

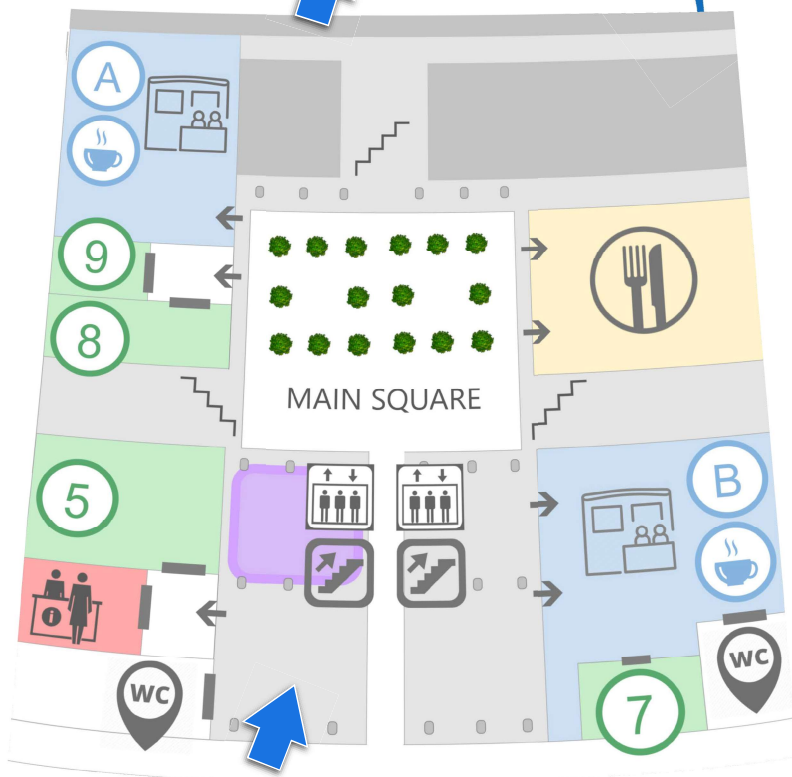
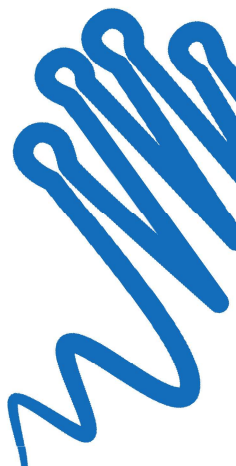
**EMC Europe** 2019 BARCELONA

# SYMPOSIUM PROGRAMME

BARCELONA | 2-6 September 2019



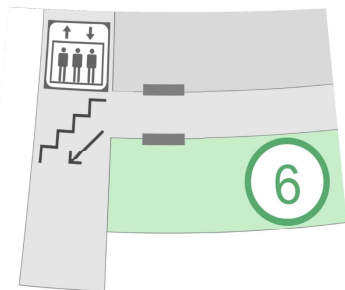
# Venue MAP



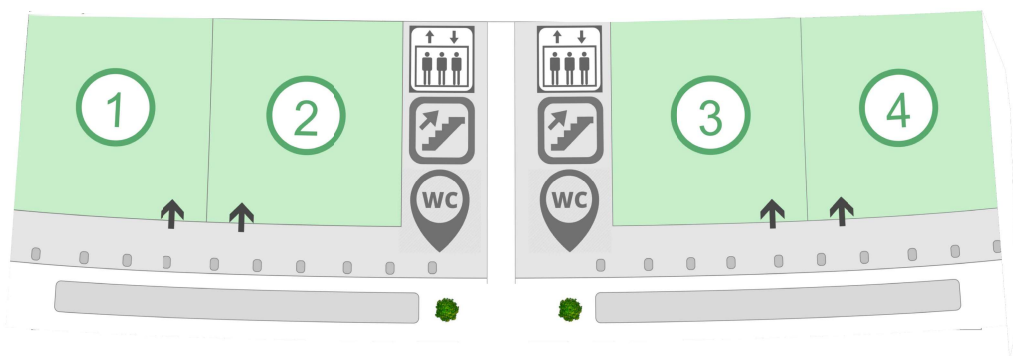
**Street Level (-1)**



- REGISTRATION
- EXHIBITION AREAS
- ROOMS (1-9)
- POSTER AREA
- RESTAURANT



## Upper Level (2)



## Terrace Level (0)

**Indications to the opening session:**

Auditori VERTEX building (6 min - 400 m walking)





# Safety tips for Attendees



Always remove your Congress pass upon leaving



Do not display large amounts of cash; carry only as much as you need



Keep your personal belongings with you, both inside and outside the venue



Be vigilant in crowds, restaurants and on public transportation



When walking around the city, know how to get to your destination in advance so you appear confident in where you are going

In the event of an incident, whether onsite or in the city

Emergency telephone line in more than 50 languages





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# Chair's Welcome

Ferran Silva

Dear symposium attendees,

On behalf of the EMC Europe International Steering Committee and the Local Organizing Committee, it is a pleasure for me to welcome you to the EMC Europe International Symposium on Electromagnetic Compatibility 2019 in Barcelona.

Besides the conference original home cities, Rome and Wroclaw, only Brugge and Barcelona have had the honor of hosting EMC Europe twice.

Comparing the present edition with the one in 2006 in terms of the number of submitted papers, workshops and tutorials sessions, attendees, sponsors and companies in the technical exhibition, we can confirm that the Electromagnetic Compatibility discipline continues enjoying very good health in Europe. At the same time, the 20% rate of non-European participants places EMC Europe as one of the leading worldwide EMC Symposiums.



This year, the conference comprises 120-hour of state-of-the-art Electromagnetic Compatibility contents. Throughout the week, you can choose to attend 20 oral sessions, 3 poster sessions, 6 Special Sessions and 18 Workshops and Tutorials arranged in five parallel tracks each day.

From Tuesday to Thursday, in the two technical exhibition areas located in the Universitat Politècnica de Catalunya (UPC) campus, 33 companies will show you their newest products and services.

Two keynote speeches will be presented in the Opening Ceremony on Tuesday: Dr. Fernando Arteche from ITAINNOVA will give the talk “EMC based design of physics detectors” and Professor Jordi José from UPC will give us a very interesting speech “Life, death and electromagnetism”.

I would like to thank the sponsors and exhibitors for their help in the conference organization as well as all the authors, reviewers and chairpersons because without them the symposium would have not been possible.

Finally, I cannot fail to express my enormous gratitude to the Local Organizing Committee members and the UPC and CIT staff for their tireless work along the last months.

We have done our best to organize this conference, now is your time to attend the technical sessions, to enjoy the social activities and to visit our beautiful city of Barcelona.

Sincerely,

**Ferran Silva**

*Chair of EMC Europe 2019 Local Organizing Committee*



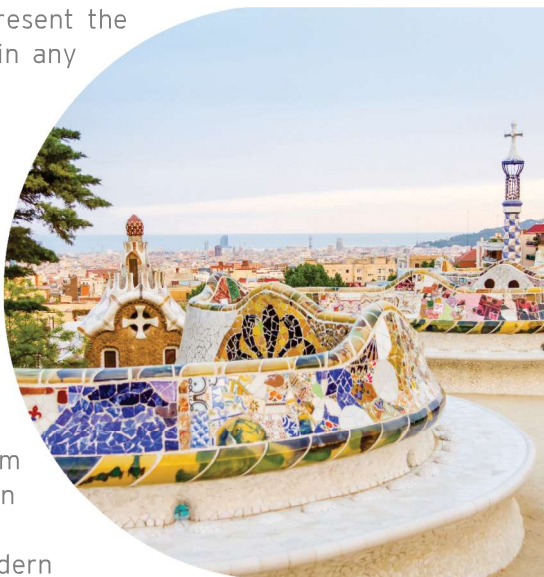


# Conference general information

## CONFERENCE AT BARCELONA

Join us at the International Symposium on Electromagnetic Compatibility (EMCEurope 2019). EMC Europe 2019 conference focuses on the high quality of scientific and technical contributions giving the unique opportunity to present the progress and results of your work in any EMC topic.

EMC Europe 2019 Symposium will be organized by Universitat Politècnica de Catalunya located in Barcelona Campus Nord. Barcelona, the capital of Catalonia, is a Mediterranean and cosmopolitan city with Roman remains, medieval quarters and the most beautiful examples of Modernism and avant-garde. Pedestrian streets in the old quarter, green areas, and a splendid seafront with a range of modern facilities are a reflection of its multifaceted character.



## VENUE LOCATION

EMC Europe 2019 is organized by Universitat Politècnica de Catalunya located in Barcelona Campus Nord

<https://goo.gl/maps/N15DNfVsFaDqQmt77>



## ACCOMMODATION



As a main touristic city, Barcelona has a wide variety of accommodations. Common touristic websites provide the best offers and availability.

Because September is high season, we recommend booking your accommodation as soon as possible.

Barcelona offers hundreds of hotels and apartments to visitors. Best deals are obtained from websites like Booking, Trivago or Airbnb, among others.

The following hotels are located at a walking distance to the conference venue:

### **Hotel Sansi Pedralbes**

Av. de Pearson, 1, 08034  
Barcelona  
*sansihotels.com*

### **Hotel SOFIA Barcelona**

Plaça de Pius XII, 4, 08028  
Barcelona  
*sofiabarcelona.com*

### **Hotel Bonanova Park**

Carrer del Capità Arenas, 51,  
08034 Barcelona  
*hotelbonanovapark.com*

### **Hotel Catalonia Rigoletto**

Carrer de Sabino Arana, 22, 24,  
08028 Barcelona  
*cataloniahotels.com*

### **Hotel Upper Diagonal**

Passeig de Manuel Girona, 7,  
08034 Barcelona  
*hotel-upperdiagonal.com*

### **Fairmont Rey Juan Carlos I**

Avinguda Diagonal, 661, 671, 08028  
Barcelona  
*fairmont.com*

### **Arenas Atiram Hotel Barcelona**

Carrer del Capità Arenas, 20,  
08034 Barcelona  
*atiramhotels.com*

# Conference general information

## REGISTRATION DESK

All attendees, also exhibitors, have to register at the registration desk. Check out the venue map to find the registration desk. The registration opens on Monday, September 2, from 12:00 and will close at 18:00. The rest of the week, September 3-6, the registration timetable is from 8:00 till 17:00.

## BADGES

When registering at the reception desk, all delegates will receive a badge, conference material and, if included in their package, invitations for social events. Please wear your badge all the time throughout the conference. This will be mandatory to enter the university campus conference venue.

## LUNCHES

Lunches will be served at the restaurant located at the main square at the street level. Admission tickets will provide you access to the buffet lunch. If you have any allergy tell it directly to the restaurant staff.

## COFFEE BREAK

Coffees, teas and other amenities will be available at the two different exhibition areas during coffee breaks. Your badge will provide you access to the exhibition areas to enjoy the coffee and visit symposium exhibitors.

On Monday and Friday, coffee will be served in the Poster Area.



## INTERNET ACCESS

Participants are able to use their WiFi devices with the following network identifier and password

WIFI SSID: **EMCEurope**

Password: **Barcelona\*19**



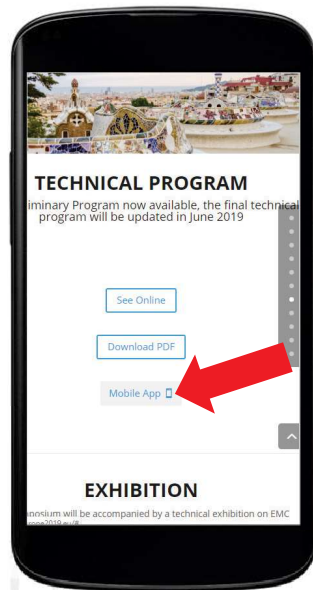
Otherwise, as the UPC is part of **Eduroam** network you can also use your regular connection.

## CONFERENCE MOBILE APP

You can find the Web-app at the following URL or at the conference Webpage (see right image):

<https://lineupr.com/emc-europe/2019-barcelona/>

The conference app is Web-Based. Meaning the app is opened via a URL and you don't need to install it in your device. We recommend adding the app to your smartphone's home screen.



**In case of an emergency**, you'll be alerted by one of the following means:

PA system



Fire alarm



UPC staff



## In case of evacuation

**1** Leave the premises.



**2** Proceed to the nearest stairway and exit.



Follow evacuation route signs.

**3** Proceed directly to the Assembly Point.



Do NOT return to the building until management or emergency services personnel tell you that you may.

## In case of fire

Notify staff if you smell something burning or discover a fire.

**1** Activate the fire alarm.



**2** Notify UPC staff and/or call Emergencies UPC.

**+34686475403**

**3** Proceed as in the case of an evacuation.

## In case of a lockdown

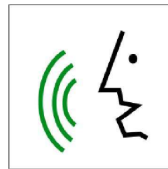
If you hear a lockdown message over the PA system or UPC staff tell you a lockdown is in effect.

**1 Don't leave the building.**

If you're outside, quickly enter any building.



**2 Wait inside the building** until the emergency coordinator or emergency services personnel tell you that you may leave.





