However, in high-power appliances or industrial systems, the size and cost of CM chokes can be prohibitive considering several practical issues.

Active EMI filters (AEFs) are a practical solution for high-power applications to effectively reduce the size and number of CM chokes in passive filters. In previous studies, the topologies and implementations of analog AEFs are demonstrated, and design guidelines for stability, reliability, and noise attenuation performance have been proposed. Also, recently, AEFs have been implemented as EMI management-integrated circuits (EMIC) to reduce CE noise.

We would like to demonstrate the performance of the AEF with EMIC using a simplified experimental setup. The EMIC is the active EMI filter IC for high-voltage and high-current application. An evaluation board has been developed to help designers to evaluate the operation and performance of the EMIC with three-phase four-line ac utility. The evaluation board can be used for small signal testing as well as real application testing. The proposed AEF is designed as a fully-isolated structure using magnetic core components of the sensing and injection transformers. It can operate with 12V supply.

Photo by Patrick Andre

IEC 61000-6-3: Spectral Density of Non-Intentional Emissions 9-150 kHz - A Measurement Approach Discussion & Demonstration
Presenter: Jacob Dixon, *International Business Machines Corp.*

IEC JWG6 has developed a generic standard of emissions limits in the 9-150 kHz frequency range (IEC 61000-6-3/A1/F2/Ed3). The need for these additional conducted emissions limits are based on observed sensitivity of equipment such as powerline communication devices, smart meters, and clocks being disrupted by emitting devices such as switching mode power supplies and PV inverters.

This technical demonstration will include an overview of measurement automation software developed to implement Integral Voltage Level (IVL) following informative annex guidance, as well as live demonstrations of emissions from various suspected emissions sources (both 6-3 residential and 6-8 commercial/industrial equipment) and how their results compare to the proposed limits.

Measuring Power Distribution Network Noise and Impedance Effects on Signal Integrity
Presenter: Michael Schnecker, *Rohde & Schwarz*

Power integrity including power distribution network (PDN) impedance and noise is one of the primary sources of signal integrity issues in digital transmission systems. Sources of noise can include power supply switching harmonics, high speed clocks, EMI and even nearby RF signals. The impedance of the PDN often varies widely with frequency resulting in ranges within which the impedance is higher allowing increased noise ingress. This demonstration will show how jitter analysis using an oscilloscope can reveal specific source of periodic jitter leading to higher overall peak to peak jitter. Further analysis of the PDN impedance, again using an oscilloscope, will be shown to reveal the specific frequency ranges corresponding to the periodic jitter sources where the impedance is higher. The resulting analysis is then used to provide a solution for mitigating the PDN noise and, along with it, the peak to peak jitter.

On the Application of FFTs for Accelerated Time Domain Scan to Reduce EMI Measurement Time
Presenter: Bill Koerner, *Keysight*

EMC testing is required for just about any product that has digital and radio components. With the growth of those products, time to complete EMC testing typically takes longer, due to competition for lab time, and for the surprises in tracking down short-burst or impulse-type emissions. The automotive industry, for example, requires exacting methodologies to measure all emissions accurately. Long test times impact test facility availability and potentially reduces the number of devices that are certified. It's also easy to miss intermittent disturbance signals with conventional scans since an extended dwell time must occur at each frequency.

With the implementation of a Short Time FFT (STFFT) engine, Keysight's N9048B PXE EMI receiver includes Time Domain Scan (TDS) and Accelerated TDS capabilities that enable independent compliance test laboratories and in-house certification labs to shorten their overall test time.

This presentation will provide an overview of TDS and Accelerated TDS capabilities to meet EMI measurement requirements and comply with EMC standards such as CISPR 16-1-1 and MIL-STD-461 and highlight how you can easily reduce receiver scan and test time from multiple hours to seconds.

Patuxent River Lightning and Electrotstatics Team "Precepitation Static Demonstration"
Presenter: Michael Stone, *Naval Air Warfare Center Aircraft Division*

P-Static has characteristics can be demonstrated in a few different forms. We can set-up 3 different configurations.

- UHF/VHF or any sort of aircraft antenna partially screwed on to a grounded aluminum plate. This will demonstrate the sound of the arcing on our Sony radios that can hook up to a speaker.
- A grounded windshield/windscreen or piece of plastic that demonstrates how the charge can remain on the surface with a static voltmeter. We then use a static control brush to show the how voltage decreases then increases when the brush moves away.
- A simple, aluminum sheet set up, that has one set-up demonstrating the arcing and one set-up that has it grounded and bonded. Painted Bolts could be a backup. This will show us the ideal and non-ideal conditions for proper bonding.

Solutions for Desense Mitigation and Radiation Emission Analysis
Presenters: Gopi Gampala, Jaehoon Kim and C.J. Reddy, *Altair*

Desense can be defined as, "the degradation in the sensitivity of the receiving antenna due to noise sources, typically which are generated by the same device". With the increase in the data rate and the routing density on the PCB, the issue of desense is becoming more and more important. Considering the example of a cell phone device, nowadays it has multiple connectivity features such as Wi-Fi, Bluetooth, GPS, GSM, NFC, etc. Each of these connectivity features has their own antenna to transmit and receive data. As these features are operating on different frequencies, altogether the antennas on the device cover a wide range of frequencies. As technology advances, mobile devices are designed to achieve a smaller form factor. This forces designers to place electronic components near by each other. Also, the PCB (Printed Circuit Board) of a cell phone device has multiple memory ICs (Integrated Circuits) which are operating at a high frequency. These ICs are connected to the central processing unit via traces/tracks on the PCB. If these routed traces are not shielded properly or if they have an improper return path they start to radiate. All these factors contribute to noise that unwantedly gets coupled with the receiving antenna which reduces its sensitivity. Not only the desense, but also the proper shielding of the connected cables is of utmost importance to an EMC engineer to mitigate the unwanted radiated emissions. This software demonstration presents advanced simulation tools for desense and radiated emissions using a combination of full wave EM solutions, Multi Transmission Line (MTL) method and PCB simulations using SPICE and 2D EM solvers. During this demo, we will present specific case studies as well as live demo using Altair Feko and PollEx.

Speed Up Your RC: Accelerated E-Field Measurements in Reverberation Chambers
Presenter: Samuel Hildebrandt, *LUMILOOP GmbH*

The demo session will start with a brief introduction on the basics of reverberation chambers (RCs). Validation and radiated immunity testing will be discussed.

We will bring a small, but fully working, stirred RC to the stage. Eight fast, synchronized electric-field probes will showcase real-time E-field strength measurements and closed loop E-field control based on statistics. LUMILOOP's LSProbe E-field Probes enable accelerated measurements according to ISO 11451-5.

Learn on how to improve you EMC measurement. Save time and money while testing!

EXPERIMENTS & DEMONSTRATIONS
The following information is preliminary and subject to change.

The Challenge of Measuring a 40 uOhm (2000 Amp) PDN with a 2-Port Probe
Presenters: Benjamin Dannan, *Signal Edge Solutions* and Steve Sandler, *Picotest*

The assessment of PDN impedance has become a well-published mantra. However, designing a power distribution network (PDN) for a scalable 2000 Amp power supply presents numerous challenges, one of which is measurement of the 2000A PDN.

Most of us are aware of the ground loop in the 2-port measurement. Most of us are also aware that we need to introduce a ground loop isolator to correct the error. If not, we've published plenty on the subject. But how much CMRR do you need to add? How does the use of a probe impact this requirement? The goal of this presentation is to demonstrate how one can effectively measure a 2000 Amp PDN or 40 uOhm using various VNAs. In addition to proving the need for CMRR rejection, discussion on how to calculate the minimum CMRR with a PDN impedance measurement using a 2-port probe will be shown. Lastly, it will be shown that it is possible to measure a sub-40 Qff impedance using a 2-port probe, when using an isolator that has sufficient CMRR.

The Concept of a Modern EMI Test Receiver
Presenter: Tobias Gross, *Rohde & Schwarz*
This workshop starts with an introduction to the basics of the EMI test receiver. Characteristics, differences to oscilloscopes or spectrum analyzers, as well as important parameters for a successful EMI measurement are highlighted. This serves as a basis for the following topics of the workshop and offers participants with different levels of knowledge the opportunity to attend this workshop. With a short journey back in time to analog instruments, the technological development of EMI measurement technology and the outstanding advantages of modern instruments will be demonstrated. Modern EMI test receivers rely on the Fast Fourier Transform (FFT), which was only made possible by modern signal processing and high computing power. This achieves gigantic speed advantages compared to conventional receivers. Very large bandwidths not only ensure considerably higher measurement speeds, but also offer unprecedented possibilities for analyzing the measurement objects. This will be examined in a practical way on the instrument as well as with external automation software. In addition, the workshop shows current measurement methods in practice that highlights the problem of high input levels and solutions to avoid false masurements or even costly damages to the device. The teaching of theory in this workshop is always supported by practical measurements and demonstrations directly on the instrument.

