Workshop Announcement

The IEEE EMC Society French Chapter and the IEEE Antennas and Propagation Technical Committee on Antenna Measurements (TCAM) are pleased to present

Advances in Antenna and EMC Measurement Techniques: A One-Day Workshop

DATE: Monday, June 30, 2025

TIME: 8:30 am to 5:00 pm

LOCATION: Université Côte d'Azur, Campus SophiaTech (Templier), 930 route des colles, 06903 Sophia Antipolis, France

AGENDA: *See below, following technical program presentation titles, abstracts and speaker bios*

REGISTRATION: There is NO CHARGE to attend, but you must register in advance to secure seating and catering. Click here to register.

OPEN: All IEEE members and non-members are welcome to attend!

Thank you to our Workshop Sponsors!

TECHNICAL PROGRAM

KEYNOTE SPEAKERS

Developments to Meet Evolving Antenna Characterization Needs

By Laurent Le Coq, University of Rennes, France

Abstract: Radiation pattern characterization remains a key step in the antenna design validation process. Even if well-known measurement techniques exist, the increase in the complexity of the device to be characterized requires improving the facilities considering all their components. For over 25 years, IETR has developed its capacity to characterize the prototypes developed for its research projects. In coherence with its academic mission to remain at the state of the art of antenna design, a significant effort is made to provide researchers and its partners with facility capabilities fitting to this main objective. In this presentation, the different topics of development carried out over the last decade will be presented. These topics cover measurement techniques, equipment and processing. The requirements to be addressed concern the devices to be characterized, the extension of the overall frequency range of interest, the limitation to be overcome.

Laurent Le Coq received the electronic engineering and radiocommunications degree and the French DEA degree (M.Sc.) in electronics in 1995 and the Ph.D. in 1999 from the National Institute of Applied Science (INSA), Rennes, France. In 1999, he joined IETR (Institut d'Electronique et des Technologies du numéRique), University of Rennes, to manage antenna centi- and milli-meter wave range test facilities. Since 2018, he is the head of M^2ARS (Manufacturing Measurement and Analysis of Radiating Systems), the IETR facility unit bringing together 7 facilities dedicated to Electro Magnetic studies up to 500GHz, among which three antenna test and imaging facilities and a prototyping service. His activities in antenna measurements and development of related procedures involved him in more than 30 research contracts of national or European interest. He is author and co-author of more than 50 papers published in peer-reviewed international journals and 50 papers in proceedings of international conferences. He serves as a regular reviewer for several journals and conferences and has regularly chaired international conference sessions. He participated in the organizing committee of international conference EuCAP 2021, as convened session co-chair. In 2024 he was the EurAAP keynote speaker at the Antenna Measurement Techniques Association (AMTA) annual symposium.

Performing OTA Measurements in an EMC Range – A Real or False Good Idea?

By Benoit Derat, Rohde & Schwarz, Munich, Germany

Abstract: With the prolific increase in the need for Over The Air (OTA) Testing to validate the performance and reliability of wireless devices and their antenna performances in an automotive platform as an example, the natural question that arises among testers is "If I already have a large EMC test chamber that can accommodate full-vehicle test, would I be able to modify it to perform both EMC and OTA tests?". Such a solution negates the need for additional space for a full-vehicle OTA only chamber and the costs associated with it. Even though the evaluation of unintended electromagnetic radiation phenomena (EMC)

and intended radiation performance (OTA) have a lot in common, they also differ in many aspects. This talk highlights the requirements for both EMC and OTA chambers for a full-vehicle tests and the trade-offs that need to be considered if a chamber has to be made a dual-purpose test chamber.

Benoit Derat is a Senior Director for Systems Developments and Project Implementations, with Rohde & Schwarz. He received the Engineering degree from SUPELEC, in 2002, and the Ph.D. degree (Hons.) in physics from the University of Paris XI, in 2006. From 2002 to 2008, he worked at SAGEM Mobiles, as an Antenna Design and Electromagnetics Research Engineer. In 2009, he founded ART-Fi, which created the first vector-array specific absorption rate measurement system. He operated as the CEO and the President of ART-Fi, before joining Rohde & Schwarz, Munich, in 2017. He is currently the Senior Director of Engineering for Vector Network Analyzers, Electromagnetic Compatibility, Over-The-Air and Antenna Test applications. Dr. Derat is a Senior Member of the Antenna Measurement Techniques Association (AMTA) and a Distinguished Lecturer of the IEEE EMC Society (2024 – 2025). He is the author of more than 80 scientific journals and conference papers, and an inventor on more than 40 patents, with main focus in antenna systems near and far-field characterization techniques.