# Conference general information

## International Steering Committee

**Chairman:** CARLSSON, Jan *SE*

**Vice-Chairman:** LEFERINK, Frank *NL*

### Regular members

BESNIER, Philippe	<i>FR</i>	RACHIDI, Farhad	<i>CH</i>
CANAVERO, Flavio	<i>IT</i>	RAMDANI, Mohamed	<i>FR</i>
FELIZIANI, Mauro	<i>IT</i>	SABATH, Frank	<i>DE</i>
GARBE, Heyno	<i>DE</i>	SARTO, Maria Sabrina	<i>IT</i>
JOSKIEWICZ, Zbigniew	<i>PO</i>	SERRA, Ramiro	<i>NL</i>
KLINGLER, Marco	<i>FR</i>	SILVA, Ferran	<i>ES</i>
MARADEI, Francesca	<i>IT</i>	TER HASEBORG, Jan L.	<i>DE</i>
MARIANI PRIMIANI, Valter	<i>IT</i>	THOMAS, David	<i>UK</i>
MARVIN, Andy	<i>UK</i>	WIECKOWSKI, Tadeusz W.	<i>PO</i>
PISSOORT, Davy	<i>BE</i>	WIKLUNDH, Kia	<i>SE</i>

### Associate members

CATRY SSE, Johan	<i>BE</i>
D'AMORE, Marcello	<i>IT</i>
DEGAUQUE, Pierre	<i>FR</i>
PERES, Gilles	<i>FR</i>
VAN DEURSEN, Alexander	<i>NL</i>

## Local Organizing committee

**Chairman:** SILVA, Ferran. *Universitat Politècnica de Catalunya (UPC)*

**Vice-Chairman:** POUS, Marc. *UPC*

ARAGÓN, Marc *UPC*

AZPÚRUA, Marco A. *UPC*

FERNÁNDEZ-CHIMENO, Mireya *UPC*

ARTECHE, Fernando *ITAINNOVA*

AÑÓN Manuel *INTA*

GONZALEZ GARCIA, Salvador *Universidad de Granada*

MEDIANO, Arturo *Universidad de Zaragoza*

# Conference general information

## International Reviewers' Board

AÑÓN CANCELA,	Manuel	ES	MARIANI PRIMIANI,	Valter	IT
ARAGÓN,	Marc	ES	MARVIN,	Andy	UK
ARTECHE,	Fernando	ES	MAURICE,	Olivier	FR
AZPÚRUA,	Marco A.	ES	MEDIANO,	Arturo	ES
BATTERMANN,	Sven	DE	MOGLIE,	Franco	IT
BEAUVOIS,	Veronique	BE	MORDACHEV,	Vladimir	BY
BERNAL	Joaquin	ES	NOWOSIELSKI,	Leszek	PL
BESNIER,	Philippe	FR	NUÑO,	Luis	ES
BOESMAN,	Bart	BE	PANDE,	D.C.	IN
BUESINK,	Frits	NL	PERDRIAUX,	Richard	FR
CAKIR,	Soydan	TR	PERES,	Gilles	FR
CANAVERO,	Flavio	IT	PEUTEMAN,	Joan	BE
CARLSSON,	Jan	SE	PILINSKY,	Vlodimir	UA
CAROBBI,	Carlo	IT	PISSOORT,	Davy	BE
CATRYSSSE,	Johan	BE	PIUZZI,	Emanuele	IT
CHEN,	Jiaqi	UK	POMMERENKE	David J.	US
CHRISTOPOULOS	Christos	UK	POUS,	Marc	ES
D AMORE,	Marcello	IT	POYATOS	David	ES
DAWSON,	John	UK	PUES,	Hugo	BE
DEGAUQUE,	Pierre	FR	PYTHOUD,	Frédéric	CH
DIAZ ANGULO,	Luis Manuel	ES	RACHIDI,	Farhad	CH
DÍAZ,	Marina	ES	RAJAMANI,	Vignesh	US
DICKMANN,	Stefan	DE	RAMANUJAN,	Abhishek	IE
DRISSI,	M'hamed	FR	RAMDANI,	Mohamed	FR
DUBOIS,	Tristan	FR	RAVELO,	Blaise	FR
DUCHAMP,	Geneviève	FR	REDOUTE,	J.-Michel	BE
DUFFY,	Alistair	UK	RIVETTA,	Claudio	US
ESCOT,	David	ES	ROC'H,	Anne	NL
FANG,	Chonghua	CN	ROSTAMZADEH,	Cyrous	US
FELIZIANI,	Mauro	IT	RUBINSTEIN,	Marcos	CH
FERNÁNDEZ-CHIMENO,	Mireya	ES	RUDDLE,	Alastair	UK
FLINTOFT,	Ian	UK	SABATH,	Frank	DE

FREI,	Stephan	DE	SADOWSKI,	Jaroslav	PL
FUJIWARA,	Osamu	JP	ŠAROLIĆ,	Antonio	HR
GAO,	R. Xian-Ke	SG	SARTO,	M. Sabrina	IT
GARBE,	Heyno	DE	SCULLY,	Robert	US
GARCÍA GÓMEZ,	David	ES	SEE,	Kye Yak	SG
GILLON,	Renaud	BE	SERRA,	Ramiro	NL
GONZALEZ	Salvador	ES	SILVA,	Ferran	ES
GARCIA					
GRASSI,	Flavia	IT	SKRZYPCZYNSKI,	Jacek	PL
GRONWALD,	Frank	DE	SOWA,	A. Edward	PL
HAYASHI,	Yuichi	JP	SPADACINI,	Giordano	IT
HOLLOWAY,	Christopher	US	SZONCSO,	Friedrich	CH
HUBING,	Todd	US	TER HASEBORG,	Jan Luiken	DE
JÓSKIEWICZ,	Zbigniew	PL	THOMAS,	David	UK
KAMI,	Yoshio	JP	TUCCI,	Vincenzo	IT
KARWOWSKI,	Andrzej	PL	VAN DEURSEN,	Alexander	NL
KEYER,	Cees	NL	VARJU,	Gyorgy	HU
KLINGLER,	Marco	FR	VICK,	Ralf	DE
KUBIAK,	Ireneusz	PL	VOGT-ARDATJEW,	Robert	NL
KUZNETSOV,	Yury	RU	WIID,	Gideon	ZA
LEFERINK,	Frank	NL	WIKLUNDH,	Kia	SE
LI,	Jia	US	WILSON,	Perry	US
LIU,	En-Xiao	SG	WOLF,	Johannes	NL
LOPEZ,	Patricia	ES	ZHAO,	Dongsheng	NL
LOUGHRY,	Joe	US	ZIELINSKI,	Ryszard J.	PL
MAGDOWSKI,	Mathias	DE	ZOZAYA,	Alfonso J.	EC
MARADEI,	Francesca	IT			

# Conference general information

## Technical Areas

As a novelty, each paper submitted to the EMC Europe 2019 was classified according to the scheme shown in the table below. Classifying the papers in terms of application domains, techniques, and methodologies allowed a program with coherent technical sessions, focused either on the (final) application or in a certain technique (Technical tracks).

Application Domains			
Aerospace	Fundamental research	Metrology	Smart-grid
Automotive	Human exposure & Health protection	Military and Defense	Standards & Regulations
Components, Semiconductors, and IC	Industry	Power electronics	
Communications	Large systems & Fixed installations	Railway	
Education	Management and Quality	Security	



## Techniques

Antennas and Co-site interference	Low frequency and power quality topics	Power Integrity and Signal Integrity	Shielding & grounding
Calibration, proficiency tests and interlaboratory comparisons	Near-field techniques	Radar systems	TEMPEST and Eavesdropping
Frequency domain techniques	New materials: absorbers, composite, and metamaterials	Reverberation chambers	Time-domain and Transient analysis
Instrumentation, virtual instruments, and measurement automation	Numerical methods	Risk assessment	Transmission lines analysis

## Methodologies

Circuit modeling	EM simulation and validation methods	On-site and study cases	Statistical modeling
Diagnosis, troubleshooting, and systems validation	Experiments, Measurements, and Testing	Software and algorithms	Theoretical analysis and/or bibliographical review

## Best Paper Award Nominees

### Title and authors

- ID: 127 **S-EHRFEM - Substrate Extraction using Highly Reduced FEM-meshes for Transient SPICE-simulation with Iterative Linear Solvers**  
**Alexander Schade<sup>1</sup>, Frank Klotz<sup>1</sup>, Stefan Jahn<sup>1</sup>, Robert Weigel<sup>2</sup>**  
<sup>1</sup>Infineon Technologies AG, Germany; <sup>2</sup>Friedrich-Alexander Universität Erlangen-Nürnberg, Germany  
*Session S\_Th\_A\_Room4: Numerical Simulation Techniques for EMC Problems (I)*
- ID: 224 **EMC Diagnostics of Complex Ship Radioelectronic Systems by the Use of Analytical and Numerical Worst-Case Models for Spurious EM Couplings**  
**Vladimir Mordachev<sup>1</sup>, Eugene Sinkevich<sup>1</sup>, Dzmitry Tsyankenka<sup>1</sup>, Yauheni Arlou<sup>1</sup>, Aliaksandr Svistunou<sup>1</sup>, Alexey Galenko<sup>1</sup>, Andrey Polkanov<sup>1</sup>, Andrey Krachko<sup>1</sup>, Yingsong Li<sup>2</sup>, Tao Jiang<sup>2</sup>, Wei Xue<sup>2</sup>**  
<sup>1</sup>EMC R&D Laboratory, Belarusian State University of Informatics and Radioelectronics, Minsk, Belarus; <sup>2</sup>Harbin Engineering University, Harbin, China  
*Session S\_Tu\_C\_Room4: EMC Diagnostics of Complex Systems (I)*
- ID: 320 **OTA Testing method for RED, Coexistence and EM Interference in Vehicle**  
**Oussama Sassi<sup>1</sup>, Naseef Mahmud<sup>2</sup>, Pascal Hervé<sup>3</sup>**  
<sup>1</sup>Volkswagen AG, Germany; <sup>2</sup>Rohde & Schwarz GmbH & Co. KG; <sup>3</sup>CSA Group Bayern GmbH  
*Session O\_Th\_A\_Room1: Automotive (I)*
- ID: 321 **Estimation approach of Packet error rate at wireless communication system in the vehicle**  
**Oussama Sassi<sup>1</sup>, Naseef Mahmud<sup>2</sup>, Pascal Hervé<sup>3</sup>**  
<sup>1</sup>Volkswagen AG, Germany; <sup>2</sup>Rohde & Schwarz GmbH & Co. KG, Germany; <sup>3</sup>CSA Group Bayern GmbH, Germany  
*Session O\_Th\_A\_Room1: Automotive (I)*
- ID: 338 **Cyclostationary Characterization of the Interference Induced by Crosstalk Between Transmission Lines**  
**Yury Kuznetsov<sup>1</sup>, Andrey Baev<sup>1</sup>, Anastasia Gorbunova<sup>1</sup>, Maxim Konovalyuk<sup>1</sup>, Johannes A. Russer<sup>2</sup>, Michael Haider<sup>2</sup>, Peter Russer<sup>2</sup>**  
<sup>1</sup>Moscow Aviation Institute (National Research University), Russian Federation; <sup>2</sup>Technische Universität München, Germany  
*Session O\_We\_C\_Room2: Near-Field techniques (I)*

## Best Student Paper Award Nominees

### Title and authors

- ID: 124 **Reverberation Chamber Enhanced Backscattering: High-Frequency Effects**  
Laurens Alexander Bronckers, Anne Roc'h, Adrianus Bernardus Smolders  
 Eindhoven University of Technology, Netherlands, The  
*Session O\_Tu\_B\_Room1: Reverberation Chambers (I)*
- ID: 172 **Stabilized Explicit Isogeometric Analysis (SE-IGA) for Efficient Modeling and Analysis of 2-D Curved Structures**  
Hayato Naojima<sup>1</sup>, Tadatoshi Sekine<sup>2</sup>  
<sup>1</sup>Graduate School of Integrated Science and Technology, Shizuoka University, Japan; <sup>2</sup>Shizuoka University  
*Session S\_Th\_A\_Room4: Numerical Simulation Techniques for EMC Problems (I)*
- ID: 185 **Wide-Frequency EMI Suppression of Stationary Clocked Systems by Injecting Successively Adapted Cancellation Signals**  
Andreas Bendicks<sup>1</sup>, Timo Osterburg<sup>1</sup>, Stephan Frei<sup>1</sup>, Marc Wiegand<sup>2</sup>, Norbert Hees<sup>2</sup>  
<sup>1</sup>TU Dortmund University, Dortmund, Germany; <sup>2</sup>Leopold Kostal GmbH & Co. KG, Lüdenscheid, Germany  
*Session O\_Tu\_B\_Room3: Conducted EMI*
- ID: 216 **Simultaneous EMI Suppression of the Input and Output Terminals of a DC/DC Converter by Injecting Multiple Synthesized Cancellation Signals**  
Andreas Bendicks, Marvin Rübartsch, Stephan Frei  
 TU Dortmund University, Dortmund, Germany  
*Session O\_Th\_B\_Room1: Automotive (II)*
- ID: 263 **Introduction of a nearfield component level test and application to an automotive communication system**  
Emanuel Panholzer<sup>1,2</sup>, Martin Aidam<sup>1</sup>, Walter Franz<sup>1</sup>, Simon Senega<sup>2</sup>, Stefan Lindenmeier<sup>2</sup>  
<sup>1</sup>Dep. of EMC and Antennas, Daimler AG, Sindelfingen, Germany; <sup>2</sup>Institute of High Frequency Technology, University of Bundeswehr Munich, Germany  
*Session O\_We\_C\_Room2: Near-Field techniques (I)*

## Oral and poster

### POSTER PRESENTATIONS

#### FORMAT

- Poster size: **A0 (1.2 m x 0.8 m)**
- Orientation: **Vertical**

#### CONTENT

The presentation must cover the same material as the paper.

Place the title of your paper and your paper number prominently at the top of the poster to allow viewers to identify your paper easily.

Highlight the authors' names, e-mail and address information in case the viewer is interested in contacting you for more information.

You have complete freedom in displaying your information in figures, tables, text, photographs, etc in the poster.

Include the background of your research followed by results and conclusions. A successful poster presentation depends on how well you convey information to an interested audience.

#### PRESENTING YOUR WORK

Poster sessions will be held in the Poster Area.

Please, determine the day your poster has been scheduled for presentation in the final Symposium Programme.

Each presenter is provided with a panel which will be labeled with the corresponding paper ID.