Transmission Lines
Presenters: John McCloskey and Jen Dimov, *NASA GSFC*
The proper functioning of any electronic system is ultimately determined by the quality of its interconnections between its circuits. Any interconnections whose length is a significant fraction of a wavelength must be treated as a transmission line. This demonstration shows 1) the importance of proper terminations of transmission lines in their characteristic impedance, and 2) impacts of improper terminations.

Troubleshooting EMI Failures on Power Delivery Networks Using an Oscilloscope and Near Field Probes
Presenter: Michael Schnecker, *Rohde & Schwarz*

Power delivery networks (PDNs) including PCB planes, capacitors, inductors and power conversion devices are common sources of both cunducted and radiated EMI. Methods for using near field probes and an oscilloscope to troubleshoot these problems are presented in this demonstration. While oscilloscopes are generally considered for observing and measuring signals in the time domain, most modern digital oscilloscopes are capable of accurate spectrum measurements as well. The benefit of using an oscilloscope with FFT-based spectrum analysis is its ability to measure in both time and frequency domains simultaneousy. Near field EMI measurements on a switched mode power supply under different load conditions and their relationship to the inductor saturation are used to illustrate this benefit.

Photo by Patrick Andre

Unveiling Time Domain Gating: Enhancing Control and Versatility with a Newly Developed Library
Presenters: Yibo Wang, *ETS-Lindgren and* Andrew Shyne, *Boeing*

Time domain gating is a well-known technique for isolating responses in reflective environments, commonly integrated into commercial vector network analyzers (VNAs). However, users often have limited options for further processing once data is downloaded from a VNA. To address this, a gating library has been developed which provides greater flexibility to users. This library can easily integrate with popular programming languages such as Matlab, Python, and C. Gated results often suffer from "band edge effects" due to limited measurement bandwidth. To mitigate this, the library incorporates standard edge treatment techniques and introduces a new Spectrum Extension Edgeless Gating (SEEG) method, significantly reducing edge effects compared to conventional methods. In addition, the library is not limited to time domain applications, but also performs well in spatial and spectrum analyses, such as image processing and antenna spectrum analyses. During demonstrations, real-time gating of antenna responses will be showcased, with parameters adjusted via Matlab script. Additionally, outputs from conventional edge renormalization and SEEG techniques will be compared to highlight the latter's superiority in edge treatment. Furthermore, spectrum mode filtering for antenna extrapolation will be demonstrated, showing the library's versatility beyond time-domain applications, utilizing data from the Boeing Dual Robotic Antenna Measurement System (DRAMS) for real-time gating in the angular spectrum domain.

Using Low Cost Software Defined Radio (SDR) for EMC Investigations
Presenter: Karen Burnham, *Electro Magnetic Applications, Inc.*

Karen Burnham will demonstrate how different SDRs, costing between $20 - 200, can be used for EMC purposes. In particular, she will demonstrate using SDR dongles in combination with antennas and/or current probes to get a sense of the EM/RF environment in a particular area and potential trouble spots.

Visualization of Low Frequency EMI Using a Smartphone
Presenters: Kevin Claytor and Ashley Mowery, *Johns Hopkins Applied Physics Laboratory*

We will be demonstrating an application where we use a smartphone to map low frequency EMI. Data is captured through a magnetic sensor connected to the headphone jack and onboard GPS sensors. This data is then fused to provide a map of low frequency EMI up to 16 kHz. The map is dynamic and interactive, allowing one to view a heatmap of EMI or interrogate the EMI spectrum at a given point.

Wi-Fi 6E/7: Amazing New Frontiers and Challenges...
Presenter: Bill Koerner, *Keysight*

Wireless connectivity has had such an impact on how we conduct our daily lives. With the wires removed, suddenly we are able to be connected to almost anyone, anywhere and anytime. According to a report released by IDC Research, 3.8 billion Wi-Fi devices were forecasted to be shipped in 2023. Over the last few years, the number and complexity of the Wi-Fi standards has grown. The U.S. opened up the 6 GHz band while the EU opened up about half of the 6 GHz bands for Wi-Fi 6E, and now Wi-Fi 7. Although the Wi-Fi 7 standard has yet to be formally adopted, manufacturers have released Wi-Fi 7 products already. Each new standard offers more... more bandwidth, more data transfer, more capability. With that increase, however, comes more measurement challenges to address for regulatory approval. This presentation will review the changes and discuss the measurement challenges in achieving regulatory approval.

Photo by Patrick Andre

TECHNICAL PROGRAM

STANDARDS WEEK 2024
The following information is preliminary and subject to change.

This is the week when we come together and focus on EMC Standards, something that impacts EMC practitioners worldwide. We're having meetings that will be open to people in person in Phoenix and remotely. You're welcome to attend and we encourage you to do so. How much do we want you to be a part of Standards Week? We'll be holding a special Happy Hour on Thursday afternoon (see below for details)—everyone who sits through to the end of one of the standards meetings listed below will receive a ticket. If one of these meetings seems to overlap with your professional interests, please join us! Standards are part of the life blood of the EMC Society, and they don't happen by accident. They happen because people like you care enough to create high quality standards that lay out the very best practices of the discipline. We hope you'll join us!

Photo by Jamie Ramie

Photo by Karthik Vepuri

STANDARDS RECOGNITION
WEDNESDAY AUGUST 7
12:00 – 12:30PM
Location: Ask the Experts area in the Exhibit Hall

Please join us as we recognize the working group members who were instrumental in publishing new IEEE EMC Society Standards in the past year. Writing a new standard, or even revising an old one, is no trivial task. So, we'd like to recognize those who put in so many volunteer hours and contributed their extensive technical expertise to making it happen.

We will be celebrating the official publication of:
IEEE 1897 "Recommended Practice for Location of Power-Line Gap Interference Sources"

IEEE 2718 "IEEE Guide for Near Field Characterization of Unintentional Stochastic Radiators"

STANDARDS HAPPY HOUR
THURSDAY AUGUST 8
4:00 – 6:00 PM
Location: 129B

Open to all who join us for one of the Standards Meetings this week, while supplies last.

Come join us for a chance to mingle and network with professionals who care about standards and technical excellence just as much as you do. As thanks to everyone who sits around a U-shaped conference table for an hour or two, we'd like to provide you with a more relaxed and informal setting to chat. Drinks and heavy appetizers will be available with ticket.

Meeting Name	Date	Start Time	End Time	Room
Standards Advisory and Coordination Committee Meeting	Monday, August 5	12:00 PM	2:00 PM	132A
Shielding Standards Continuity Group Meeting + IEEE 299/299.1 WG	Tuesday, August 6	8:00 AM	10:00 AM	132A
P2710, Flexible Shielding Characterization, Working Group	Tuesday, August 6	12:00 PM	2:00 PM	131C
IEEE P1848.1 Working Group Information Session	Tuesday, August 6	1:00 PM	2:00 PM	132C
IEEE 1560 Power Line Filters Working Group	Wednesday, August 7	8:00 AM	9:00 AM	131C
Managing Functional Safety Risks Caused by EMI - IEEE 1848-2020 Continuity Working Group	Wednesday, August 7	8:30 AM	10:30 AM	132C
Standards Recognition	Wednesday, August 7	12:00 PM	12:30 PM	Exhibit Hall
IEEE Standard P2855 Group Monthly Meeting	Wednesday, August 7	2:00 PM	4:00 PM	132C
Computational Electromagnetics Continuity Group - Annual Meeting	Wednesday, August 7	2:00 PM	5:00 PM	131AB
PAR 2838 WG Aircraft Components Lightning Direct Effects Qualification	Thursday, August 8	9:30 AM	11:00 AM	131C
Standards Development and Education Meeting	Thursday, August 8	2:00 PM	4:00 PM	131C
Standards Happy Hour	Thursday, August 8	4:00 PM	6:00 PM	129B
IBIS Summit	Friday, August 9	8:00 AM	12:00 PM	132A

EMISSION MEASUREMENTS OF ANSI C63.4 AND TIME DOMAIN APPLICATIONS (ANSI C63.25 SERIES)
(Visit www.c63.org for more information)

This workshop will share the activity currently underway in the ANSC C63® committee for C63.4 and C63.25 series. Among the many updates, EMC Site Validation requirements are migrating from C63.4 to the C63.25 standards series: ANSC C63 - C63.25.1, C63.25.2, and C63.25.3. Topics covered include: (1) Review of the latest draft edition of ANSI C63.4:20xx and (2) Application of Time Domain (TD) SVSWR in C63.25.1 (1 GHz – 18 GHz) (3) Newly streamlined procedures for site validation measurements in C63.25.2 (30 MHz – 1 GHz) (4) Latest development for site validations using Cylindrical Mode Filtered SVSWR (CMF SVSWR) measurements for test site validation and antenna calibration (18 GHz – 40 GHz) to be included in C63.25.3.