Emulation of Complex Electromagnetic Field Environments Using Reverberation Chambers
By Ramiro Serra, Eindhoven University of Technology (TU/e), The Netherlands
Abstract: Reverberation chambers have emerged as a powerful tool for the modeling and prediction of (random) electromagnetic fields in complex environments. This presentation will introduce the basic principles and applications of reverberation chambers, highlighting their versatility and effectiveness in emulating complex field environments. We will explore how these chambers are utilized for Over-The-Air (OTA) testing of wireless systems, providing a controlled yet realistic environment to evaluate the performance and reliability of wireless devices (including coexistence and interference studies). Additionally, the presentation will cover the use of reverberation chambers in modelling complex propagation environments, which is crucial for making better-informed design choices in EMC risk management for densely packed electromagnetic environments and/or large electronic systems.

Ramiro Serra is an Associate Professor, Eindhoven University of Technology (TU/e) in the Netherlands. He received the MSc degree in electronic engineering from the Instituto Tecnológico de Buenos Aires, Argentina, in 2000, the postgraduate degree specializing in technological applications of nuclear energy from Instituto Balseiro, Bariloche, Argentina in 2004 and the PhD degree in electronics and communications engineering from Politecnico di Torino, Italy in 2009. He is currently an associate professor within the Laboratory of EMC at the Eindhoven University of Technology (TU/e) in the Netherlands and the program director of the electrical engineering department at TU/e. Dr. Serra is a member and the vice-chair of the international steering committee of EMC Europe and a member of the international TPC of EMC Compo. He is the chairman of URSI Commission E for the Netherlands and secretary of URSI National Committee of the Netherlands. He is also co-convener of the SC 77B/CISPR-A joint working group for the standard IEC 61000-4-21 on reverberation chambers.

INVITED SPEAKERS

The VIRC: a "2-in-1" Reverberation Chamber for EMC and Antenna Applications

By Guillaume Andrieu, Xlim Laboratory, University of Limoges, Limoges, France

Abstract: Proposed in the early 2000's by Frank Leferink from Thales Netherlands, Vibrating Intrinsic Reverberation Chambers (VIRC) are reverberation chambers made a flexible metallized tent. Due to strong "structural" advantages (low-cost, dismantable, movable), the use of VIRC among industries and academics as grown quickly over the last few years. This talk will try to show that these reverb chambers, if correctly designed and stirred, can — for some applications — overcome the efficiency of classical reverberation chambers made of parallelepipedic metallic cavities. On the one hand, the continuous movement of the VIRC allows a reduction of the duration of EMC tests as well as a high number of independent samples to be collected. On the other hand, the time-domain movement of the metallized tent gives the possibility to drastically cancel the amplitude of the unstirred paths within the reverb chamber to obtain an almost perfect "chaotic" cavity paving the way to perform traditional anechoic measurements (radiation pattern, radar cross-section) in the VIRC test environment.

Guillaume Andrieu was born in 1980, in Limoges, France. He received the Master's degree in radiofrequencies and optical communications from the university of Limoges, Limoges, in 2003, and the Ph.D. degree in electronics from the IEMN laboratory, Group Telice, University of Lille, Villeneuve d'Ascq, France, in 2006. In 2003, he was also with Renault Technocentre, Guyancourt, France. In 2006, he joined the Xlim laboratory as a Postdoctoral fellow, Limoges. Since 2009, he is an associate professor at Xlim Laboratory, University of Limoges. His current research interests include coupling on cables and EMC testing including reverberation chambers and bulk current injection tests. He is since 2021 the Chair of the French IEEE EMC chapter. He has been in 2020 the editor of a reverberation chamber book (https://shop.theiet.org/electromagnetic-reverberation-chambers, editor: IET).

Anechoic Chambers – New or Old Technology?