The presenters are the sole responsible for hanging and removing their posters.

Your posters must be attached to the panel with double-sided tape or pushpins, which will be provided to the poster presenters. If you need more double-sided tape or pushpins, please contact the Staff. After you have removed your poster, please leave the double-sided tape or pushpins on the board.

Posters must be removed by the authors after the respective poster session. At the end of the day, the remaining posters (if any) will be removed and discarded by the staff. The organizer will not be responsible for posters and materials left on poster boards after the stated hours.

## ORAL SESSIONS

The following instructions are aimed to assist you in preparing, delivering and presenting your paper in the EMC Europe 2019 | Barcelona. Please, take them into consideration for ensuring the success of your technical talk.

### TIME

Each oral presentation is limited to **20 minutes** including questions and answers. This means a maximum of 15 minutes for your presentation and 5 minutes for Q&A.

Session Chairs are being asked to be very strict in keeping to the time schedule. Please make sure your presentation is well timed according allotted time frame.

### PREPARING YOUR SLIDES

Only PowerPoint and PDF presentation files are allowed, that is, **.ppt, .pptx and .pdf**.

The slide aspect ratio must be **16:9**.

When saving a PowerPoint file or printing your PDF presentation, please be sure to **embed all fonts**.

Preparing no more than 1 slide per minute available is a good rule of thumb. Using appropriate font size and checking the presentation has good readability is also advised. Avoid slides overstuffed with text and/or equations. Reserve enough time for presenting and discussing your results.

# Conference general information

## DELIVERING YOUR SLIDES

You must bring your presentation on a USB memory stick. A back-up is always advisable. Please note that **it is not allowed to use your own computer/laptop**.

With the assistance of our staff, load it onto the presentation computer at least **10 minutes prior to the start of the session**, before the first session in the morning or during the corresponding previous break.

Identify yourself to one of the session Chairs.

At the end of each technical session, all presentation files will be deleted permanently. The conference organizers will not distribute the presentations.

## AUDIO VISUAL RESOURCES

All rooms are equipped with the following audio-visual equipment:

- LCD Projector
- Windows-based PC
- Screen
- Laser Pointer
- Microphone

## PRESENTING YOUR WORK

The presenting authors should be ready in the session room before the session starts since the Session Chair will check all presenters at the beginning of each session. Please, stay seated in the first row, near the podium.

The Chairman will present you only by your full name and filiation. Long biographical resumes are not necessary, so don't bother to bring them with you.

Again, We kindly ask you to respect the allotted time.



## Special sessions, workshops & tutorials

Date	Special Session
Sep. 3 14:00 - 17:00	EMC Diagnostics of Complex Systems
Location	Room 4
Chair:	<i>Vladimir Mordachev Eugene Sinkevich</i>
Sep. 4 9:00 - 10:40	Electromagnetic Eavesdropping TEMPEST
Location	Room 3
Chair:	<i>Ireneusz Kubiak</i>
Sep. 4 14:00 - 15:20	Electromagnetic Environmental Effects on Aircrafts
Location	Room 1
Chair:	<i>Manuel Añón Cancela</i>
Sep. 4 16:00 - 17:00	Magnetometric Instruments and New Methodologies of Calibration and Testing
Location	Room 1
Chair:	<i>Marina Díaz Michelena</i>
Sep. 5 9:00 - 10:40	EMC in Physics Experiments and Particle Accelerators
Location	Room 3
Chair:	<i>Fernando Arteché</i>
Sep. 5 9:00 - 15:20	Numerical Simulation Techniques for EMC Problems
Location	Room 4
Chair:	<i>Salvador González García</i>

# Conference general information

Date	Workshop
Sep. 2 14:00 - 18:00 Location Chair:	Advanced Graphene-based Nanomaterials for Electromagnetic Shielding and Absorbing Applications: Towards 5G Technology Room 1 <i>Maria Sabrina Sarto</i> <i>Alessio Tamburrano</i>
Sep. 2 14:00 - 18:00 Location Chair:	Signal & Power Integrity, EMI/EMC for PCB Design with ANSYS tools Room 2 <i>Flavio Calvano</i> <i>Samuel Lopez</i>
Sep. 4 9:00 - 17:00 Location Chair:	Challenges in Special Applications of Electrically Small, HF Vehicular Antennas Room 5 <i>Diethard E.A. Hansen</i> <i>Ilona Danelyan</i>
Sep. 5 9:00 - 12:40 Location Chair:	Electromagnetic Interference on Static Electricity Meters Room 5 <i>Paul Simon Wright</i>
Sep. 6 9:00 - 18:00 Location Chair:	Automotive EMC Room 1 <i>Marco Klingler</i>
Sep. 6 9:00 - 10:40 Location Chair:	Measurements of conducted emissions in time domain and power-line filter design Room 4 <i>Albert-Miquel Sánchez</i> <i>F. Javier Pajares</i>

Date		Workshop
Sep. 6	11:20 - 18:00	Computational Electromagnetics and Multiphysics Methods for Simulating Complex Electromagnetic Environment
Location		Room 2
Chair:		<i>Wenyan Yin</i>
Sep. 6	11:20 - 18:00	Protecting Against the Risks of Lightning and EMI in Systems and Components
Location		Room 3
Chair:		<i>Andy Plumer</i>
Sep. 6	11:20 - 18:00	Components and topologies for passive EMI/EMC filters useful in conducted emissions: a practical approach
Location		Room 4
Chair:		<i>Ismael Molina Alba</i>

# Conference general information

Date	Tutorial
Sep. 2 14:00 - 18:00 Location Chair:	Analysis of Interference and Design Considerations in Internet of Things Applications Room 3 <i>Francisco Falcone</i>
Sep. 2 14:00 - 18:00 Location Chair:	Understanding EMC / Radio / Automotive Standards, Electromagnetic (EM)-Field-related Testing Room 4 <i>E.A. Hansen</i>
Sep. 2 14:00 - 18:00 Location Chair:	Near Field Probes: Useful tools for electronic engineers Room 5 <i>Arturo Mediano</i>
Sep. 3 11:40 - 17:00 Location Chair:	Protection of Civil Infrastructures against Intentional EMI (I) Room 5 <i>Martin Schaarschmidt</i> <i>Michael Suhrke</i>
Sep. 5 14:00 - 17:00 Location Chair:	MIL-STD461 Military EMC Tests and Challenges/Pitfalls Room 5 <i>Osman Sen</i> <i>Soydan Cakir</i>
Sep. 6 9:00 - 10:40 Location Chair:	Paper Preparation for the IEEE EMC Transactions Room 2 <i>John Norgard</i> <i>Perry Wilson</i>
Sep. 6 9:00 - 10:40 Location Chair:	Uncertainty about uncertainties along the EMC-compliance chain Room 3 <i>Pierre Beeckman</i>

Date	Tutorial
Sep. 6 9:00 - 10:40	Ionizing Radiation and Electromagnetic Interference on Integrated Circuits: from the need of combined tests to current solutions
Location	Room 5
Chair:	<i>Fabian Vargas</i>
Sep. 6 11:20 - 18:00	EMI and power quality issues in Smart Cities and Transportation Systems
Location	Room 5
Chair:	<i>Flavia Grassi</i> <i>Petre-Marian Nicolae</i>

# Conference general information

## Upcomming EMC conferences

Date	Conference
7-11 Sep. 2020	EMC Europe 2020. International Symposium on Electromagnetic Compatibility
Location	Rome, Italy
<i>Chairs:</i>	<i>Mauro Feliziani</i> <i>Maria Sabrina Sarto</i>
<i>Website:</i>	<i><a href="http://www.emceurope2020.org/">http://www.emceurope2020.org/</a></i>
19-22 May 2020	ASIA PACIFIC ELECTROMAGNETIC COMPATIBILITY SYMPOSIUM 2020
Location	Sydney, Australia
<i>Chair</i>	<i>Mark Mifsud</i>
<i>Website:</i>	<i><a href="https://apemc2020.org/">https://apemc2020.org/</a></i>
July 27-31 2020	2020 IEEE International Symposium on EMC, Signal and Power Integrity
Location	Reno, USA
<i>Chair</i>	<i>Darryl P. Ray</i>
<i>Website:</i>	<i><a href="http://www.emc2020.emcss.org/">http://www.emc2020.emcss.org/</a></i>



## Meetings

Date	Meeting
Sep. 4 9:00 - 10:40	IEEE P 2718 WG on "Guide for Near field Characterization of Unintentional Stochastic Radiators" <i>Location: Room 6</i>
Sep. 4 11:20 - 15:20	MeterEMI Research Project <i>Location: Room 6</i>
Sep. 4 16:00 - 17:00	Spanish IEEE EMC Chapter annual meeting <i>Location: Room 6</i>
Sep. 4 & 5 9:00 - 17:00	Advisory Committee on Electromagnetic Compatibility (ACEC) <i>Location: Room 8</i>
Sep. 5 9:00 - 12:40	IEEE Standard Working Groups on Characterization of Shielding Effectiveness (P2715 and P2716) <i>Location: Room 6</i>
Sep. 5 15:20 - 17:00	EMC Europe International Steering Committee (ISC) <i>Location: Room 9</i>
Sep. 6 9:00 - 10:40	SCENT and ETOPIA projects <i>Location: Room 6</i>

# Welcome reception Sant Pau

World Heritage by UNESCO

The Welcome Reception will take place on  
Tuesday, September 3 from 19:00 h



The Art Nouveau hospital pavilions were declared World Heritage by UNESCO in 1997. After more than a century as the home of the Hospital de la Santa Creu i Sant Pau, an ambitious restoration project following the transfer of all healthcare activities to the new Hospital has restored the cultural and artistic glories of the Sant Pau Art Nouveau Site, the most important work of Catalan architect Lluís Domènech i Montaner.

With this transformation, the Sant Pau Art Nouveau Site, in which history and innovation go hand in hand, has become a new point of reference in the city of Barcelona.

## Welcome cocktail schedule

### Self-guided visit

*From 19:00*

*At your arrival you will receive a leaflet to explore by yourself Sant Pau following the indications*

### Musical performance

*At 19:10*

*Inside the administration building, at Domènech i Montaner Hall, Toni Cotoli will be performing (for more information see page 55 of the final program)*

### Food and drinks

*From 19:30 till 21:30*

*Drinks and light food will be served at the gardens if the weather allows us, otherwise, it will be served inside Sant Pau main administration building*

### Closing time

*22:00*

## Indications

### Sant Pau Art Nouveau Site address:

Sant Antoni Maria Claret, 167, 08025 Barcelona

Coordinates: **41°24'42.0"N 2°10'27.6"E**

### Public transport:

Metro: L5 Sant Pau | Dos de Maig

Bus: H6, H8, 19, 47, 117, 192



## From conference venue to Sant Pau Art Nouveau Site:




5:39 PM from Zona Universitària

11 min

[DETAILS](#)

48 min

- **Campus Nord**  
Carrer de Jordi Girona, 1-3, 08034 Barcelona
- Walk  
✓ About 5 min, 400 m
- **Zona Universitària**
-  **H6** Fabra i Puig  
✓ 37 min (20 stops) · Stop ID: 556
- **Rda Guinardó-Castillejos**
- Walk  
✓ About 6 min, 500 m
- **Recinte Modernista de Sant Pau**  
Carrer de Sant Antoni Maria Claret, 167, 08025 Barcelona







5:43 PM from Zona Universitària

11 min

[DETAILS](#)

33 min

- **Campus Nord**  
Carrer de Jordi Girona, 1-3, 08034 Barcelona
- Walk  
✓ About 6 min, 500 m
- **Zona Universitària**
-  **L9S** Aeroport T1  
✓ 1 min (non-stop) · 
- **Collblanc**
- Go to Collblanc  
About 1 min
- **Collblanc**
-  **L5** Vall d'Hebron  
✓ 15 min (9 stops) · 
- **Sant Pau | Dos de Maig**
- Walk  
✓ About 4 min, 300 m
- **Recinte Modernista de Sant Pau**  
Carrer de Sant Antoni Maria Claret, 167, 08025



# **Gala dinner**

# **Les Drassanes**

## **Medieval Shipyards of Barcelona**

**The Gala dinner will take place on  
Wednesday, September 4 from 20:00 h**





Les Drassanes were the medieval shipyards of Barcelona, which now house the Barcelona Maritime Museum. Built in the fourteenth century, Les Drassanes is perhaps the most stirring ancient industrial space of any kind and certainly the most complete shipyard that has survived from the Middle Ages.

Les Drassanes were declared a Cultural Site of National Interest in 1976 because, despite renovation over the centuries, they remain true to their original design.