This workshop is designed to increase your understanding of the C63.4 standard and the expected changes in the next revision, and what to anticipate in the new C63.25 series on EMC site validation methods.

For the C63.4 discussions, there will be an analyses and changes in the requirements for the above 1 GHz test method, use of the 2 dB rule, compliance files, test setup changes and many other aspects.

For the C63.25 discussion, application of time domain and mode filter methods for validating EMC test sites will also be presented along with a live demonstration on its usage.

NEW this year – an update will be provided on the recently published C63.2 "Specifications of Electromagnetic Interference and Field Strength Measuring Instrumentation in the Frequency Range 9 kHz to 40 GHz."

In the C63.4 workshop, you will learn:
- RF emission measurement procedures
- National and international regulatory implications
- Test facility and instrumentation requirements
- Equipment test arrangements and configurations

In the Time Domain (C63.25) workshop, you will learn:
- Application for site validation
- Application for antenna calibration

With the C63.2 update, you will learn:
- The new requirements for instruments used for EMI measurements
- Importance of quasi-peak, peak, and average detection in the frequency range 9 kHz to 40 GHz

WHO SHOULD ATTEND
Those responsible for determining compliance with FCC Rules and Regulations (and CISPR 22), including:
- Product managers and developers
- EMC engineers and test technicians
- Regulatory compliance managers
- Test instrumentation developers
- Those using and calibrating antennas in making radiated emission compliance measurements
- Calibration technicians
- Calibration and measurement accreditation bodies
- Lab quality assessors
- Test instrumentation and chamber manufacturers

EXPERT INSTRUCTORS
The workshop features industry experts and active technical contributors to ANSC C63, including Andy Griffin (Cisco), C63.4 Working Group Chair and Chair of Subcommittee 1 (SC1), Techniques and Development. Standards C63.4 and C63.25 are developed and maintained by SC1; as well as Zhong Chen (ETS-Lindgren), Vice Chair ANSC C63 and C63.25.1 Working Group Chair; plus Jens Medler (Rohde & Schwarz), C63.2 Working Group Chair.

DATES AND LOCATION • AUGUST 2 AND 3, 2024
Compliance Testing in Mesa, AZ. See www.emc2024.org for symposium hotel info and to reserve your hotel room.

FEE INCLUDES
Complete lecture slides, continental breakfast, lunch, breaks, and completion certificate. Fee does NOT include copies of the draft or published standards. Fee does NOT include hotel accommodations.

AGENDA
FRIDAY, AUGUST 2
8:30 am: Registration and Continental Breakfast **9:00 am to 5:00 pm:** Workshop Lectures

SATURDAY, AUGUST 3
8:30 am: Continental Breakfast **9:00 am to 12:00 pm:** Workshop Lectures and Live Demonstrations

REGISTRATION FORM Contact: Janet O'Neil • Telephone: 425-443-8106 • j.n.oneil@ieee.org

Ms./Mr._____

Company_____

Address_____

City_____State_____Zip_____

Daytime Phone_____Fax_____

Email_____

Signature: _____

Check or Credit Card Number must accompany registration.

To pay by credit card, please so indicate when you submit your registration form and an invoice will be emailed to you.

Workshop Fee – All Day August 2 and Morning Only August 3

By July 5*:	$1,100 USD _____
C63® & S/C Members (by July 5)	$975 USD_____
Add $200 if after July 5 or at the door**	$200 USD _____
	Total USD $_____

Make check payable to:
U.S. EMC Standards Corporation in U.S. dollars drawn on a U.S. bank.

Mail to:* Janet O'Neil
ETS-Lindgren
8422 NE Meadowmeer Drive
Bainbridge Island, WA 98110

**NOTE: You are not registered until you receive confirmation.**
*Please do not mail after July 15. **With prior telephone or email registration only.*

The organizing committee reserves the right to substitute speakers, modify the program (or lecture notes), restrict attendance or to cancel the workshop(s). In the event the workshop is canceled, registration fees will be refunded. No refunds will be made to individuals who cancel after July 1. Substitutions are allowed. Workshops without a minimum of 10 attendees registered by 10 July 2024 will be cancelled and registration fees returned. It is suggested that you book refundable travel arrangements as appropriate if workshop is cancelled.

TECHNICAL TOURS

The following information is preliminary and subject to change. Tickets are limited and will be sold on a first-come, first-served basis.

ARIZONA STATE UNIVERSITY

Two decades ago, Arizona State University (ASU) set forth a new and ambitious trajectory to become a comprehensive knowledge enterprise dedicated to the simultaneous pursuit of excellence, broad access to quality education, and meaningful societal impact. From that point forward, all of its energy, creativity and resources have been brought to bear on the design of a uniquely adaptive and transdisciplinary university committed to producing master learners. Today, ASU exemplifies a new prototype for the American public research university. ASU's culture of innovation and inclusion draws pioneering researchers to its faculty and attracts highly qualified students from all 50 states and more than 130 nations. ASU is expanding academic and entrepreneurial opportunities for every type of learner at all stages of life.
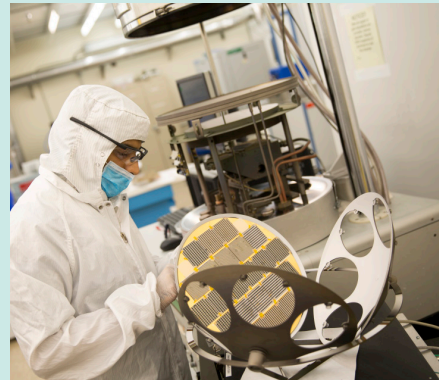
Join us for this unique technical tour where attendees will see three distinct laboratories addressing Antenna and Microwave, Terahertz, and NanoFab research. The Antenna Lab includes one of the largest university-based anechoic chambers in the US. This lab is well-known as the hub of activity for ASU Regents' Professor Emeritus, Constantine A. Balanis. The Terahertz Lab houses a variety of small and large signal tools tailored for characterization of high frequency circuits and systems. NanoFab is a flexible nanoscale processing and fabrication facility offering state-of-the-art device processing and characterization tools for university research and external company prototype development. Attendees will see a 3,800 square-foot class 100 cleanroom and eight auxiliary labs.

Date: Thursday, August 8
Time: 4:00 pm – 7:30 pm
Cost: $50 advance registration/$65 after July 1

THE BOEING COMPANY

The Boeing facility in Mesa, Arizona, stands as a cornerstone of the company's defense and aerospace endeavors. Specializing in the production and maintenance of military aircraft, particularly the renowned AH-64 Apache attack helicopter, it serves as a vital component of U.S. military operations. The facility not only boasts advanced manufacturing capabilities but also houses a suite of material measurements laboratories. These labs play a crucial role in ensuring the quality and reliability of materials used in Boeing's products, employing cutting-edge techniques for material analysis and testing. Through the dedication of its skilled workforce, the Mesa facility upholds Boeing's reputation for excellence in defense aviation. It stands as a testament to Boeing's commitment to innovation and precision in aerospace engineering.

Date: Friday, August 9
Time: 4:00 pm – 7:30 pm
Cost: $75 advance registration/$90 after July 1

CLICK HERE FOR FULL DETAILS

COLLATERAL MEETINGS
The following information is preliminary and subject to change.

WORKING GROUPS, COLLATERAL MEETINGS & SOCIAL EVENTS

Times are subject to change. Please confirm the meeting schedule on the website, in the final program, and on the mobile app closer to the symposium start date.