By Garth D'Abreu, ETS-Lindgren, USA

Abstract: Anechoic chambers have been in widespread use as the defacto standard to support RF measurements for several decades. Industries ranging from aerospace and automotive to consumer and medical electronics, have developed measurements based on the use of RF absorber lined chambers covering frequencies that extend from the low kHz to well above 100 GHz. There have been several advancements in the modeling and characterization of chambers as well as the development of absorber materials. In this presentation we will look at the drivers for common chamber designs, the impact some of these advances have had on the design of RF chambers used today, and the advantages presented to users especially as it relates to chambers used for multiple measurement purposes, including those for antenna and EMC.

Garth D'Abreu is the Director, Automotive Solutions at ETS-Lindgren based at the corporate headquarters in Cedar Park, Texas. He has primary responsibility for the design and development functions worldwide within the Systems Engineering group, specializing in turn-key solutions for Automotive EMC and Wireless test integration. Some of these more complex full vehicle and electronic sub-assembly (ESA) test chambers involve his coordination with the RF engineering team on custom components, and the certified, internal Building Information Modeling (BIM) team at ETS-Lindgren. Due to his considerable industry experience, he is the ETS-Lindgren global subject matter expert responsible for the ongoing research and development of Automotive EMC / Wireless test chambers for Regular, Electric/Hybrid Electric and Autonomous Vehicles, focusing on combination anechoic chambers, reverberation chambers, GTEM cells, EMP protection applications, and wireless device test systems. Mr. D'Abreu is a Senior Member of the IEEE EMC Society and active participant in standards development, including the SAE, ISO, and CISPR D automotive EMC standards, with over 30 years of experience in the RF industry. He holds a BSc degree in Electronics and Communications Engineering, from North London University, UK

Precision in EMC Immunity Testing: Power Budgeting, Amplifier Selection, and Mismatch Management

By Juan Antonio del Real, Maury Microwave, Nice, France

Abstract: This technical session addresses key engineering decisions behind EMC immunity testing, with a focus on RF power amplifier selection and system design. Topics include calculating and optimizing power budgets for required field strengths, managing insertion loss, and handling mismatch through VSWR tolerance. We'll compare amplifier classes (Class A vs AB), discuss the impact of modulation and gain compression, and explore how solid-state GaN amplifiers enable wideband, high-efficiency testing across compliance standards like ISO 11452, MIL-STD-461, and IEC 61000. Real-world block diagrams and test setups will illustrate how to design for accuracy, reliability, and cost-effective performance.

Juan Antonio del Real is the Sales Director for EMEA at Maury Microwave, a global leader in RF and microwave measurement solutions. He holds a degree in Electronics Engineering from ITESO, Mexico, and specialized in RF Systems Engineering at Paul Sabatier University, France. With a distinguished career in the RF and microwave industry, Juan has held key positions at leading companies such as Intel, Rohde & Schwarz, and Sigfox, gaining extensive expertise in test and measurement solutions for aerospace, defense, telecommunications, and quantum computing applications. With a strong background in technical sales and applications engineering, Juan has collaborated with top research institutions, defense contractors, and commercial enterprises to optimize RF performance through advanced calibration, load pull, and measurement automation techniques. His areas of expertise include phase noise analysis, impedance tuning, high-power RF characterization, and state-of-the-art signal generation. Juan is an active contributor to the RF and microwave community,

frequently presenting at industry conferences and publishing technical papers on RF measurement techniques.

RF and Antennas in the Certification Context
By Walid El Hajj, Intel, Nice, France

Abstract: Nowadays, new wireless technologies such as 5G and Wi-Fi utilize more and more radiofrequency (RF) spectrum. At the same time, more and more applications are included as additional features to wireless technologies to improve the user experience and to offer practical capabilities in addition to the basic communication features. Proximity, motion, and gesture sensing, as well as localization, and health monitoring are some application examples. Consequently, more challenges are faced in terms of RF front end designs but also in terms of compliance at the device level from regulatory and industry certification stand points. Different challenges are involved in relation to EMC, EMI, and human exposure constraints which may impact the device performance. This presentation discusses several trade-off illustrations between RF design, regulatory constraints, and device performance. More focus is placed at the antenna level with some specific examples presented and analyzed.