### Gala dinner schedule

Garden Welcome	20:00 <i>At your arrival, you will enjoy CAVA while there is some music performance</i>
Food served	At 20:30 <i>The food will be served inside Les Drassanes</i>
Activities	During the dinner <i>Best paper prizes, speeches and music performance.</i>
Closing time	22:45

## Indications

### Les Drassanes address:

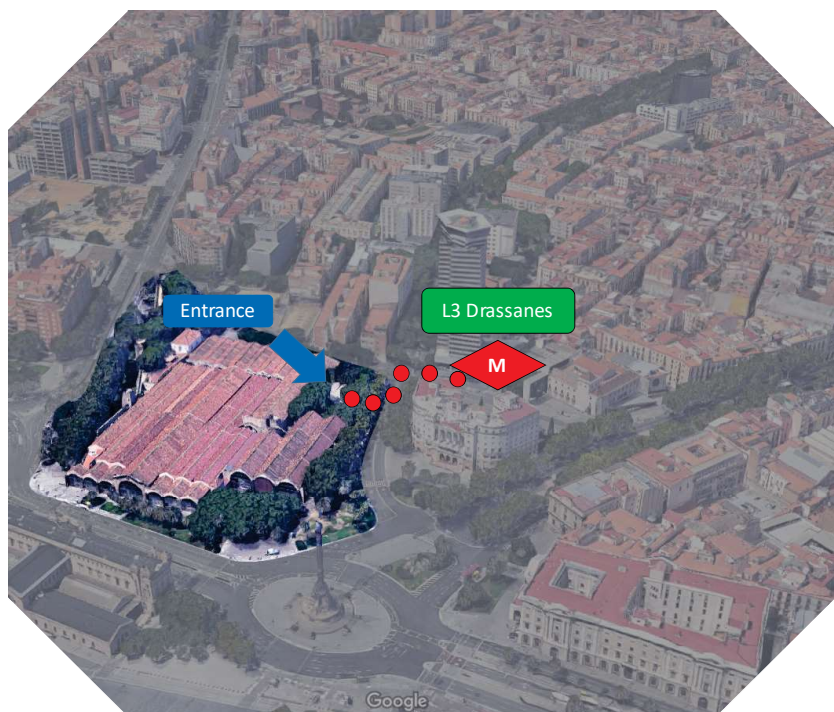
Av. de les Drassanes 1, 08001 Barcelona

Coordinates: **41°22'33.8"N 2°10'32.5"E**

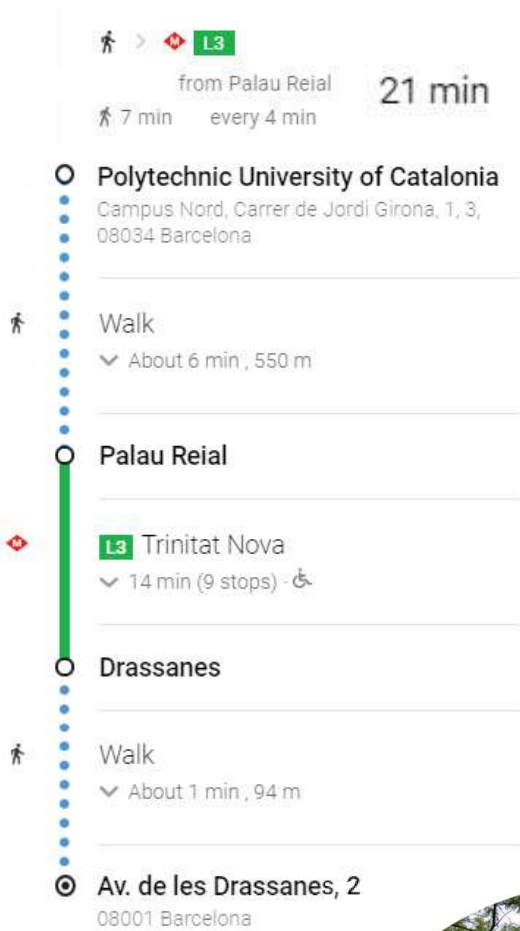
### Public transport:

Metro: L3 Drassanes

Bus: V13, D20, H14, 59, 120



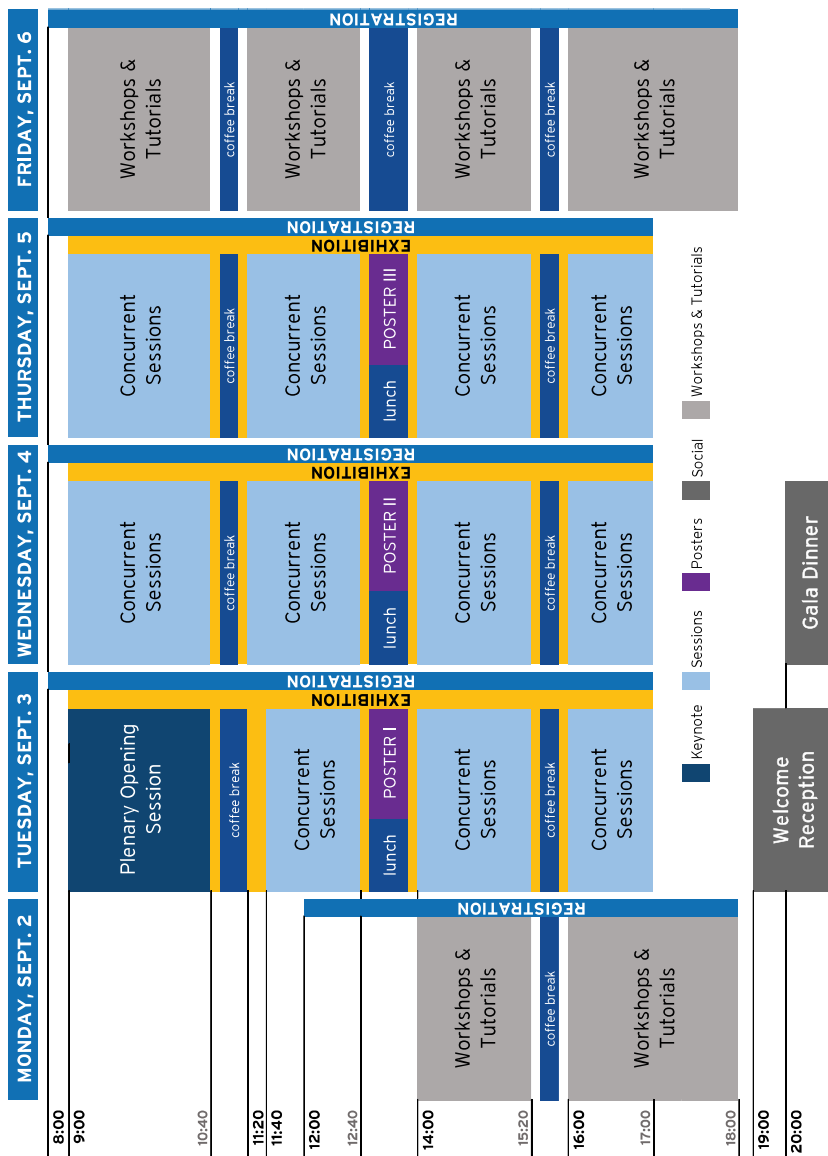
From conference venue to Les Drassanes:



Look for this entrance



# Schedule at a glance



This year, EMC Europe has a fantastic technical program that must not be missed. The conference comprises 5 days with state-of-the-art Technical Sessions, Workshops, and Tutorials on EMC. In summary,

<b>214</b>	<b>29</b>	<b>18</b>	<b>120</b>
Technical Papers	Sessions	Workshops & Tutorials	Hours of content

Oral presentations were allocated in sequences intended to make sense for participants. In this manner, we aspire to maximize the interaction/involvement speaker-audience and the general enjoyment in benefit of all participants. This resulted in 20 oral sessions, 6 special sessions, and 3 poster sessions.

Moreover, in the technical program, you will find 9 Workshops and 9 Tutorials distributed along the whole symposium week. While Workshops are intended to be a period of discussion or practical work in which a group of people shares their knowledge or experience, Tutorials are meant as educational talks on specific topics.



**ROHDE & SCHWARZ**



**ROHDE & SCHWARZ**

Monday Schedule

MONDAY, SEPT. 2				
ROOM 1		ROOM 2	ROOM 3	ROOM 4
ROOM 5		REGISTRATION		
12:00		coffee break		
14:00		Advanced Graphene-based Nanomaterials for Electromagnetic Shielding and Absorbing Applications: Towards 5G Technology I	Signal& Power Integrity, EMI/EMC for PCB Design with ANSYS tools I	Analysis of Interference and Design Considerations in Internet of Things Applications I
15:20				Understanding EMC / Radio / Automotive Standards, Electromagnetic (EM)-Field-related Testing, update I
16:00		Advanced Graphene-based Nanomaterials for Electromagnetic Shielding and Absorbing Applications: Towards 5G Technology II	Signal& Power Integrity, EMI/EMC for PCB Design with ANSYS tools II	Analysis of Interference and Design Considerations in Internet of Things Applications II
18:00				Understanding EMC / Radio / Automotive Standards, Electromagnetic (EM)-Field-related Testing, update II
				Near Field Probes: Useful tools for electronic engineers II
				Near Field Probes: Useful tools for electronic engineers I

Workshops      Tutorials



W\_Mo\_C\_1: Workshop

14:00 - 18:00

**Advanced Graphene-based Nanomaterials for  
Electromagnetic Shielding and Absorbing  
Applications: Towards 5G Technology**

Session Chairs      Sabrina Sarto  
                                 Alessio Tamburrano

**Room 1**

**Abstract** - The Workshop focuses on the development of new multifunctional graphene-based nanomaterials for electromagnetic shielding and radar absorption, such as graphene-nanocomposites or coatings and multilayer metal-free screens. Theoretical modelling approaches, simulation methods, production and experimental characterization techniques for the development of the EM screens are presented. Moreover, protection against electromagnetic interference (EMI) from the upcoming fifth-generation (5G) communication devices is discussed and new metal-free graphene-based absorbers above 24 GHz are proposed.

**Agenda:**

- Introduction to graphene-based nanomaterials for electromagnetic shielding and radar absorption. M.S. Sarto, Sapienza University of Rome, Rome, Italy.
- Production and electromagnetic characterization of graphene-based paint and thin coatings. A. Tamburrano, Sapienza University of Rome, Rome, Italy.
- Radar absorbing fiber-reinforced graphene-filled composites with enhanced mechanical properties. F. Marra, Sapienza University of Rome, Rome, Italy
- Towards next generation wireless 5G technology. M. D'Amore, Sapienza University of Rome, Rome, Italy.
- New metal-free absorbers for 5G high-frequency bands. A.G. D'Aloia, Sapienza University of Rome, Rome, Italy • Discussion of assumptions/limits in the experiments and how well they fit simulations

W\_Mo\_C\_2: Workshop

14:00 - 18:00

## **Signal & Power Integrity, EMI/EMC for PCB Design with ANSYS tools**

Session Chairs  
Flavio Calvano  
Samuel Lopez

**Room 2**

**Abstract** - In this workshop, the typical Power and Signal integrity EMI/EMC issues on PCBs will be solved by a Full wave hybrid simulation approach coupled with the help of an advanced circuit simulator for the non-linear time transient analysis.

The PCB scattering parameter extraction provided by our full wave hybrid numerical code helps to identify issues on Power Delivery Network (PDN) and run a design of experiment genetic algorithm which can find the right decoupling capacitor strategy based on PDN noise and capacitor number minimization. Examples of this technique will be presented in this workshop.

### **Agenda:**

- Introduction to Electromagnetic simulation for PCB design
- DC and thermal Multiphysics simulation for PCB
- Power Integrity Analysis and decoupling capacitor strategy and optimization
- Signal Integrity, Eye Diagrams, TDR and ZO impedance scan
- EMI/EMC near and far field analysis

### **Speakers:**

- Dr. Flavio Calvano (flavio.calvano@ansys.com) ANSYS Italy,
- Dr. Frederic Bocquet (frederic.bocquet@ansys.com) ANSYS France
- Samuel Lopez (samuel.lopez@ansys.com) ANSYS Spain.

T\_Mo\_C\_3: Tutorial

14:00 - 18:00

## **Analysis of Interference and Design Considerations in Internet of Things Applications**

Session Chairs  
Francisco Falcone

**Room 3**

**Abstract** - In this tutorial, we will provide an overview of the trends, limitations, and challenges in relation with communication system design, considering multiple systems and Heterogeneous Network operation, with special emphasis on interference conditions, characterization, and management. An overview of the wireless communication systems and related transceiver/devices will be given, as well as the specific characteristics in terms of Quality of Service/Quality of Experience requirements. Different

interference sources will be characterized to perform coverage/capacity estimations, as well as to analyze node density and node location variation impact in overall system performance. Interference estimation methods within the application scenarios will be described, based on analytical approximations, deterministic 3D ray launching, full-wave electromagnetic simulation, and hybrid simulation techniques. The challenges in terms of computational complexity will also be described. Co-location at device/sub-system level will be outlined, as well as the impact of multi-frequency operation in interference requirements, to provide an overview for the device as well as for system designers in relation with overall performance evaluation.

#### Agenda:

- Introduction. Characteristics and Requirements of IoT communications
- Coverage/Capacity relations. Interference analysis and node location/density considerations
- Interference modelling and simulation
- Description of Use Cases within IoT application scenarios

T\_Mo\_C\_4: Tutorial

14:00 - 18:00

### **Understanding EMC / Radio / Automotive Standards. Electromagnetic (EM)-Field-related Testing**

Session Chair Diethard E.A. Hansen

**Room 4**

**Abstract** - Basic EMC/Radio/Wireless/Automotive lab testing background/knowledge. Focus on electromagnetic (EM) field related testing, mostly a less understood topic. Understanding physics/history/common principles in testing, incl. Mil-STD; calibration, instruments, sensors, antennas, and EM test sites (radiated emissions, immunity). Standard's limitations/agreed Tech-Compromises in CE product compliance testing is explained; formal procedures. Product risk assessment/EM test norms get now more transparent. CE Compliance (2016/17 enforced EU-EMC, RED directive), Quality of accredited ISO/EN 17025 (2017) test reports. Important topics: History, EMC Units including Decibels, Constants in physics, frequency spectrum (to GHz), simple EM-radiators, test antenna characteristics, near/far-field, spectrum and radiation efficiency of printed circuit boards, electronic components real-world properties, relevant EMC standards, EMF, legislation/ regulations, MRA, other EU Directives, Tech.-Doc., Notified Body vs. non/harmonized standards, typical EMC Tests for Pre/Compliance Testing. Based on existing knowledge, clients improve their basic understanding of EMC testing and formal CE procedures. We promote "help yourself" by understanding, rather than just blindly searching for 10 golden EMC design rules leading to successful product compliance.