SUNDAY, AUGUST 4

Meeting Name	Start Time	End Time	Room	Type	Attendees
EMC Board Meeting	9:00 AM	5:00 PM	Sheraton - PV	Other	Pre-Registration

MONDAY, AUGUST 5

Meeting Name	Start Time	End Time	Room	Type	Attendees
Speaker Breakfast	7:00 AM	8:30 AM	126ABC	Other	Speakers Only
Technical Advisory Committee (TAC) Meeting #1	7:00 AM	8:30 AM	131AB	Technical Services	
EMC Society Chapter Chair Training	12:00 PM	1:30 PM	131AB	Member Services	
Standards Advisory and Coordination Committee Meeting	12:00 PM	2:00 PM	132A	Standards Services	
SC-1 Smart Grid and EMC Issues Committee Meeting	5:30 PM	6:30 PM	132A	Technical Services	
EMC+SIPI Jeopardy! YP Event	6:00 PM	10:00 PM	The Arrogant Butcher	Social Event	Pre-Registration

TUESDAY, AUGUST 6

Meeting Name	Start Time	End Time	Room	Type	Attendees
Speaker Breakfast	7:00 AM	8:30 AM	126ABC	Other	Speakers Only
TC-2 EMC Measurements Committee Meeting	7:00 AM	9:00 AM	132B	Technical Services	
Shielding Standards Continuity Group Meeting + IEEE 299/299.1 WG	8:00 AM	10:00 AM	132A	Standards Services	
TC-8 Aeronautics and Space EMC Committee Meeting	12:00 PM	1:00 PM	131AB	Technical Services	
TC-10 Signal and Power Integrity Committee Meeting	12:00 PM	1:00 PM	132A	Technical Services	
TC-7 Electrical Systems and Power Electronics EMC Committee Meeting	12:00 PM	1:30 PM	132B	Technical Services	
P2710, Flexible Shielding Characterization, Working Group	12:00 PM	2:00 PM	131C	Standards Services	
IEEE P1848.1 Working Group Information Session	1:00 PM	2:00 PM	132C	Standards Services	
Member Elevation Event - Taking Your Membership to the Next Level	2:30 PM	4:00 PM	126A	Member Services	
Welcome Reception	5:00 PM	7:00 PM	Exhibit Hall 5&6	Social Event	
"After the Welcome Reception" YP Event	19:00	10:00 PM	Huss Brewing	Social Event	Pre-Registration

WEDNESDAY, AUGUST 7

Meeting Name	Start Time	End Time	Room	Type	Attendees
Speaker Breakfast	7:00 AM	8:30 AM	126ABC	Other	Speakers Only
Education Committee (EdCom) Meeting	7:00 AM	8:30 AM	132C	Technical Services	
TC-1 EMC Management Committee Meeting	7:30 AM	9:00 AM	132A	Technical Services	
IEEE 1560 Power Line Filters Working Group	8:00 AM	9:00 AM	131C	Standards Services	
TC-12 EMC for Emerging Wireless Technologies Committee Meeting	8:00 AM	9:00 AM	132B	Technical Services	
Managing Functional Safety Risks Caused by EMI - IEEE 1848-2020 Continuity Working Group	8:30 AM	10:30 AM	132C	Standards Services	
Standards Recognition	12:00 PM	12:30 PM	Exhibit Hall 5&6	Standards Services	
TC-9 Computational Electromagnetics Committee Meeting	12:00 PM	1:00 PM	131AB	Technical Services	
TC-5 High Power Electromagnetics (HPEM) Committee Meeting	12:00 PM	1:30 PM	131C	Technical Services	
TC-11 Nanotechnology and Advanced Materials Committee Meeting	12:00 PM	1:30 PM	132B	Technical Services	
Past President Lunch	12:00 PM	1:30 PM	126A	Social Event	Invitation Only
TC-4 Electromagnetic Interference Control Committee Meeting	12:00 PM	2:00 PM	132A	Technical Services	
IEEE Standard P2855 Group Monthly Meeting	2:00 PM	4:00 PM	132C	Standards Services	
Computational Electromagnetics Continuity Group - Annual Meeting	2:00 PM	5:00 PM	131AB	Standards Services	
Women in Engineering Meeting	3:30 PM	05:30 PM	126AB	Member Services	Pre-Registration
Gala Dinner	7:00 PM	10:00 PM	120A	Social Event	Pre-Registration

THURSDAY, AUGUST 8

Meeting Name	Start Time	End Time	Room	Type	Attendees
Team EMC Spin Class	6:30 AM	8:00 AM	Sheraton Lobby	Other	Pre-Registration
Speaker Breakfast	7:00 AM	8:30 AM	126ABC	Other	Speakers Only
TC-6 Spectrum Engineering Committee Meeting	7:00 AM	9:00 AM	131AB	Technical Services	
TC-3 Electromagnetic Environment Committee Meeting	8:00 AM	9:30 AM	131C	Technical Services	
T-EMC, T-SIPI, L-EMCPA Associate Editor Meeting	8:00 AM	10:00 AM	132A	Communication Services	
PAR 2838 WG Aircraft Components Lightning Direct Effects Qualification	9:30 AM	11:00 AM	131C	Standards Services	
SC-3 Special Committee on Machine Learning and AI in EMC and SIPI	10:30 AM	12:00 PM	131AB	Technical Services	
Awards Lunch	12:00 PM	1:30 PM	120A	Social Event	Pre-Registration
EMC-S PerCom Meeting	2:00 PM	3:00 PM	132A	Communication Services	
Standards Development and Education Meeting	2:00 PM	4:00 PM	131C	Standards Services	
Standards Happy Hour	4:00 PM	6:00 PM	129B	Standards Services	Invitation Only
EMC Board Meeting	6:00 PM	8:00 PM	131AB	Other	Pre-Registration

FRIDAY, AUGUST 9

Meeting Name	Start Time	End Time	Room	Type	Attendees
Speaker Breakfast	7:00 AM	8:30 AM	126ABC	Other	Speakers Only
Technical Advisory Committee (TAC) Meeting #2	7:00 AM	9:00 AM	131AB	Technical Services	
IBIS Summit	8:00 AM	12:00 PM	132A	Standards Services	

TECHNICAL COMMITTEES

The following information is preliminary and subject to change.

EMC SOCIETY TECHNICAL COMMITTEES – BUILD YOUR EXPERTISE AND YOUR CAREER

No matter where you are in the industry, at some point you will deal with an EMC issue. Maybe a device is causing interference or maybe it's vulnerable to radio-frequency fields. Maybe a device crashes or resets after an electrostatic discharge. Maybe you've been looking for help explaining an EMC problem to your customer or your boss. All of these things happen. **Become part of the solution.**

The **IEEE EMC Society's Technical Committees (TCs)** convene to set EMC standards & practices and develop tools for success. Covering topics ranging from professional development to nanotechnology, the TCs are volunteer consensus groups that build our industry's foundations. Join remotely or in-person and help form important technical practices.

Find your place among these forward-looking committees. Join a TC today and set standards, explore emerging technology and help develop programs and create the tools that you and your industry need.

If you are interested in joining a committee, please complete the TC/SC Interest form. www.emcs.org/technical-committees/tc-sc-interest-form

WORKING GROUPS AND TECHNICAL COMMITTEE MEETINGS

The EMC Society has many working groups and committees that are tackling the wide range of functions of the society's mission. The working groups primarily come out of the EMC Society Standards activities developing new EMC Standards and revising existing standards. Standing and special committees are formed to address a broad range of needs, ranging from interfacing with other industry organizations to dealing with the administration of the society. All of these meetings are open to everyone (unless listed otherwise). Join them for breakfast, breaks, lunch or dinner. Learn what other EMC members are working on and influence how the society operates.

COLLATERAL MEETINGS

With so many people attending this pinnacle event from across the globe, it's a perfect opportunity for groups other than the EMC Society to hold meetings in parallel to the Symposium. Be sure to check out the schedule to find out about the numerous collateral meetings and who can participate. The EMC Society is neither responsible for nor endorses any of these collateral meetings and discourages any meetings from conflicting with the technical and networking programs of the Symposium.

If you would like to schedule a meeting, please contact: Michelle Measel - m.measel@ieee.org

Photo by Richard Georgerian

TECHNICAL COMMITTEES

The following information is preliminary and subject to change.

TC 1 EMC Management	This committee is concerned with the development and dissemination of Best Practices and Methodologies for the successful leadership, supervision and guidance of EMC related activities. These Best Practices and Methodologies shall be structured so as to provide assistance to all managers, and engineers. Appropriate and convenient tools shall serve as a foundation to these Best Practices and Methodologies.
TC 2 EMC Measurements	The committee reviews the adequacy of measurement procedures and measurement instrumentation specifications for radiated and conducted emission and immunity tests. Also discussed is the rationale for product emission limits and immunity test levels including performance requirements. The committee also supports EMC standards and procedures that deal with measurements and their uncertainty and how they are interpreted and applied.
TC 3 Electromagnetic Environment	The charter of TC3, the Technical Committee on Electromagnetic Environment is to encourage research on the: • electromagnetic environment (EME) • development of standards for EME measurement and characterization • natural and man-made sources of electromagnetic environment that comprise this environment • effects of noise (unwanted portions of EME) on systems performance • effects of international civil and military standards intended to control man-made intentional and unintentional emissions of electromagnetic energy.
TC 4 Electromagnetic Interference Control	This committee is concerned with design, analysis, and modeling techniques useful in suppressing interference or eliminating it at its source. Bonding, grounding, shielding, and filtering are within the jurisdiction of this committee. These activities span efforts at the system, subsystem, and unit levels
TC 5 High Power Electromagnetics	This committee is concerned with the effects and protection methods for electronic equipment and systems for all types of high power and other electromagnetic threat environments. These environments include electromagnetic pulse (EMP), intentional EMI environments (i.e., narrowband and wideband), lightning electromagnetic currents and fields, electrostatic discharge and geomagnetic storms. In addition this committee deals with the commercial data security issue through electromagnetic information leakage activities. Interactions with subsystems, systems and platforms are included.
TC 6 Spectrum Engineering	This committee is concerned with the analysis, design, and measurement techniques for intentional RF transmitting and receiving equipment to prevent interference and promote efficient spectrum use through technology and operational based approaches,such as software design, dynamic spectral allocation, waveform control, as well as frequency coordination and management procedures.
TC 7 Electrical Systems and Power Electronics EMC	This technical committee is concerned with low-frequency EMC including Power Quality in electric power systems. The committee is focusing on application of fundamental EMC concepts also to low frequency conducted disturbances. EMC in power systems is expected to be increasingly important. This is due to increased use of electronics in renewables, electric vehicles, energy efficient technologies and Smart Grid applications.