Walid El Hajj received a National Degree of Master for his Research in "Microwave materials and devices for communication systems" from Telecom Bretagne, Brest–France, in 2008. He received a Ph.D. degree on Information and Communications Sciences and Technologies from Telecom Bretagne, Brest–France in 2011. From 2011 to 2013, he was a Researcher in Microwave department of LabSTICC laboratory at Telecom Bretagne. Walid El Hajj joined Intel Corporation in 2014. He is currently Scientist Officer at the Wireless Test and Certification Center group. He is leading the different Research and Development activities related to new wireless technologies and products certification. Dr. El Hajj is an IEEE Senior Member and is participating and leading several standardization efforts in the human exposure and product safety domains. He is mandated as expert in French Standardization Association (AFNOR). Since 2017, he participates in the development of several IEEE/IEC standards on human exposure computational and measurement assessments. He is member of IEC TC 106, IEEE ICES TC95, and TC34. He is the co-convener of IEC/IEEE JWG12 developing Measurement Methods standards to assess the power density in close proximity to the head and body from 6-300 GHz. He was the chair of WG 5 under SC 6 of IEEE ICES TC95 that published the guide IEEE 2889-2021 studying the different aspects of Incident Power Density Definition. He is also member of CMC TF Radio group in IECEE. Walid has more than 35 scientific publications and 19 patents.

Technical Tour of the EMC and Antenna Lab at Intel

Following the presentations, an optional private technical tour of the EMC and Antenna Lab at Intel will be provided. Visitors will see the Wireless RF Lab at Intel, an ISO 17025 accredited lab for testing Intel Wi-Fi modules. View various EMC and EMI test setups in semi-anechoic and full anechoic chambers, including human exposure setups for SAR and power density testing. You'll also see mmWave, device performance,

and some custom R&D test setups. Intel's lab is located some 10 minutes by car from the workshop location at the Université Côte d'Azur. Attendees may carpool or uber to the technical tour; transportation is not provided. There is no cost to attend the tour, but advance registration is required.

PRELIMINARY AGENDA

8:30 am	Registration/Check-In with Coffee/Tea Service
9:00 am	IEEE EMC Society, TCAM, and Host Welcome: Janet O'Neil, IEEE EMC Society/TCAM and Fabien Ferrero, Université Côte d'Azur, France
9:10 am	RF and Antennas in the Certification Context By Walid El Hajj, Intel, Nice, France
9:45 am	EMC Society Distinguished Lecturer Presentation: Performing OTA Measurements in an EMC Range – A Real or False Good Idea? By Benoit Derat, Rohde & Schwarz, Munich, Germany
10:45	BREAK
11:05 am	Anechoic Chambers – New or Old Technology? By Garth D'Abreu, ETS-Lindgren, Cedar Park, Texas
11:40 pm	EMC Society Distinguished Lecturer Presentation: Emulation of Complex Electromagnetic Field Environments Using Reverberation Chambers By Ramiro Serra, Eindhoven University of Technology, the Netherlands
12:40	LUNCH Sponsored by ETS-Lindgren, Maury Microwave, and IEEE APS TCAM
1:30 pm	Keynote Presentation: Developments to Meet Evolving Antenna Characterization Needs By Laurent Le Coq, University of Rennes, Rennes, France
2:30 pm	The VIRC: A "2-in-1" Reverberation Chamber for EMC and Antenna Applications By Guillaume Andrieu, Xlim Laboratory, University of Limoges, Limoges, France
3:05	BREAK
3:25 pm	Precision in EMC Immunity Testing: Power Budgeting, Amplifier Selection, and Mismatch Management By Juan Antonio del Real, Maury Microwave, Nice, France
4:00 pm	Closing Comments by France EMC Society Chapter Chair Guillaume Andrieu, University of Limoges, Limoges, France, and Fabien Ferrero, Université Côte d'Azur, France

4:15-5:00 pm	Optional Technical Tour: EMC and Antenna Lab at Intel, Nice, France – Directions to Lab will be provided on site.

Workshop Contacts:

Janet O'Neil, IEEE EMC Society, janet.oneil@ets-lindgren.com, +1 512-531-2676

Guillaume Andrieu, President of the French IEEE EMC Chapter, guillaume.andrieu@xlim.fr, +33 5 55 45 77 39

Fabien Ferrero, Host Representative, Fabien.ferrero@univ-cotedazur.fr

Sima Noghanian, IEEE APS TCAM, sima_noghanian@ieee.org**,** https://www.ieeeaps.org/committees/tc/tc7

Directions:

Campus access information (in French) : https://polytech.univ-cotedazur.fr/vie-etudiante/campus-sophiatech/venir-sur-le-campus-sophiatech