T\_Mo\_C\_5: Tutorial

14:00 - 18:00

## **Near Field Probes: Useful tools for electronic engineers**

Session Chair Arturo Mediano

**Room 5**

**Abstract** - Main goal of the tutorial is to introduce knowledge on near field probes and to review the different techniques to use them in the RF/EMI/EMC practical design and troubleshooting work. The attendees will be able to know the basics of electric and magnetic near field probes, the principles of working with them including useful frequency range and shielded vs. non-shielded versions. Both homebrew and commercial near field probes are presented from the smaller models to test at the pin level to modern scanners to test complete boards. The attendees will understand how to use a near field probe with different instruments including oscilloscopes, spectrum analyzers (with and without tracking generator), Voltage Standing Wave (VSWR) Bridges, network analyzers and other special tools. Near field scanners are introduced. Once the combination of the probe and the instruments is understood they will be able to see how to apply those techniques to typical design and troubleshooting high-frequency systems from the component and material level, through the PCB design (including slots in ground planes), shielding and cable analysis and evaluation. They will be able to see some examples of probes, hardware demos and some real-world cases where the instructor found the probes useful.

# Smart and Low EMI Power Electronics



**The laboratory** is specialized in the design and development of smart solutions aimed to optimize the energy efficiency and electromagnetic noise of electrical systems, mixing new technologies based on energy storage devices, power converters and Electromagnetic Compatibility (EMC).

## CERTIFIED TESTING LAB

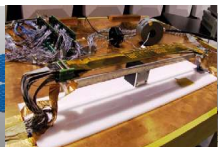
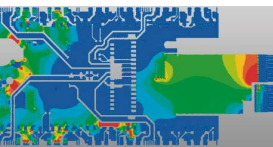
EMC  
Electrical Safety

## R&D

EMC  
Simulation Models  
Power Electronics

## SECTORS

- Transport  
(automotive, railways & aeronautics)
- Scientific instrumentation  
& facilities
- Machinery
- Households
- Industry



🏠 [www.itainnova.es](http://www.itainnova.es)  
✉ [info@itainnova.es](mailto:info@itainnova.es)  
☎ Tel. +34 976010000

## Aragon Institute of Technology

INDUSTRY 4.0 - DIGITAL TRANSFORMATION - DESIGN AND DEVELOPMENT OF NEW PRODUCTS - IMPROVEMENT OF PRODUCTIVE PROCESSES - TEST - CALIBRATION

**Construyendo Europa desde Aragón**  
Fondo Europeo de Desarrollo Regional (FEDER)



Tuesday

TUESDAY, SEPT. 3					
ROOM 1		ROOM 2		ROOM 3	
ROOM 4		ROOM 5			
8:00	Opening: Plenary Opening Session (ROOM AUDITORIUM - VERTEX BUILDING)				
9:00					
10:40	Exhibition Inauguration				
	coffee break				
11:40	Reverberation chambers I	EM Simulation	Conducted EMI	Transient EMI	Protection of Civil Infrastructures against Intentional EMI I
12:40	POSTER I (POSTER'S AREA)				
	lunch				
14:00	Reverberation chambers II	EM Field Probes I	Smart-grid & Power Quality I	EMC Diagnostics of Complex Systems I	Protection of Civil Infrastructures against Intentional EMI II
15:20	coffee break				
16:00	Reverberation chambers III	EM Field Probes II	Smart-grid & Power Quality II	EMC Diagnostics of Complex Systems II	Protection of Civil Infrastructures against Intentional EMI III
17:00					

Sessions

Posters

Keynote

Special Sessions

Tutorials

Opening Oral session  
**Plenary Opening Session**

9:00 - 10:40

Session Chair Ferran Silva  
Marc Pous

**Auditori VERTEX**

## SPEECHES

**Ferran Silva**

Chair of EMC Europe 2019 Barcelona Local Organizing Committee

**Francesc Torres**

Rector of Universitat Politècnica de Catalunya (UPC)

**Jan Carlsson**

Chair of EMC Europe International Steering Committee

**Bruce Archambeault**

President of IEEE EMC Society

**Mauro Feliziani**

Chair of EMC Europe 2020 Roma Local Organizing Committee

## KEYNOTE SPEAKERS

**Fernando Arteché**

EMC based design of physics detectors: Top-Down vs. Bottom-Up Approach  
Technology coordinator of Electrical Systems Division at ITAINNOVA

**Jordi José**

Life, death and electromagnetism: From Frankenstein to a Manned-Mission to Mars

Professor of Physics and Research Vice-Dean at the UPC Diagonal-Besòs Campus

## MUSICAL PERFORMANCE

**Toni Cotolí**

Performing classical guitar Luis Nuño compositions

## Keynote speaker



**Fernando Arteché** is the technology coordinator of Electrical Systems Division at ITAINNOVA. From 1999 to 2007, he was at CERN (Switzerland) and Imperial College of London working on the design of LHC and CMS experiment. He joined ITAINNOVA in 2007, where he has continued his research on EMC and power distribution systems for the new generation of high energy physics experiments such as Belle II

(Japan) and CMS upgrade at CERN.

### ***EMC based design of physics detectors: Top-Down vs. Bottom-Up Approach***

The control of EMI phenomena in physics experiments is a complex task due to the nature and rate of events, the environment and the sensitive electronics installed in the detectors. In order to ensure good performance of physics detectors, it is necessary to develop techniques and studies covering areas outside the scope of any EMC standards. The main goal of these studies is to define general design rules emerging from particular components or sub-systems (Top-Down vs. Bottom-Up Approach).

This talk shows how these techniques have been developed and implemented in real experiments to define practical solutions compatible with the detector technology. The impact that the sensor technology, power distribution topology and detector layout have in the implementation of realistic integration strategies is presented. Examples from the past, present and future generation of high energy physics experiments are shown.



## Keynote speaker

**Jordi José** is a Full Professor of Physics and Research Vice-Dean at the UPC Diagonal-Besòs Campus. He currently coordinates the Astronomy & Astrophysics research group at UPC. He is an expert on stellar evolution, with emphasis on stellar explosions and their contribution to the chemical abundances in the Cosmos.



### *Life, death and electromagnetism: From Frankenstein to a Manned-Mission to Mars*

Short Abstract. Long before the scientific foundations of electromagnetism were firmly established, some ancient cultures were already aware of the curious properties exhibited by two minerals - amber and magnetic iron ore. At those ancient times, and during centuries, electricity and magnetism were regarded as peculiar and mystifying phenomena.

In this talk, we will first review a suite of experiments (conducted by C. F. du Fay, L. Galvani and others), that sparked curious interpretations and contributed to surround electricity and magnetism with a mysterious aura.

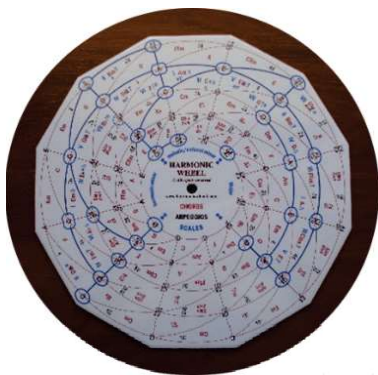
We will also present a number of curious examples, extracted from literature and cinema, that stress current misconceptions about electromagnetism. Finally, we will discuss possible electromagnetic-based threats faced by future astronauts in a manned-mission to Mars."

## Musical performance

### LUIS NUÑO

Chairman of IEC/SC 77B: *Electromagnetic Compatibility. High Frequency Phenomena* (2006 - 2015), Member of IEC/ACEC: *Advisory Committee on Electromagnetic Compatibility* (2011-2019), Member of IEC/SC 77B/WG 10: *Radiated and conducted continuous phenomena immunity tests*, since 2009. Chairman of the Spanish National Committee on EMC (AEN/CTN 208), since 2010.

Ph. D. in Telecommunications Engineering and Professor in the Area of Signal Theory and Communications at the Polytechnic University of Valencia (Spain), he also lectures for the University Master on Music and Scenic Arts. His current research interest includes Numerical Methods in Electromagnetism, Electromagnetic Compatibility and Music Theory.



He has developed three abacuses summarizing Music Theory, Harmony and Improvisation, called respectively *MUSICAL ABACUS*, *HARMONIC WHEEL* and *IMPROCHART™*. He has composed two CD's of guitar music: *Puesta de Sol (Sunset)* (2010) and *Sueños (Dreams)* (2014). Both CD's are performed by international guitarist Toni Cotolí.

[www.harmonicwheel.com](http://www.harmonicwheel.com)

## TONI COTOLÍ

Toni Cotelí has established himself as one of the leading figures in contemporary Spanish guitar, taking his music to the United States, Japan, China, the Arab Emirates and, of course, throughout Europe. He has been characterized by his musical versatility, adding his own personal identity on the Spanish guitar, rhythms and trends in different aspects of flamenco, tango, blues and rock, going through the impeccable execution of the pieces created by great classical composers such as Albéniz, Tárrega, Piazzolla or Giuliani.

He has received many different awards, including the prestigious Euterpe Music Award of the Valencian Community in 2002. In addition, he is one of the promoters of the innovative Ricardo Gallén Course of Guitar and Physiotherapy.

All this professional background and experience is reflected in his catalogue of six edited CD's: *Toni Cotelí* (2003), *Entre Amigos* (2007), *Puesta de Sol* (2010), *Sueños* (2014), *Aromas de Guitarra - Oda* (2015) and *Rock Road* (2018).

[www.tonicotoli.es](http://www.tonicotoli.es)



## ORAL SESSIONS

O\_Tu\_B\_1 Oral session

11:40 - 12:40

### Reverberation Chambers (I)

Session Chair Frank Leferink

Room 1

#### Reverberation Chamber Enhanced Backscattering: High-Frequency Effects

Laurens Alexander Bronckers, Anne Roc'h, Adrianus Bernardus Smolders

Eindhoven University of Technology, Netherlands, The

#### The Effect of Peripheral Equipment Loading on Reverberation-Chamber Metrics

A. Hubbrechtsen<sup>1</sup>, L.A. Bronckers<sup>2</sup>, K.A. Remley<sup>1</sup>, R. Jones<sup>1</sup>, R.D. Horansky<sup>1</sup>, A.C.F. Reniers<sup>2</sup>, A. Roc'h<sup>2</sup>, A.B. Smolders<sup>2</sup>

<sup>1</sup>NIST, United States of America; <sup>2</sup>Eindhoven University of Technology, The Netherlands

#### Bayesian Analysis of Reverberation Chamber Measurement Data

Carlo Carobbi<sup>1</sup>, Ramiro Serra<sup>2</sup>

<sup>1</sup>Università degli Studi di Firenze, Italy; <sup>2</sup>Eindhoven University of Technology, The Netherlands

O\_Tu\_B\_2 Oral session

11:40 - 12:40

### EM Simulation

Session Chair Jan Carlsson

Room 2

#### Comparison of BBSPICE to PEEC Equivalent Circuit Models for Simulation of Floating PCB Above Ground Plane

Herbert Hackl<sup>1</sup>, Martin Ibel<sup>1,3</sup>, Bernhard Auinger<sup>1</sup>, Christian Stockreiter<sup>2</sup>, Bernd Deutschmann<sup>3</sup>

<sup>1</sup>Silicon Austria Labs, Graz, Austria; <sup>2</sup>ams AG, Premstätten, Austria; <sup>3</sup>Institute of Electronics, Graz University of Technology, Austria

#### Comparative study between EMTR technique and a GA-based method for modeling EM radiation source in the Near Field

Sassia HEDIA<sup>1,2</sup>, Bessem ZITOUNA<sup>1</sup>, Jaleddine BEN HADJ SLAMA<sup>1</sup>, Lionel PICHON<sup>2</sup>

<sup>1</sup>Université de Sousse, Ecole Nationale d'Ingénieurs de Sousse, LATIS- Laboratory of Advanced Technology and Intelligent Systems, 4023, Sousse, Tunisie; <sup>2</sup>Group of Electrical Engineering, Paris (GeePs), CNRS UMR 8507, Centrale Supélec, University of Paris-Sud, University of Paris-Saclay, France

#### Influence of Dielectric Permittivity on Radiated Immunity in Real and Emulated Far-Fields

Mohsen Koohestani, Richard Perdriau, Mohamed Ramdani

ESEO-IETR, RF-EMC Research Group, France

O\_Tu\_B\_3 Oral session

11:40 - 12:40

## Conducted EMI

Session Chair Mauro Feliziani

Room 3

### Wide-Frequency EMI Suppression of Stationary Clocked Systems by Injecting Successively Adapted Cancellation Signals

Andreas Bendicks<sup>1</sup>, Timo Osterburg<sup>1</sup>, Stephan Frei<sup>1</sup>, Marc Wiegand<sup>2</sup>, Norbert Hees<sup>2</sup>

<sup>1</sup>TU Dortmund University, Dortmund, Germany; <sup>2</sup>Leopold Kostal GmbH & Co. KG, Lüdenscheld, Germany

### Comprehensive Analysis of Converter Output Voltage for Conducted Noise Simulation

Danil Drozhzhin, Vefa Karakasli, Gerd Griepentrog

TU Darmstadt, Germany

### Generation of Terminal Equivalent Circuits Applied to a DC Brush Motor

Philipp Hillenbrand, Hermann Aichele, Christoph Keller, Peter Kralicek

Robert Bosch GmbH, Germany

O\_Tu\_B\_4 Oral session

11:40 - 12:40

## Transient EMI

Session Chair Diethard E.A. Hansen

Room 4

### Fast Lightning Stroke Localization in the Time Domain

Petr Kadlec, Martin Marek, Martin Štumpf

Brno University of Technology, Czech Republic

### A Parametric Study of an Energy Storage Effect due to Nonlinear Components and HPEM-Excitation

Robert Michels<sup>1</sup>, Martin Willenbockel<sup>2</sup>, Frank Gronwald<sup>1</sup>

<sup>1</sup>University of Siegen, Germany; <sup>2</sup>Bundeswehr Research Institute for Protective Technologies and NBC Protection, Germany

### Analysis of the CAN communication error when applying ESD on the CAN communication harness

Younghun Lee<sup>1</sup>, Youngyu Kim<sup>1</sup>, Sunguk Choi<sup>2</sup>, Youngduk Park<sup>1</sup>, Junho Choi<sup>1</sup>

<sup>1</sup>Hanonsystems, Korea, Republic of (South Korea); <sup>2</sup>KAIST, Korea, Republic of (South Korea)

T\_Tu\_B\_5 Tutorial session 11:40 – 17:00

## Protection of Civil Infrastructures against Intentional EMI

Session Chairs Martin Schaarschmidt  
Michael Suhrke

Room 5

**Abstract** - Intentional EMI is becoming more and more a threat to modern society because the availability of I-EMI is increasing, while modern electronic systems are becoming more vulnerable. Due to the widespread use of wireless systems this risk is increasingly important. Our civil infrastructures depend on the use of modern communication systems, and several research projects have been recently been carried out. In this tutorial we will give an overview of high-power and low-power I-EMI threats, the risks to civil infrastructures and preventive actions.