TECHNICAL COMMITTEES
The following information is preliminary and subject to change.

TC 8
Aeronautics and Space EMC

This committee is concerned with EMI/EMC issues in aircraft, spacecraft & space launch vehicles, robotic and crewed. The space environment provides unique challenges in the design, development, test and operation of space systems to avoid EMI and achieve EMC. Aeronautics & space EMC covers a wide range of topics on the part, board, box, system, multi-system, planetary and interplanetary levels. The harshness of the atmospheric, launch and space environments necessitates a broader view of EMC issues than traditional terrestrial projects, often leading to creative methods and solutions that can benefit our society's efforts elsewhere on Earth.

TC 9
Computational Electromagnetics

This committee is concerned with broad aspects of Applied Computational Electromagnetic techniques which can be used to model electromagnetic interaction phenomena in circuits, devices, and systems. The primary focus is with the identification of the modeling methods that can be applied to interference (EMC) phenomena, their validation and delineating the practical limits of their applicability. Included are low and high frequency spectral-domain techniques and time-domain methods.

TC 10
Signal and Power Integrity

This committee is concerned with the design, analysis, simulation, modeling and measurement techniques useful in maintaining the quality of electrical signals and power distribution network in printed circuit boards, ICs and within systems. These activities encompass all aspects of signal and power integrity from the integrated circuit level to the system level.

TC 11
Nanotechnology and Advanced Materials

Concerned with modelling, simulation and experimental characterization of nanomaterials and nanodevices for EMC applications. Nanotechnology is the understanding and controlling of matter at atomic and molecular scale.
Nanotechnology has already found its way into various EMC applications. New materials such as single- and multi-phase composites filled with nanoparticles, nanotube and/or nanofibres have been designed and tested for gaskets and absorbing screens with outstanding performance and capabilities. Innovative nanostructured shields have shown multifunctional properties and higher efficiency than commonly used materials. Nanowires for high speed interconnects and high density integrated systems, could replace copper in the near future, but require adequate modelling and simulation approaches for signal integrity and also to avoid electromagnetic interference problems.

TC 12
EMC for Emerging Wireless Technologies

This committee is concerned with the EMC design, analysis, modeling, measurement, and testing aspects of emerging wireless products, such as Internet of Things and 5th Generation of Wireless Communication. The committee encourages research including but not limited to the following areas:
- Innovative Wireless Component Design for System Integration: wireless component design with integrated EMC functions and/or meeting certain EMC specifications
- Radio-Frequency Interference and De-sense: characterization and mitigation of interference from digital circuits to wireless antennas
- EMC and OTA Measurement & Testing of Wireless Systems: development of methods and standards for wireless performance and compliance testing
- Wireless Coexistence: interference control/mitigation among various wireless radios, as well as related testing methods and standard development
- Wireless Product or Subsystem EMC: wireless-specific EMC design for Autonomous cars, Phased Array, and others.

SC 1
Smart Grid Support and EMC Issues

This special committee is concerned with coordinating the EMC Society activity on providing EMC principles for those organizations and associated documentation and specifications that address the efficient use of the AC power grid including the control of power entering a house or building. Such control may be from a meter at the point of power entry into these facilities to control incorporated into appliances and other electronic devices in these facilities. Such controllers may be sources of undesirable RF emissions and at the same time vulnerable to the RF environment which speaks to the need for EMC. It is expected that the coordination aspect of this special committee will involve several EMCS Technical Committees.

TECHNICAL COMMITTEES
The following information is preliminary and subject to change.

SC 3
Artificial Intelligence and Machine Learning in EMC + SIPI

This special committee is concerned with all aspects of machine learning, artificial intelligence and deep learning as it applies to the Society's Field of Interest (FoI). It is not limited to any specific aspect of the Society but recognizes that machine learning and related approaches have relevance across the entire spectrum of Society activities.

SC 5
Power Electronics EMC

This special committee is concerned with power electronics converters EMI/EMC issues. These are mainly, converters that use switching frequency schemes to control the output parameters, such as voltage and current. These converters, including inverters, can be found as interface between the raw power and the electrical grid to provide the end-user with the desired operating power. Applications can range from grid-connected PV systems, wind farms, automotive, aerospace, and communication systems.

Standards Advisory and Coordination Committee (SACCom)

The IEEE EMC Society Standards Advisory and Coordination Committee is responsible for providing technical liaison between the IEEE EMC Society Standards Development Committee and various non-IEEE entities involved with EMC standards activities.

In particular, the SACCom will include the following:
- Propose to the EMCS board of directors (BOD), the appointment of representatives to various non-IEEE standards developing entities.
- To monitor the activities of various non-IEEE standards developing organizations with a view toward making recommendations to the EMCS board of directors on any required coordination of those activities within the society.
- To communicate and coordinate with non-IEEE standards developing activities and the EMCS Standards Development Committee on matters relating to the development of EMC related standards.

Standards Development and Education Committee (SDECom)

The IEEE EMC Society Standards Development and Education Committee is responsible for guiding the development of IEEE EMC Standards, the training of those involved in the standards making process and the education of the EMC Society community on all aspects of EMC Standards. The IEEE EMC Society is the primary international developer of fundamental test, measurement and verification standards for EMC.

Education Committee (EdCom)

This committee's mission is to promote EMC education related activities of the IEEE EMC Society. Our vision is to provide opportunities for individuals and organizations involved with electrotechnology and products to become aware of EMC at levels consistent with their needs, and our goals are to establish an awareness of EMC fundamentals throughout industry and academia as well as to enhance EMC education through the development of improved education techniques, materials, opportunities, and communications.

MEET AND NETWORK WITH LIKE-MINDED INDIVIDUALS AT OUR SOCIAL EVENTS

Network with your peers and other top industry professionals throughout the week during numerous planned events!

The following information is preliminary and subject to change.

WELCOME RECEPTION

The EMC+SIPI 2024 Welcome Reception will be held in the Exhibit Hall at the Phoenix Convention Center on Tuesday. **New for this year**, the attendance is open to everyone with a Symposium name badge, regardless of registration type. Food will be provided, but drink tickets will be available for purchase.

Join us for this chance to celebrate the beginning of the Symposium and to meet our Exhibitors.

Location: Exhibit Hall 5 & 6 Phoenix Convention Center
Date: Tuesday, August 6, 2024
Time: 5:00 – 7:00 PM

Photo by Patrick Andre
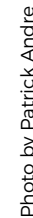
EVENING GALA EVENT

The Gala is our Symposium celebration that is traditionally a sit-down dinner event with entertainment. Thanks to our sponsor, Rohde & Schwarz, the EMC+SIPI 2024 Gala will have a fun German themed dinner, décor, and entertainment!

One ticket to this event is included in all 5-Day technical registrations EXCEPT student registrations. Extra tickets to the Gala may be purchased as an add-on to your registration.

SPONSORED BY:

ROHDE&SCHWARZ
Make ideas real

Location: 120A–Phoenix Convention Center
Date: Wednesday, August 7, 2024
Time: 7:00 – 10:00 PM
Cost: $110 advanced registration/ $120 after July 1

Photo by Patrick Andre

AWARDS LUNCHEON

The Awards Luncheon is a wonderful opportunity to recognize achievements and network with families and EMC professionals from academia, industry, government, military, and retired sectors. The event will start off with a catered sit-down meal. Afterwards, the EMC Society will take time to recognize members and non-members for their contribution to the Society and for professional excellence.

Location: 120A – Phoenix Convention Center
Date: Thursday, August 8, 2024
Time: 12:00 – 1:30 PM
Cost: $60 advanced registration/$70 after July 1

Photo by Richard Georgerian

TABLE OF CONTENTS

The following information is preliminary and subject to change.

CHAPTER CHAIR TRAINING SESSION AND LUNCHEON

The Chapter Chair Training Session provides a forum for focused training to the Chapter Chairs, the opportunity to discuss chapter issues and get group feedback. Additionally, the session gives the Chapter Chairs the opportunity to meet other Chapter Chairs from around the world and for the Chapter Coordinator to disseminate important information from IEEE headquarters and the EMC Society Board of Governors. A Social Session will precede the Luncheon to give the Chapter Chairs the opportunity to socialize with the other Chapter Chairs and their Angels.