### Agenda:

- Introduction
- IEMI Risk Analysis at the System Level. Frank Sabath
- IEMI vulnerability tests of critical infrastructure components. Michael Suhrke
- Vulnerability of building security systems to IEMI. Martin Schaarschmidt
- Performance of redundant server infrastructures under IEMI influence. Isa Wegmann, Heyno Garbe
- Vulnerability of Wireless Systems to (Intentional) EMI. Robert Vogt-Ardatjew.
- Conclusion

O\_Tu\_C\_1 Oral session 14:00 – 15:20

## Reverberation Chambers (II)

Session Chair Philippe Besnier

Room 1

### The Semi Reverberating Chamber (SRC) Used for Emulating Typical Real-Life Environments

Antonio Sorrentino, Sergio Cappa, Maurizio Migliaccio, Ferdinando Nunziata  
Università degli Studi di Napoli Parthenope, Italy

### Geometry and loading effects on performances of mode-stirred reverberation chambers: an experimental study

Ludivine Le Bars<sup>1</sup>, Jean-François Rosnarho<sup>1</sup>, Philippe Besnier<sup>2</sup>, Jérôme Sol<sup>2</sup>, François Sarrazin<sup>3</sup>, Elodie Richalot<sup>3</sup>

<sup>1</sup>SIEPEL : Société Industrielle d'Etudes et Protections Electroniques, Impasse de la Manille, F-56470 La Trinité-sur-Mer, France; <sup>2</sup>INSA Rennes, CNRS, IETR - UMR 6164, F-35000 Rennes, France; <sup>3</sup>Université Paris-Est, ESYCOM (FRE2028), CNAM, CNRS, ESIEE-Paris, Université Paris-Est Marne-la-Vallée, F-77454 Marne-la-Vallée, France

## Measurements and Power Balance Calculations of the Shielding Effectiveness of Partitioned Equipment Enclosures

**Andy Marvin, Sarah Parker, John Dawson, Martin Robinson**  
University of York, United Kingdom

## Geometry and loading effects on performances of mode-stirred reverberation chambers: an experimental study

**Ludivine Le Bars<sup>1</sup>, Jean-François Rosnarho<sup>1</sup>, Philippe Besnier<sup>2</sup>, Jérôme Sol<sup>2</sup>, François Sarrazin<sup>3</sup>, Elodie Richalot<sup>3</sup>**

<sup>1</sup>SIEPEL: Société Industrielle d'Etudes et Protections Electroniques, France; <sup>2</sup>INSA Rennes, CNRS, France; <sup>3</sup>Université Paris-Est, ESYCOM (FRE2028), CNAM, CNRS, ESIEE-Paris, Université Paris-Est Marne-la-Vallée, France.

O\_Tu\_B\_2 Oral session

14:00 - 15:20

### EM Field Probes (I)

Session Chair Heyno Garbe

**Room 2**

#### Evaluation of Detection Response of an Electric Field Probe to AM Signals Using Equivalent Circuit Model

**Ilong Wu, Yasushi Matsumoto, Kaoru Gotoh, Kanako Wake, Soichi Watanabe**  
National Institute of Information and Communications Technology (NICT), Japan

#### Advanced Modeling of an isotropic Three-Axis magnetic field probe using coils and a near field source approach

**Marcel Messer, Michael Kühn**  
AUDI AG, Germany

#### Validation of a three-axis magnetic field probe model for homogeneous and inhomogeneous fields

**Marcel Messer, Michael Kühn**  
AUDI AG, Germany

#### Proximity Errors in Quasistatic Magnetic Field Measurements on Line Sources Using Coil Probes

**Alastair R. Ruddle**  
HORIBA MIRA Limited, United Kingdom

O\_Tu\_B\_3 Oral session

14:00 - 15:20

### Smart-grid & Power Quality (II)

Session Chair Flavia Grassi

**Room 3**

#### On-site Waveform Characterization at Static Meters Loaded with Electrical Vehicle Chargers

**Tom Hartman<sup>1</sup>, Marc Pous<sup>2</sup>, Marco Azpúrua<sup>2</sup>, Ferran Silva<sup>2</sup>, Frank Leferink<sup>1,3</sup>**  
<sup>1</sup>University of Twente, Enschede, the Netherlands; <sup>2</sup>Universitat Politècnica de Catalunya, Barcelona, Spain; <sup>3</sup>THALES Nederland B.V., Hengelo, the Netherlands

## Low Frequency Conducted Emissions Caused by Series Arc Faults

Christopher James Rose<sup>1</sup>, David W P Thomas<sup>1</sup>, Christopher Smartt<sup>1</sup>, Peipei Meng<sup>2</sup>

<sup>1</sup>University of Nottingham, United Kingdom; <sup>2</sup>Wuhan University of Technology, China

## Sensitivity of static energy meter reading errors to changes in non-sinusoidal load conditions

Zander Marais<sup>1,2</sup>, Helko van den Brom<sup>1</sup>, Gert Rietveld<sup>1</sup>, Ronald van Leeuwen<sup>1</sup>, Dennis Hoogenboom<sup>1</sup>, Johan Rens<sup>2</sup>

<sup>1</sup>Van Swinden Laboratory, Delft, The Netherlands; <sup>2</sup>North West University, Potchefstroom, South Africa

## Inclination of Fast Changing Currents Effect the Readings of Static Energy Meters

Bas ten Have<sup>1</sup>, Tom Hartman<sup>1</sup>, Niek Moonen<sup>1</sup>, Frank Leferink<sup>1,2</sup>

<sup>1</sup>University of Twente, Netherlands, The; <sup>2</sup>THALES Nederland B.V., Netherlands, The

S\_Tu\_C\_4 Oral Special Session

14:00 - 15:20

### EMC Diagnostics of Complex Systems (I)

Session Vladimir Mordachev

Chairs Eugene Sinkevich

Room 4

## EMC Diagnostics of Complex Ship Radioelectronic Systems by the Use of Analytical and Numerical Worst-Case Models for Spurious EM Couplings

Vladimir Mordachev<sup>1</sup>, Eugene Sinkevich<sup>1</sup>, Dzmitry Tsyaneuka<sup>1</sup>, Yauheni Arlou<sup>1</sup>, Aliaksandr Svistunou<sup>1</sup>, Alexey Galenko<sup>1</sup>, Andrey Polkanov<sup>1</sup>, Andrey Krachko<sup>1</sup>, Yingsong Li<sup>2</sup>, Tao Jiang<sup>2</sup>, Wei Xue<sup>2</sup>

<sup>1</sup>EMC R&D Laboratory, Belarusian State University of Informatics and Radioelectronics, Minsk, Belarus; <sup>2</sup>Harbin Engineering University, Harbin, China

## Experimental test results of EMC between 5G and Radio relay links in millimeter band

VALERY TIKHVINSKIY<sup>1,3</sup>, VIKTOR KOVAL<sup>2</sup>, PAVEL KORCHAGIN<sup>2</sup>, ALTAY AITMAGAMBETOV<sup>4</sup>

<sup>1</sup>NIITC LLC, Russian Federation; <sup>2</sup>GEYSER-TELECOM Ltd.; <sup>3</sup>MOSCOW TECHNICAL UNIVERSITY OF COMMUNICATIONS AND INFORMATICS; <sup>4</sup>ITU

## Automated Selection of Solutions for Protection of On-board System from External Electromagnetic Disturbances

Ivan Shakinka, Dzmitry Tsyaneuka, Yauheni Arlou, Eugene Sinkevich, Vladimir Mordachev

Belarusian State University of Informatics and Radioelectronics

## Setups for measuring the beat of two 1 THz waves

Marcin Wojciechowski

Główny Urząd Miar (Central Office of Measures), Poland



O\_Tu\_D\_1 Oral session

16:00 - 17:00

## Reverberation Chambers (III)

Session Chair Ramiro Serra

Room 1

### Improvement of Performances of a Reverberation Chamber with Fixed Metallic Spheres Using the ``Well-Stirred'' Condition Method

Guillaume Andrieu<sup>1</sup>, Nicolas Ticaud<sup>2</sup>

<sup>1</sup>XLIM Laboratory, University of Limoges, France; <sup>2</sup>CISTEME company, Limoges, France

### Statistical Analysis of the Induced Voltage on a DUT in a Reverberation Chamber where Mechanical and Source Stirring Actions are Implemented

Alfredo De Leo, Graziano Cerri, Paola Russo, Valter Mariani Primiani

Universita Politecnica Marche, Italy

### Numerical Simulation of a Direct Current Mode Stirred Reverberation Chamber

Markus Rothenhaeusler<sup>1</sup>, Alexander Schoisl<sup>1</sup>, Martin Schwarz<sup>2</sup>

<sup>1</sup>Airbus Defence and Space GmbH, Germany; <sup>2</sup>Wehrtechnische Dienststelle für Informationstechnologie und Elektronik, WTD81

O\_Tu\_D\_2e Oral session

16:00 - 17:00

## EM Field Probes (II)

Session Chair Jan Luiken ter Haseborg

Room 2

### AC magnetic field imaging by using atomic magnetometer and micro-mirror device

Shuji Taue<sup>1</sup>, Nao Arita<sup>1</sup>, Yoshitaka Toyota<sup>2</sup>

<sup>1</sup>Kochi University of Technology, Japan; <sup>2</sup>Okayama University, Japan

### Thermo-fluorescent images of electric and magnetic near-fields of a High Impedance Surface

Hugo Ragazzo<sup>1</sup>, Daniel Prost<sup>1</sup>, François Issac<sup>1</sup>, Stephane Faure<sup>2</sup>, Julian Carrey<sup>2</sup>, Jean-François Bobo<sup>3</sup>

<sup>1</sup>Université de Toulouse; <sup>2</sup>INSA; <sup>3</sup>CEMES

O\_Tu\_D\_3 Oral session

16:00 - 17:00

## Smart-grid & Power Quality (II)

Session Chair Frank Sabath

Room 3

### Investigating Lightning Induced Currents in Photovoltaic Modules

Kurt Michael Coetzer, Pieter Gideon Wiid, Arnold Johan Rix  
Stellenbosch University, South Africa

### Characteristics of Radiated Emission by PLC Signal from Three-wire Power Cable

Nobuo Kuwabara<sup>1</sup>, Tohlu Matsushima<sup>1</sup>, Yuki Fukumoto<sup>1</sup>, Hiroyuki Okumura<sup>2</sup>  
<sup>1</sup>Kyushu Institute of Technology, Japan; <sup>2</sup>Panasonic Corporation, Japan

### Detection Methods for Current Signals Causing Errors in Static Electricity Meters

Fani Barakou<sup>1</sup>, Paul Wright<sup>1</sup>, Helko van den Brom<sup>2</sup>, Gertjan Kok<sup>2</sup>, Gert Rietveld<sup>2</sup>  
<sup>1</sup>National Physical Laboratory, United Kingdom; <sup>2</sup>VSL, The Netherlands

S\_Tu\_C\_4 Oral Special Session

16:00 - 17:00

## EMC Diagnostics of Complex Systems (II)

Session Vladimir Mordachev

Chairs Eugene Sinkevich

Room 4

### Experimental Validation of Applicability of Low-Level Test Methods to Assess the Effectiveness of Shielding from High-Power Electromagnetic Fields

Vladimir Mordachev<sup>1</sup>, Eugene Sinkevich<sup>1</sup>, Dzmitry Tsyankenka<sup>1</sup>, Oleg Mikheev<sup>2</sup>, Konstantin Sakharov<sup>2</sup>, Alexander Sukhov<sup>2</sup>, Vladimir Turkin<sup>2</sup>, Wen-Qing Guo<sup>3</sup>, Xie Ma<sup>3</sup>, Hao-Yue Zheng<sup>3</sup>

<sup>1</sup>Belarusian State University of Informatics and Radioelectronics, Belarus; <sup>2</sup>All-Russian Scientific Research Institute for Optical and Physical Measurements (VNIIOFI); <sup>3</sup>China Electronics Technology Cyber Security Co., Ltd.