The Luncheon will be served at the end of the Social Session. Besides a great meal, each Chapter Chair or their representatives will have the opportunity to share what their chapter has been doing for the past year. After the Luncheon, an interactive brainstorming session will conclude the meeting. This session is intended to allow participants to exchange information and new ideas for effective chapter management, as well as to discuss best practices and suggestions for future development and growth of the EMC chapters.

Location: 131AB – Phoenix Convention Center
Date & Time: Monday, August 5 • 12:00 – 1:30 PM
Cost: Free for Chapter Chairs

This is a free event open to Chapter Chairs or their representatives. Please check with your Chapter Chair, as you can be that representative for your chapter if your Chapter Chair cannot attend this event

Photo by Karthik Vepuri

PAST PRESIDENTS LUNCHEON

The Luncheon is open to Past-Presidents of the EMC Society, and current members of the Board of Directors. The luncheon is a chance for the old and the new to mix, exchanging experiences of the past and challenges of the future relative to the EMC profession. A sit down lunch is provided. Past-Presidents should inform the Chair of the History Committee (danhoolihanemc@aol.com) of their interest in attending so there will be seating and food available for all.

Location: 126BC- Phoenix Convention Center
Date: Wednesday, August 7, 2024
Time: 12:00 – 1:30 PM

TEAM EMC

Please join us and your fellow EMC colleagues for an in-door, air conditioned private spin class. The ride is for all levels of participation. A TEAM EMC jersey will be included for 1st-time participants on a first come first serve basis, while quantities last. If you received a jersey on one of our past rides, please don't forget to bring it with you. This year's artwork "Mountain Bike Cowboy Skeleton" for the jersey has been designed by PHX local artist Bill Gulino.

Seats are limited to first come, first serve. Reservations are binding due to the limited seats available. **Contact for reservation by July 15th: Susanne Vogel, susanne.vogel@ieee.org**

The spin class will take place at a nearby gym. Sports clothes will be recommended in the gym. No helmet required. If you have a car available, please provide a ride for other riders too. We will also organize a shared ride via Uber/Lyft to the gym for all registered participants.

Meeting Location: Sheraton Registration Desk, 340 N 3rd St
Class Location: The Underground
Date & Time: Thursday, August 8 • 6:30 AM

IEEE EMC SOCIETY WOMEN IN ENGINEERING (WIE) EVENT

IEEE Women in Engineering (WIE) is a global network of IEEE members and volunteers dedicated to promoting women engineers and scientists, and inspiring girls around the world to follow their academic interests in a career in engineering and science. Our goal is to facilitate the recruitment and retention of women in technical disciplines globally. We envision a vibrant community of IEEE women and men collectively using their diverse talents to innovate for the benefit of humanity.

Location: 126BC – Phoenix Convention Center
Date: Wednesday, August 7, 2024
Time: 3:30 – 5:30 pm
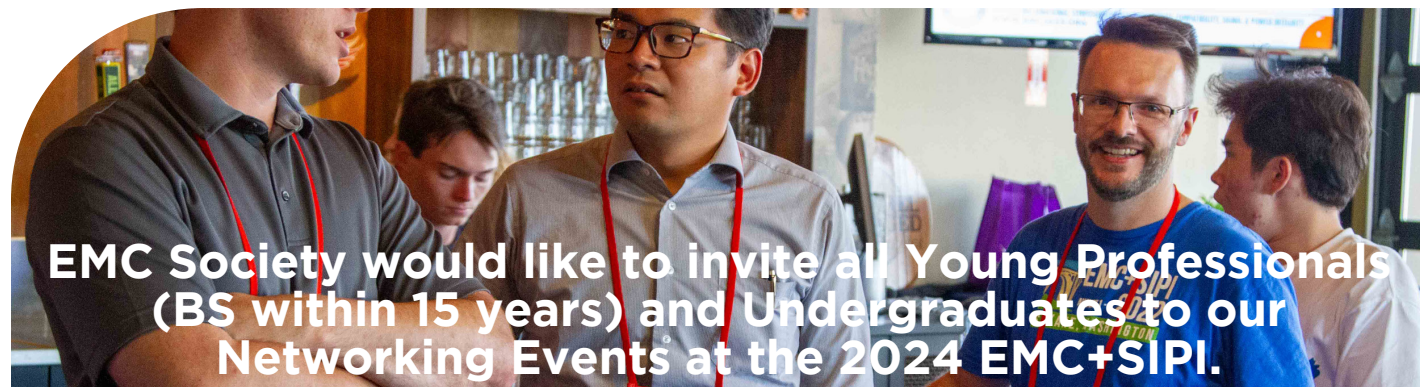**Cost:** $10, refreshments included

Let's meet for a networking and enrichment event during the IEEE EMC+SIPI 2024 Symposium and share experiences. We, the IEEE WIE and the IEEE EMC Society, invite you to attend this wonderful event. Please join us for a special celebration at the end of the presentations.

Everyone is welcome - men and women - to attend the special presentations!

AGENDA

Time	Description
3:30 pm	**Welcome** **Ms. Tara Kellogg**, *ETS-Lindgren, EMC Society WIE Chair, Americas, IEEE EMC Chapter Chair, Central Texas*
3:40 pm	**Speaker Introduction** **Mr. Anil Kumar**, *Principal Engineer, Client Computing Group, INTEL*
3:50 pm	**WIE Panel Discussion: Artificial Intelligence: What Motivates the Women in Engineering at INTEL?** **Ms. Nikita Tiwari**, *Senior AI Enabling Engineer, Client Computing Group, INTEL* **Ms. Neethu Elizabeth Simon**, *Senior Software Engineer, Network & Edge Group, INTEL* **Ms. Joyce Weiner**, *Principal Engineer, AI Software Architecture, INTEL* This panel of semiconductor industry engineering experts has over 50 years of combined experience. From data science to software to artificial intelligence (AI), hear how they have navigated their demanding careers while juggling their personal lives and giving back through their community leadership. Ask your questions during the interactive section. You'll learn there is nothing artificial about these women engineers!
4:50 pm	**Break & Networking Exercise**
5:20 pm	**Welcome Back Toast and Refreshments to Celebrate WIE!**
5:30 pm	**Adjourn**

YOUNG PROFESSIONALS

EMC Society would like to invite all Young Professionals (BS within 15 years) and Undergraduates to our Networking Events at the 2024 EMC+SIPI.

EMC+SIPI JEOPARDY! YP EVENT

During the 2024 Symposium, back by popular demand, we will hold "EMC+SIPI Jeopardy!" – Trivia, with a Twist! This event is great at building your expertise in EMC+SIPI as well as providing a welcoming, informal environment to network with YP colleagues and experienced professionals alike. Once again, you'll have the opportunity to test your knowledge against our EMC+SIPI Jeopardy! Experts (stay tuned for more details). Come mingle with your fellow YPs and a handful of EMC+SIPI gurus! Additionally, we'll have some guest speakers who will share their experience and insights in volunteering within IEEE EMC Society, we'll highlight the Best Student Paper Candidates, and last but not least, we'll be announcing the newly selected 2024-2025 EMC Society Young Professionals Ambassadors.

Location: The Arrogant Butcher - 2 E. Jefferson #150
Date: Monday, August 5, 2024
Time: 6:00 – 10:00 PM
Registration Fee: $35 advance registration / $40 after July 1
Includes: Dinner and 1 Drink ticket, Limited space available

"AFTER THE WELCOME RECEPTION" EVENT

Get to know your fellow Young Professionals in a casual, informal setting after the Welcome Reception. We'll have networking games planned, intended to help YPs get to know one another, and to gain a better understanding of the EMC Society. Besides the games, drinks and appetizers, this is a great time to continue the conversations started during the Welcome Reception or to introduce your friends to one another. Relationships formed in the EMC Society can lead to future collaborations on projects and will provide valuable contacts when you need a friend to bounce ideas off!

Location: Huss Brewing Downtown PHX Brewpub -
225 E Monroe St
Date: Tuesday, August 6, 2024
Time: 7:00 – 10:00 PM
Registration Fee: $20 registration
Includes: 2 drink tickets and shared appetizers included
Limited space available

YOUTH TECHNICAL PROGRAM

The following information is preliminary and subject to change.

HARNESS THE POWER OF THE SUN!

Have you ever stood outside on a hot, sunny day, and wondered whether all that sunshine could be used for something? Join us on August 7 for the 2024 Youth Technical Program of the IEEE EMC+SIPI Symposium in Phoenix, AZ, where we will discuss the principles of renewable energy, the photoelectric effect, and their application to photovoltaic technology. Each participant will apply these principles to construct a solar powered car, useful for cruising the streets of Phoenix, and beyond! Open to children 6-16. Younger participants are welcome if accompanied by an older sibling or parent. Sign up via the registration portal.

Location: 129B – Phoenix Convention Center
Date: Wednesday, August 7, 2024
Time: 1:00 PM - 3:30 PM
Registration Fee: FREE

COMPANION CLUB

The Companion Club is your chance to meet new people and catch up with old friends. You may register for the Companion Club as a part of the technical attendee's registration or separately.

Paid Companion Club members are welcome to visit the beautiful Companion Suite where a delicious breakfast will be served Monday to Thursday, from 7:00 to 10:00 am. There will also be daily raffles!

This year, the EMC+SIPI Symposium offers two attractive group Companion Tours. However, you don't have to be registered for the Companion Club to participate in a tour.

If you register for the Companion Club, you may sign up for the tours with your own registration. Otherwise, you may purchase tours through the technical attendee's registration; there will be a drop down space to add your name.

Join your technical attendee at any of our Social Events for more fun and to meet more people. We have special prices for companions under the age of 18. Tickets to the Welcome Reception, a great networking time for all, are included in all Companion Club registrations. The Evening Gala is also a fun event, and companions are invited to register for this event separately in their Companion Club or technical attendee's registration.

For the younger crowd, our ever popular Youth Technical Program is back once again to amaze all companions and guests aged 8 to 17. This program will again be free of charge, but please register early to be assured a project kit. Registration for each young person can be made either through your own Companion Club registration or the technical attendee's registration. Your children don't have to be registered in the Companion Club to sign up for the Youth Technical Program, but an adult must accompany them to the session since this is a hands-on project.

JOIN THE BREAKFAST CLUB

Would you like to invite your technical attendee to join you for breakfast in the Companion Suite? **"Breakfast Club"** tickets may be purchased by the technical attendee as an option for each day breakfast is desired. Tickets must be purchased at a minimum 24 hours in advance to ensure adequate seating and catering.

Join fellow companions at the symposium by registering for the Companion Club. This is an excellent opportunity to meet new people and reconnect with old friends! Adult or youth (ages 8 to 17) companions who are pre-registered may go directly to the registration desk located in the Convention Center to obtain a special Companion Registration Packet.
This will include:
• Name badge that will allow you access to the Companion Suite and Exhibit Hall (during regular hours)
• Gift bag with goodies
• One ticket to the Tuesday evening Welcome Reception
• Any tour or social event tickets you may have purchased

Youths (ages 8-17) who are registered for the Junior Companion Club are welcome in the Companion Suite with an adult Companion Club member. Children under age 8 do not receive a gift bag, but will be admitted free if accompanied by a registered adult Companion Club member.

Your ticket to the Welcome Reception is an opportunity to enjoy another great event with your technical attendee where everyone can have more fun and meet new people. It is a great networking time for all. The Wednesday night Gala Banquet is also a fun event; however, companions must purchase tickets separately for that event. Discounted prices are available for youth under age 18, and children under age 8 will be admitted for free if accompanied by a registered adult.

COMPANION CLUB RATES:
Adult, age 18+:
Advance Rate: $240 / Regular Rate: $270 (After July 1, 2024)
Junior, age 8-17:
Advance Rate: $75 / Regular Rate: $85 (After July 1, 2024)
Children under 8: No charge

A LA CARTE TOURS ARE AVAILABLE
www.emc2024.org/programs/companions-tours

COMPANION TOURS
The following information is preliminary and subject to change.

TALIESIN WEST TOUR
Your personalized tour of Taliesin West takes you along the courtyards and terraces, garden paths and reflecting pool area, past a bearing citrus grove and beside the former working drafting studio of the Taliesin Architectural Group. This World heritage Site and national landmark occupies over 600 acres of Sonoran Desert in the foothills of the spectacular McDowell Mountains. Designed by architectural genius Frank Lloyd Wright, Taliesin West was designed to be a bold new architectural experiment.

Date: Monday, August 5, 2024
Time: 9:00 AM – 12:30 PM
Cost: $155
Includes: Transportation and entrance fees

MUSICAL INSTRUMENT MUSEUM TOUR
The Musical Instrument Museum is the world's only global musical instrument museum, with exhibits featuring musical heritage, cultures, and instruments from more than two hundred countries. The museum displays more than 7,000 instruments collected from around 200 of the world's countries and territories. On the first level, guests can hear music and see objects from celebrities; listen to a twenty-five-foot-wide dance organ; and play instruments from around the globe. The second level is devoted to instruments and music of the world.

Date: Wednesday, August 7, 2024
Time: 8:30 AM – 12:00 PM
Cost: $110
Includes: Includes Transportation, entrance fees, guide and headset

EXHIBIT HALL

Photo by Richard Georgerian

EXPLORE THE EXHIBIT HALL AND LEARN ABOUT NEW TECHNOLOGIES, INSTRUMENTATION AND SOLUTIONS THAT SERVICE THE INDUSTRY

WHAT'S HAPPENING IN THE EXHIBIT HALL?

- Explore and learn from over a hundred top suppliers
- Attend "Ask the Experts" panels and get your questions answered
- Enjoy Experiments, Demonstrations and Poster Sessions
- Visit exhibitor booths to participate in raffles and daily prizes
- Student Hardware Competition

INTERESTED IN EXHIBITING?

We welcome the opportunity to have your organization join us as an industry partner and exhibit at this year's Symposium.

To learn more about exhibiting and sponsorship opportunities, or to reserve your space today visit:
www.emc2024.org/exhibitors-sponsors

EXHIBIT HALL IS LOCATED IN PHOENIX CONVENTION CENTER EXHIBIT HALL 5&6
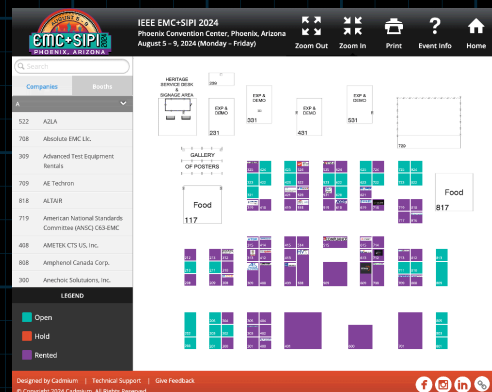
MEET THE EMC+SIPI 2024 EXHIBITORS

EXHIBITOR LIST

The following information is preliminary and subject to change.

DISCOVER OUR EXHIBITORS!

412 TW Benefield Anechoic Facility	622	Lightning EMC, LLC	712
A2LA	522	LUMILOOP GmbH	325
Absolute EMC Llc.	708	M Precision Laboratories, Inc.	718
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AE Techron	709	MESAGO Messe Frankfurt GmbH	421
ALTAIR	818	MVG, Inc.	609
Amber Precision Instruments	623	Narda Safety Test Solutions S.r.l. - Italy	520
American National Standards Committee (ANSC) C63-EMC	719	NEMKO USA, Inc.	717
AMETEK CTS US, Inc.	408	Nexio Technologies	308
Amphenol Canada Corp.	808	Nexperia Semiconductor	422
Anechoic Solutions, Inc.	300	Ohtama Co., Ltd.	810
ANSI-ASQ National Accreditation Board (ANAB)	302	OnRule	813
AP Americas Inc.	713	OPHIR RF Inc.	404
*Applied Technical Services	304	Picotest	209
Boeing Little Mountain Test Facility	201	PPG Cuming Lehman Chambers / Cuming Microwave	816
Bureau Veritas Consumer Products Services, Inc.	313	PRANA R&D	514
*Compliance Testing	714	R&K Company Limited	205
Com-Power Corporation	400	RATLR, Inc.	701
Comtest Engineering, bv	620	Raymond EMC Enclosures Ltd.	701
*Copper Mountain Technologies	812	RF Exposure Lab	303
CPI TMD Technologies	724	Robust Physics	625
D.L.S. Electronic Systems, Inc	301	Rohde & Schwarz USA, Inc.	600
Dassault Systèmes SIMULIA	323	Safety & EMC China	621
DesignCon	801	Schlegel Electronics Materials, Inc.	319
Detectus	518	Siemens	423
*DEWETRON	523	Spira Manufacturing Corp	415
*Diamond Microwave Chambers Ltd	208	TDK Lambda Americas	315
Electro Magnetic Applications, Inc.	525	TDK RF Solutions, Inc.	701
Element Materials Technology	321	The Boeing Company	203
Elite Electonic Engineering, Inc.	519	The EMC Shop	402
*EMcoretech co., Ltd.	613	Transient Specialists, Inc.	412
EMCoS LLC	418	TUV Rheinland	305
EMCPIONEER	419	V Technical Textiles, Inc.	424
ESDEMC Technology	212	Vectawave	414
ETS-Lindgren Inc.	401	Werlatone, Inc.	624
Fair Rite Products Corp.	619	Wurth Elektronik	524
Faraday Defense Corporation	413		
Fischer Custom Communications Inc.	509		
GAUSS Instruments International GmbH	409		
Global Sealing Systems, INC.	425		
*Global Validity Corporation	521		
Grand Valley State University	213		
HV Technologies, Inc.	508		
IEEE MTT-S	722		
In Compliance Magazine	515		
Intertek	312		
Jiangsu WEMC Electronic Technology Co., LTD.	711		
Keysight Technologies	615		
KGS America	618		