### Worst-case model of bonding strap effectiveness for equipment case irradiated by an electromagnetic field

Yauheni Arlou, Tsyankenka Dzmitry

Belarusian State University of Informatics and Radioelectronics, Belarus

### The effect of low-grade repeaters on DCS1800 base station receivers in the frequency band 1710-1785 MHz

Vadym Blagodarnyi, Volodymyr Korsun

State Enterprise Ukrainian State Centre of Radio Frequencies, Ukraine

Poster I Poster Session

12:40 - 14:00

## Poster Session (I)

Session Chair Pierre Degauque

**Poster Area**

### Time-domain just-before-test verification method to detect failures and ensure the measurement accuracy for conducted emissions and immunity tests

Marc Pous<sup>1</sup>, Marco Azpúrua<sup>1</sup>, Soydan Çakir<sup>2</sup>, Osman Şen<sup>2</sup>, Ferran Silva<sup>1</sup>

<sup>1</sup>Universitat Politècnica de Catalunya, Spain; <sup>2</sup>TUBITAK UME, Turkey

### Impact of Tower Arrangement on the Mitigation of the Electric Field Intensity on the High-Voltage Conductors

Adnan Carsimamovic<sup>1</sup>, Adnan Mujezinovic<sup>2</sup>, Zijad Bajramovic<sup>2</sup>, Irfan Turkovic<sup>2</sup>, Nedis Dautbasic<sup>2</sup>, Milodrag Kosarac<sup>1</sup>

<sup>1</sup>Independent System Operator in Bosnia and Herzegovina, Bosnia and Herzegovina;

<sup>2</sup>University of Sarajevo, Faculty of Electrical Engineering

### Estimation of Electromagnetic Background Intensity Created by Wireless Systems in Terms of the Prediction of Area Traffic Capacity

Vladimir Mordachev

Belarusian State University of Informatics and Radioelectronics, Belarus

### Analysis of different Sleeve Ferrite Cores Performance according to their Dimensions

Adrian Suarez<sup>1</sup>, Jorge Victoria<sup>1,2</sup>, Pedro A. Martinez<sup>1</sup>, Antonio Alcarria<sup>2</sup>, Jose Torres<sup>1</sup>, Ismael Molina<sup>2</sup>

<sup>1</sup>Department of Electronic Engineering, University of Valencia, Spain; <sup>2</sup>Würth Elektronik eiSos GmbH & Co. KG, Germany

### Wavelet Based Detection of Signal Disturbances in Cab Signalling System

Volodymyr Havryliuk

Dnipropetrovsk National University of Railway Transport named after Academician V. Lazaryan, Dnipro, Ukraine

### Difference Between the Method of Moments and the Finite Element Method for Estimation of Complex Permittivity in Liquids Using a Coaxial Probe

Kouji Shibata, Masaki Kobayashi

Hachinohe Institute of Technology, Japan

### Fade analysis in DAB+ SFN network in Wrocław

Ryszard J. Zielinski

Wrocław University of Science and Technology, Poland

### Theoretical and experimental study on electromagnetic induction from power line against multi-point grounded conductors

Atsushi Nagao, Norihito Hirasawa, Hidenori Ito, Ryuichi Kobayashi

NTT EAST Corp, Japan

### Analysis of Radiated EMI in single switch ZVS applied to induction cooking

Juan Mon González<sup>1</sup>, Manuel Lamich Arocas<sup>1</sup>, Carlos Bernal Ruiz<sup>2</sup>

<sup>1</sup>Universitat Politècnica de Catalunya, Spain; <sup>2</sup>Universidad de Zaragoza, Spain

## Why Frequency Domain Tests Like IEC-61000-4-19 Are Not Valid; a Call for Time Domain Testing

Bas ten Have<sup>1</sup>, Tom Hartman<sup>1</sup>, Niek Moonen<sup>1</sup>, Frank Leferink<sup>1,2</sup>

<sup>1</sup>University of Twente, Netherlands, The; <sup>2</sup>THALES Nederland B.V., Netherlands, The

## An integrated solution for electromagnetic perturbation computing of railway track with real traffic conditions and applications

Noël HADDAD, Tarik HAMMI, Michel CUCCHIARO

SNCF, France

## Global Optimization Techniques for Optimal Placement of HF Antennas on a Shipboard

Mustafa Ural<sup>1</sup>, Can Bayseferogullari<sup>2</sup>

<sup>1</sup>ASELSAN Inc. Turkey, Turkey; <sup>2</sup>ASELSAN Inc. Turkey, Turkey

## Autonomous electromagnetic mapping system in augmented reality

RIOULT Jean<sup>1</sup>, DEGRANDE Samuel<sup>2</sup>, BREMARD Nicolas<sup>2</sup>, COPIN Gregoire<sup>3</sup>, DENIAU Virginie<sup>1</sup>

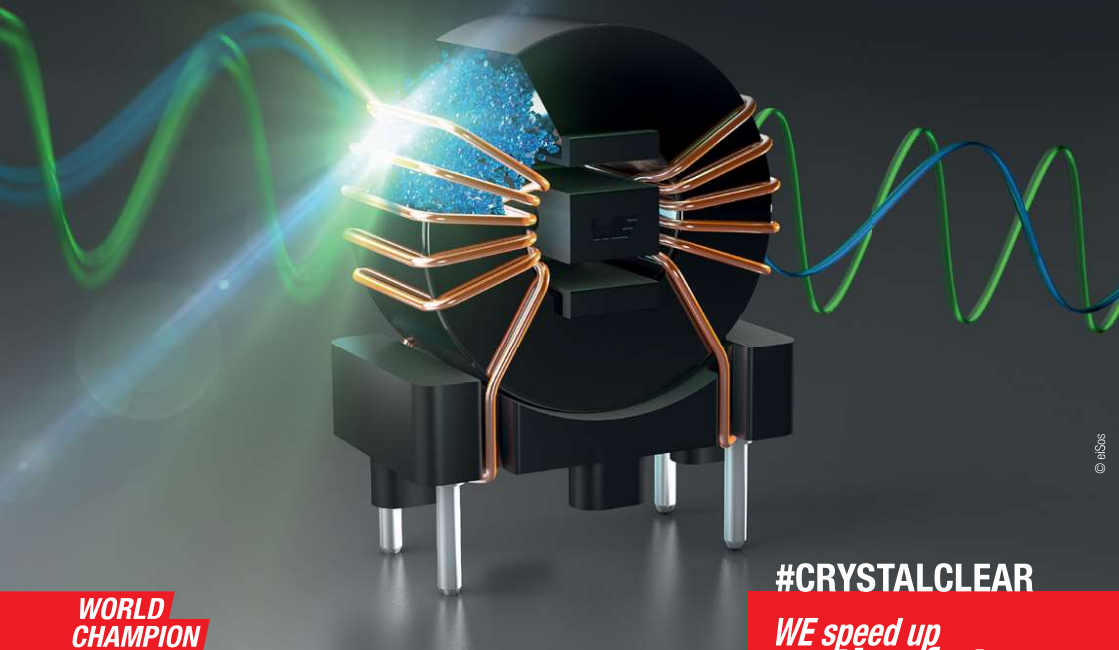
<sup>1</sup>IFSTTAR, France; <sup>2</sup>IRCICA/CRISAL; <sup>3</sup>LUXONDES

## An Effective Approach to Mitigate IC Radiated Susceptibility in EM Far-Field Region

Mohsen Koohestani, Richard Perdriau, Mohamed Ramdani

ESEO-IETR, RF-EMC Research Group, France

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Wednesday

WEDNESDAY, SEPT. 4				
ROOM 1	ROOM 2	ROOM 3	ROOM 4	ROOM 5
8:00 9:00 10:40	Aeronautics	Power Electronics I	Electromagnetic Eavesdropping TEMPEST	New materials for EMC
	coffee break			
	Statistics on EMC	Power Electronics II	Standards & Regulations	Transmission lines
	lunch			
11:20 12:40	Electromagnetic Environmental Effects on Aircrafts	Near-Field techniques I	Metrology on EMC I	Shielding & grounding I
	coffee break			
	Magnetometric Instruments and New Methodologies of Calibration and Testing for Space Magnetism	Near-Field techniques II	Metrology on EMC II	Shielding & grounding II
	Registration			
14:00 15:20	Challenges in Special Applications of Electrically Small, HF Vehicular Antennas I	Challenges in Special Applications of Electrically Small, HF Vehicular Antennas II	Challenges in Special Applications of Electrically Small, HF Vehicular Antennas III	Challenges in Special Applications of Electrically Small, HF Vehicular Antennas IV
	POSTER II (POSTER'S AREA)			
	Challenges in Special Applications of Electrically Small, HF Vehicular Antennas I	Challenges in Special Applications of Electrically Small, HF Vehicular Antennas II	Challenges in Special Applications of Electrically Small, HF Vehicular Antennas III	Challenges in Special Applications of Electrically Small, HF Vehicular Antennas IV
	Registration			
16:00 17:00	Challenges in Special Applications of Electrically Small, HF Vehicular Antennas I	Challenges in Special Applications of Electrically Small, HF Vehicular Antennas II	Challenges in Special Applications of Electrically Small, HF Vehicular Antennas III	Challenges in Special Applications of Electrically Small, HF Vehicular Antennas IV
	POSTER II (POSTER'S AREA)			
	Challenges in Special Applications of Electrically Small, HF Vehicular Antennas I	Challenges in Special Applications of Electrically Small, HF Vehicular Antennas II	Challenges in Special Applications of Electrically Small, HF Vehicular Antennas III	Challenges in Special Applications of Electrically Small, HF Vehicular Antennas IV
	Registration			

Sessions

Posters

Workshops

Special Sessions

O\_We\_A\_1: Oral Session

9:00 - 10:40

## Aeronautics

Session Chair Salvador Gonzalez Garcia

Room 1

### 3D Visualization of Numerically Calculated Bearing Error Texture in Disturbed DVOR Scenarios

Sergei Sandmann, Heyno Garbe

Institute of Electrical Engineering and Measurement Technology, Germany

### Fastener Lightning Current Assessment in Aircraft Fuel Tank

Paul Monferran<sup>1</sup>, Christophe Guiffaut<sup>1</sup>, Alain Reineix<sup>1</sup>, Fabian Fustin<sup>2</sup>, Fabrice Tristant<sup>2</sup>

<sup>1</sup>XLIM laboratory, Limoges, France; <sup>2</sup>Dassault Aviation Company, Saint-Cloud, France

### Characterization at High Frequencies of Planar Transformers for Aeronautical Converters

Carlos Dominguez-Palacios, Joaquin Bernal, Mariangeles Martín-Prats

University of Seville, Spain

### Imaging electric and magnetic near field of radiating structures by infrared thermography

Daniel Prost<sup>1</sup>, François Issac<sup>1</sup>, Maxime Romier<sup>2</sup>

<sup>1</sup>ONERA, France; <sup>2</sup>CNES, France

### A Numerical Analysis of HIRF- and DCI-Equivalence by Characteristic Mode Theory

Jan Ückerseifer<sup>1</sup>, Martin Aidam<sup>2</sup>, Markus Rothenhäusler<sup>3</sup>, Frank Gronwald<sup>1</sup>

<sup>1</sup>University of Siegen, Germany; <sup>2</sup>Daimler AG, Germany; <sup>3</sup>Airbus Defence and Space, Germany

O\_We\_A\_2: Oral Session

9:00 - 10:40

## Power Electronics (I)

Session Chair Anne Roc'h

Room 2

### Influence of gate drive circuit for power device on EMI noise characteristics in a phase-leg topology

Takaaki Ibuchi, Tsuyoshi Funaki

Osaka University, Japan

### EMC Focused Half-Bridge Characterization and Modeling

Julian Dobusch, Philipp Konarski, Daniel Kuebrich, Thomas Duerbaum

Friedrich-Alexander University of Erlangen-Nürnberg, Germany

## Modeling and Analysis of Near-Field Radiated Emission in Wide Bandgap Power Modules

Asif Imran Emon, Balaji Narayanasamy, Tristan Mark Evans, Fang Luo, H. Alan Mantooth

University of Arkansas, United States of America

## Determining crucial sources of conducted interference in power electronics from heat sink capacitive coupling

Stephan Fink, Klaus F. Hoffmann, Stefan Dickmann

Helmut Schmidt University Hamburg, Germany

## Synthesis of an Optimized Control Signal for an Improved EMC Switching Behavior of MOSFETs Using a System Characterization Approach

Caroline Krause, Andreas Bendicks, Tobias Dörlemann, Stephan Frei

TU Dortmund University, Germany

S\_We\_A\_3: Oral Special Session

9:00 - 10:40

## Electromagnetic Eavesdropping TEMPEST

Session Chair Ireneusz Kubiak

**Room 3**

### ("Oops! Had the silly thing in reverse")—Optical injection attacks in through LED status indicators

Joe Loughry

University of Denver, United States of America

### A study on a Effective Evaluation Method for EM Information Leakage without Reconstructing Screen

Ryota Birukawa<sup>1</sup>, Yu-ichi Hayashi<sup>2</sup>, Takaaki Mizuki<sup>3</sup>, Hideaki Sone<sup>3</sup>

<sup>1</sup>Graduate School of Information Sciences, Tohoku University, Japan; <sup>2</sup>Graduate School of Science and Technology, Nara Institute of Science and Technology, Japan; <sup>3</sup>Cyberscience Center, Tohoku University, Japan

### DVI (HDMI) and DisplayPort digital video interfaces in electromagnetic eavesdropping process

Ireneusz Kubiak, Artur Przybyś

Military Communication Institute, Poland

### Effect evaluation of countermeasure method for image information leakage by electromagnetic radiation from ITE

Kimihiro Tajima, Yasunao Suzuki

NTT Advanced Technology Corporation, Japan

### Impact of Intentional Electromagnetic Interference on Pure Combinational Logic

Qualid Trabelsi, Laurent Sauvage, Jean-Luc Danger

Télécom ParisTech, France



O\_We\_A\_4: Oral Session

9:00 - 10:40

## New materials for EMC

Session Chair Maria Sabrina Sarto

**Room 4**

### Experimental Demonstration of Antenna Isolation Improvement using Planar Resonant Absorbers

**Sofian Hamid<sup>1</sup>, Dirk Heberling<sup>1,2</sup>**

<sup>1</sup>RWTH Aachen, Germany; <sup>2</sup>Fraunhofer Institute for High Frequency Physics and Radar Techniques (FHR)

### Lightning Direct Effect and Electromagnetic Shielding Analysis of Conductive Aircraft Composite

**Richard Xian-Ke Gao<sup>1</sup>, Hui Min Lee<sup>1</sup>, Zaifeng Yang<sup>1</sup>, Warintorn Thitsartarn<sup>2</sup>, Si-Ping Gao<sup>3</sup>, En-Xiao Liu<sup>1</sup>**