* Please welcome our new first-time exhibitors

EXHIBIT HALL SCHEDULE

EXHIBIT HOURS:
TUESDAY, AUGUST 6
Exhibits Open: 9:30 AM – 7:00 PM
Welcome Reception: 5:00 PM – 7:00 PM

WEDNESDAY, AUGUST 7
Exhibits Open: 10:00 AM – 5:00 PM

THURSDAY, AUGUST 8
Exhibits Open: 10:00 AM – 1:00 PM

ATTENDEES

Photo by Richard Georgerian

EMC+SIPI 2024 ONCE AGAIN COMBINES ELECTROMAGNETIC COMPATIBILITY AND SIGNAL & POWER INTEGRITY INTO ONE INSPIRING SYMPOSIUM

A full, 5-day attendee registration includes:

- Access to all of EMC+SIPI 2024
- Multiple days of EMC+SIPI original papers
- Five days of practical EMC+SIPI Workshops and Tutorials
- Experiments and Demonstrations of fundamental and advanced topics
- Exhibit Hall, showcasing the latest EMC+SIPI products and services
- Welcome Reception
- Gala Event
- Awards Luncheon
- Symposium Proceedings with all Workshop & Tutorial slide presentations and Technical papers

REGISTRATION TYPES

TECHNICAL ATTENDEE:

We offer 5-Day or 1-Day Registrations:
You have access to all EMC and SIPI paper sessions, Workshops & Tutorials, Experiments & Demonstrations, and the Exhibit Hall. There are also special events available, as well as Technical Committee Meetings, Standards Meetings, and networking opportunities.
- The 5-Day registration includes 5 days of technical sessions, 3 day pass to the exhibit hall, Symposium Record, and social events.
- The 1-Day registration includes 1 day of technical sessions, same day pass to the exhibit hall (if open), and the Symposium Record.

EXHIBIT HALL ONLY:

This is an EMC+SIPI exhibition with many technical activities. For adult (age 18+) customers and clients of our exhibitors. **$25/day**.
- Exhibitors and their reps must pre-register through EXHIBITORS registration using their assigned exhibitor's code.
- Companions/guests may be obtain a pass (Basic Badge) through their technical attendee's registration. Anyone under age 18 may be registered as a companion, and must be accompanied by a registered adult. A minor release form will need to be completed and submitted before obtaining a badge for anyone under the age of 18.

COMPANIONS/GUESTS:

For family and friends of all ages who accompany a registered, technical attendee or exhibitor.
We offer two types of badges:
- Companion Club: This package will again include a gift, access to the Companion Suite (4 mornings with breakfast), Exhibit Hall pass, and Welcome Reception ticket. Individual registrations are required. (Add cost section) Cost: $240 Advanced/ $280 Regular
- Basic Badge: For Exhibit Hall entrance and/or Youth Technical Program registration. Sign up your companion within your own 5-Day or 1-Day technical registration. No bar code, no tracking, no charge. Basic Badges are limited to 1 adult companion and their children. **Cost: Free**

EXHIBITOR:

All adult (age 18+) exhibitor staff, reps, and booth workers must register using the link and discount code sent to the Exhibitor/ Sponsor contact to receive an EXHIBITOR ribbon and early access to the Exhibit Hall. Anyone under age 18 must be accompanied by a registered adult and a minor release form submitted prior to obtaining a badge. **There are two badge types:**
- Technical Exhibitor: receives a full, 5-Day Technical Registration plus EXHIBITOR ribbon.
- Booth Staff: receive 3-Day pass to the Exhibit Hall, with early access plus an EXHIBITOR ribbon and access to the welcome reception is included.

www.emc2024.org/registration

IMPORTANT REGISTRATION INFORMATION

AUTHORS: Symposium registration (IEEE Member or Non-Member) is required by at least one author, or the speaker, before the final paper submission deadline, 15 May 2024. Failing to meet this requirement will result in the paper not being published or presented – no exceptions. Your registration confirmation number will be needed for the final paper submittal.

More details can be found on the AUTHOR/SPEAKER page

More details at the EMC+SIPI 2024 Website AUTHOR/PRESENTER page

ADVANCE REGISTRATION: You must be paid in full by midnight PDT, July 1, 2024 to receive the Advanced rates.

EMC SOCIETY MEMBERS: Special rate for full, 5-Day Technical Registrations only. Your membership must be in good standing and paid in full for 2024. If you are not a member and would like to become a EMC-S member, please **CLICK HERE** or call 1-800-678-IEEE. Please note that you must be a member at the time of registration to receive the member rate.

IEEE MEMBERS: Your membership must be in good standing and paid in full for 2024. Have your member number and current member grade ready when registering. If you are not a member and would like to become an IEEE member, please **CLICK HERE** or call 1-800-678-IEEE. Please note that you must be a member at the time of registration to receive the member rate.

SISTER SOCIETY MEMBERS: Members of IEEE EMC-S Sister Societies are eligible for the discounted EMC-S Member rate at the annual symposium. Contact the Registration Service to obtain this discount. **View a list of the 2024 active Sister Society relationships.**

IEEE LIFE MEMBER: There is a further rate reduction for IEEE Life members. IEEE Life Membership is automatically bestowed upon an active IEEE member based on age and years of membership.

EMC-S HONORED MEMBER: You must be an EMC Society Honored Award recipient who was presented with this award in a prior year. No discount code is necessary to register; this is a special rate category.

EMC-S RETIRED OR UNEMPLOYED: EMC-S Retired or Unemployed. Special ADVANCE rate discount for retired / unemployed EMC Society members only. Have your last place of employment and the date of retirement or unemployment ready when registering.

COMPANY GROUP RATE: Sign up to request a company-wide discount code now! We will give each employee a special discounted rate which is roughly 35% off the non-member rate, and over 10% off the EMC-S Member rate! Send an email to: **EMC@iplanitmeetings. com** to receive your Company Discount Code.
   Cost: Advance rate is $715/person

FULL-TIME STUDENTS: Special rates for both IEEE members and non-members. You must be enrolled in a full time course of study at a college or university to register in the student categories. Have your college ID number and advisor's name & email ready when registering. **Note:** Student 5-Day registration packages will include the attendee bag, Symposium Record, and tickets to the Welcome Reception & Awards Luncheon. The Gala ticket however is NOT included, but may be purchased separately or awarded through volunteering at the symposium.

OTHER INFORMATION:

CERTIFICATE OF PARTICIPATION

A Certificate of Participation may be used to officially document attendance at the Symposium. A personalized certificate will be available at no charge to all registered Symposium attendees and participants. Please visit the Registration Desk to verify your name and affiliation and to pick up your certificate. If you have any questions, please email: **emc@iplanitmeetings.com**.

PAYMENT

Payment is due upon submittal of your registration. Payment can be made by:
- Check (in USD) made out to IEEE EMC+SIPI 2024, and mailed within 2 weeks.
- Credit Card: Visa, MasterCard, American Express, Discover Card.
- Wire Transfer: (Note: Banks usually charge a fee for wire transfers. These are the responsibility of the registrant.)
- Invoice (Government Purchase Order)

Payments by credit card will be charged immediately upon submission of registration. Checks and Wire Transfers must be received within two weeks of the registration date.
You may pay for Companion Club Registration along with your own registration, or via a separate credit card. If you need to pay for tours and social events separately, select "Check" as your payment method and then contact Registration Services at the number on your email confirmation.

CANCELLATION POLICY

For Registration and total order:
- Notice of cancellation must be received in writing via email, sent to **emc@iplanitmeetings.com**. A $50.00 (USD) processing fee will be charged for registrations cancelled by June 24, 2024. For cancellations between June 25 and July 15, 2024, a 50% refund will be given. There will be no refunds after midnight PDT on July 15, 2024.
- If you applied for a Visa and it is denied, a full refund will be issued less a $20 service charge.
- In the event of a full cancellation of the conference, IEEE and EMC Society are not responsible for, and will not reimburse, flight costs and other expenses incurred by the attendee

FOR SOCIAL EVENTS, TOURS AND EXTRAS ONLY
- Notice of cancellation of an individual "extra" item must be received in writing via email, sent to **emc@iplanitmeetings.com**, by June 27, 2024. There will be no refunds after midnight PDT on June 28, 2024.
- The EMC 2024 Symposium Committee reserves the right to cancel any tour that does not meet the minimum requirement. If a tour is cancelled, you will receive a full refund and will be contacted prior to the symposium.

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