<sup>1</sup>Institute of High Performance Computing, Singapore; <sup>2</sup>Institute of Materials Research and Engineering, Singapore; <sup>3</sup>National University of Singapore, Singapore

### Transparent Graphene-Based Absorber for Next Generation Wireless 5G Technology

**Alessandro Giuseppe D'Aloia<sup>1,2</sup>, Marcello D'Amore<sup>1,2</sup>, Maria Sabrina Sarto<sup>1,2</sup>**

<sup>1</sup>IDIAEE - Sapienza University of Rome; <sup>2</sup>Research Center for Nanotechnology applied to Engineering of Sapienza University

### An Angularly Stable Frequency Selective Surface with Vent Holes for 5G Electromagnetic Shielding

**Liping Yan<sup>1</sup>, Liuliu Xu<sup>1</sup>, Xiang Zhao<sup>1</sup>, Richard Xian-Ke Gao<sup>2</sup>**

<sup>1</sup>Sichuan University, China, People's Republic of; <sup>2</sup>Institute of High Performance Computing, A\* Star, Singapore

### Challenges of RF Absorber Characterization: Comparison Between RCS- and NRL-Arch-Methods

**Willi Hofmann, Christian Bornkessel, Andreas Schwind, Matthias A. Hein**

Technische Universität Ilmenau, Germany

W\_We\_A\_5: Workshop

9:00 - 17:00

## Challenges in Special Applications of Electrically Small, HF Vehicular Antennas

Session Chairs  
Diethard E.A. Hansen  
Ilona Danelyan

**Room 5**

**Abstract** - Vehicular, mobile HF (short wave 1.5/3 to 30 MHz, 200/100 to 10m) communication is up today still in beneficial use. Due to ionospheric propagation conditions, under presently low sunspot activities, only the lower spectrum part can mostly be used. Exactly this is a technical challenge, because here electrically short, vertical HF mobile antennas are known to be

inefficient. There is however very little practical, experimental or simulation data available in the open literature. Aside from the military, emergency disaster relief organizations (humanitarian, medical, technical aid) depend on HF mobile on the go. In troubled areas communication infrastructure is mostly gone. Improvised, quick, reliable, and still cost-effective deployment is vital. Sat-Com or 3 or 4G mobile phones are often no option. Our detailed experimental and EM-simulation investigations include Automotive EMC, analysis of electrically short HF Antennas, critical communications S/N-ratio, antenna performance impacting parameter studies, rubber tire impact, antenna input impedance, radiation pattern, the impact of soil/ground under the automobile, far-field simulations with absolute antenna efficiency, incl. vertical elevation angle. Validation measurements (groundwave, sky-wave) were performed in the critical low bands of shortwave spectrum around 1.8/3.5/7MHz and above. These representative bands were used base on existing government Amateur Radio transmitting licenses. Antenna efficiency tests by ground-wave propagation were conducted over 2.8 km flat farmland. Sky-wave antenna efficiency test lead to estimates, via statistics, from extended, real world, EU Ionospheric Propagation experiments. The only successful way to address antenna elevation patterns, without having H-field sensing drones available, was to use validated, professional EM-Simulation Codes. Agreement between tests and simulation results are very reasonable, given the many impacting parameters. Innovative antenna design concepts will be discussed.

## Agenda:

- Motivation, background, open literature, state of the art, interested users
- Basic technical challenges: Emergency Communication needs in remote disaster areas, Automotive EMC, electrically short HF Antennas, critical communications SNR on short wave low bands
- Test cars: Mainly Audi A6 Avant, similar in most results to the BMW 316i Touring
- R&D Antenna design and choice of tested frequency bands were based on an existing government transmission license as HAM radio operator. This allowed in principle use of HF spectrum bands from 1.8 to 29.7 MHz
- Antenna problem analysis by equivalent circuit/simulation model (car chassis, tires, short monopole, soil/ground)
- Efficiency impacting parameter studies (measured/simulated): Tire capacitance impact, Antenna Input Impedance, VSWR (S11), e.g. on 80m (ca. 3.5MHz, R&D Test Antenna, capacitive head, 1.88m long, vertical radiator, large XL resonance coil)
- Far Field Ant. Radiation Pattern (azimuth, elevation) impact for different soil/ground characteristic under the automobile, incl. simulated ant. efficiency
- Ant. efficiency-tests by a ground wave over 2.8 km flat farmland, efficiency estimates by statistics from extended EU Ionospheric Propagation experiments. Experimental dB (or %) efficiency => ranking of el. short HF mobile antennas for both R&D, as well as commercial, tested types.
- Skywave test: Comparing HF mobile to a fixed reference dipole type antenna with a simulated radiation pattern
- What makes a better radiator? Experiment / Simulation Comparison of two 80m R&D
- Antennas over PEC ground (efficiency, elevation angle)

- Discussion of assumptions/limits in the experiments and how well they fit simulations
- Outlook: Now we understand the underlying physics. Discussion of ideas to improve antenna principles by innovative procedures and design

O\_We\_B\_1: Oral Session

11:20 - 12:40

## Statistics on EMC

Session Chair John Dawson

Room 1

### Combining Kriging and Controlled Stratification to Identify Extreme Levels of Electromagnetic Interference

Thomas HOURET<sup>1,2</sup>, Philippe BESNIER<sup>1</sup>, Stéphane VAUCHAMP<sup>2</sup>, Philippe Pouliquen<sup>3</sup>

<sup>1</sup>INSA Rennes,CNRS,IETR, France; <sup>2</sup>CEA DAM, Gramat, France; <sup>3</sup>DGA, Paris, France

### Statistical Analysis of MIL-STD-461 Emission Test Reports of Commercial Off-The-Shelf Products

Janne Petteri Pulkkinen

Finnish Defence Forces, Finland

### Sensitivity Analysis of Microstrip Line Parameters on Total Radiated Power Through Surrogate Modelling

Florent DELAPORTE<sup>1,2</sup>, Philippe BESNIER<sup>1</sup>, Béatrice AZANOWSKY<sup>2</sup>

<sup>1</sup>IETR CNRS, France; <sup>2</sup>Thales, France

### Stochastic Analysis of Multi-Twisted Bundle of Twisted-Wire Pairs (MTB-TWP) Above Ground Plane With Random Non-uniform Twisting

Oussama Gassab<sup>1</sup>, Liang Zhou<sup>1</sup>, Wen-Yan Yin<sup>1,2</sup>

<sup>1</sup>Key Lab of Ministry of Education for the Design and EMC of High-Speed Electronic Systems, Shanghai Jiao Tong University, Shanghai 200240, China, China, People's Republic of; <sup>2</sup>Information Science and Electronic Engineering, Zhejiang University, Hangzhou 310058, China

O\_We\_B\_2: Oral Session

11:20 - 12:40

## Power Electronics (II)

Session Chair Joaquin Bernal Mendez

Room 2

### Battery Management System Demonstrator Board design using EMC System simulation

Adrien Doridant, Kamel Abouda, Philippe Givelin, Barbara Thibaud  
NXP Semiconductors, France

### Development and Characterization of a Simple Multi-Cell, Multi-Module Battery Assembly for Experimental Validation of Electromagnetic Models

Yu Xian Teo, Jiaqi Chen, Alastair R. Ruddle  
HORIBA MIRA Ltd, United Kingdom

## Predicting the RF Impedance of Cells in Parallel for Automotive Traction Battery Applications

Yu Xian Teo, Jiaqi Chen, Alastair R. Ruddle

HORIBA MIRA Ltd, United Kingdom

## Improved EMC filter performance of ferrite cores based on hysteresis and saturation

Bernhard Wunsch<sup>1</sup>, Skibin Stanislav<sup>1</sup>, Thomas Christen<sup>1</sup>, Ville Forsstrom<sup>2</sup>

<sup>1</sup>ABB Corporate Research, Switzerland; <sup>2</sup>ABB Oy Drives, Helsinki, Finland

O\_We\_B\_3: Oral Session

11:20 - 12:40

### Standards & Regulations

Session Chair Luis Nuño

Room 3

## Far Field Region of Radiated Emissions from Wind Energy Conversion Systems

Sven Fisahn<sup>1</sup>, Hoang Duc Pham<sup>1</sup>, Sebastian Koj<sup>2</sup>, Sergei Sandmann<sup>1</sup>, Heyno Garbe<sup>1</sup>

<sup>1</sup>Leibniz Universität Hannover, Germany; <sup>2</sup>IAV GmbH, Gifhorn

## Analysis on the Correlation Between Vehicle RFI and Component EMI Tests Using BCI and RI Methods

Younghun Lee<sup>1</sup>, Keunsu Kim<sup>1</sup>, Jeonggil Heo<sup>1</sup>, Youngduk Park<sup>1</sup>, Ickjae Yoon<sup>2</sup>

<sup>1</sup>Hanonsystems, Korea, Republic of (South Korea); <sup>2</sup>Chungnam National University

## Radiated Disturbance Measurements in SAC and on OATS for Wireless Power Transfer System

Tetsu Shijo, Kenichirou Ogawa, Masatoshi Suzuki, Kazuhiro Inoue, Yasuhiro Kanekiyo, Koji Ogura, Shuichi Obayashi, Masaaki Ishida

Toshiba Corporation, Japan

## Use of the Goal Structuring Notation (GSN) as Generic Notation for an "EMC Assurance Case"

Davy Pissoort, Jeroen Boydens, Johan Catrysse, Theresa Bultinck

KU Leuven, Belgium

O\_We\_B\_4: Oral Session

11:20 - 12:40

### Transmission lines

Session Chair Christos Christopoulos

Room 4

## Reverse engineering of Voltage Limiting Devices in 1500 V DC Railway Lines through transient transmission line modeling

Achraf DSOU<sup>1</sup>, Clement REBOUL

SNCF RESEAU, France

## The Effect of a Bend on the Stochastic-Field Coupling to a Single Wire Transmission Line Over a Conductive Ground Plane

**Johanna Kasper, Ralf Vick**

Otto von Guericke University Magdeburg, Germany

## Time-Frequency analysis for wiring soft faults detection

**Ilhssane Bzikha, Christophe Guiffaut, Alain Reineix**

Xlim laboratory, France

## Multi-Objective Design of Transmission Line Referenced to Meshed Ground Planes by Preference Set-based Design

**Koki Matsuishi, Yoshiki Kayano, Fengchao Xiao, Yoshio Kami**

The University of Electro-Communications, Japan

S\_We\_C\_1: Oral Special Session

14:00 - 15:20

## Electromagnetic Environmental Effects on Aircrafts

Session Chair Manuel Añón Cancela

**Room 1**

### Lightning Low Level vs High Level Direct Current Injection Tests on a Full Scale Aircraft Cockpit

**Fernando Cano<sup>1</sup>, Guadalupe Gutierrez<sup>1</sup>, Raul Molero<sup>1</sup>, Hugo Tavares<sup>2</sup>, Angel Ramirez<sup>3</sup>**

<sup>1</sup>Airbus, Spain; <sup>2</sup>ISQ, Portugal; <sup>3</sup>LCOE, Spain

### Lightning Strike Protection of Radomes

**Christian Karch<sup>2</sup>, Christian Paul<sup>1</sup>, Fridolin H. Heidler<sup>1</sup>**

<sup>1</sup>University of the Federal Armed Forces Munich, Germany; <sup>2</sup>Airbus Defence and Space GmbH, Manching, Germany

### A refresh on HIRF Equipment susceptibility above 8GHz

**Frédéric THEROND<sup>1</sup>, Didier DE-MATA<sup>2</sup>, Marc MEYER<sup>3</sup>, Marc PONCON<sup>3</sup>, Fabrice TRISTANT<sup>4</sup>, Eric LACAM<sup>5</sup>, Franck FLOURENS<sup>1</sup>, Alain SAUVAGE<sup>1</sup>**

<sup>1</sup>Airbus Operations SAS, France; <sup>2</sup>Liebherr-Aerospace Toulouse SAS, France;

<sup>3</sup>Airbus Helicopters SAS, France; <sup>4</sup>Dassault Aviation, France; <sup>5</sup>DGA-Aeronautical Systems, France

### Limitations in the Measurement of the Shielding Effectiveness of Aeronautical Multi-ply CFC Laminates

**PATRICIA GÓMEZ<sup>1</sup>, DAVID ESCOT<sup>1</sup>, BORJA PLAZA<sup>2</sup>, SERGIO FERNÁNDEZ<sup>1</sup>, DAVID POYATOS<sup>1</sup>**

<sup>1</sup>INTA, Spain; <sup>2</sup>ISDEFE, Spain

O\_We\_C\_2: Oral Session

14:00 - 15:20

## Near-Field techniques (I)

Session Chair David Thomas

Room 2

### Cyclostationary Characterization of the Interference Induced by Crosstalk Between Transmission Lines

Yury Kuznetsov<sup>1</sup>, Andrey Baev<sup>1</sup>, Anastasia Gorbunova<sup>1</sup>, Maxim Konovalyuk<sup>1</sup>, Johannes A. Russer<sup>2</sup>, Michael Haider<sup>2</sup>, Peter Russer<sup>2</sup>

<sup>1</sup>Moscow Aviation Institute (National Research University), Russian Federation; <sup>2</sup>Technische Universität München, Germany

### A Rigorous Method to extrapolate Radiated Susceptibility from Near-Field Scan Immunity

Alexandre Boyer

LAAS-CNRS, France

### Far-field Cyclostationary Characterization of Emissions from DUT Based on the Jefimenko's Equations

Andrey Baev<sup>1</sup>, Yury Kuznetsov<sup>1</sup>, Anastasia Gorbunova<sup>1</sup>, Maxim Konovalyuk<sup>1</sup>, Johannes A. Russer<sup>2</sup>, Michael Haider<sup>2</sup>, Peter Russer<sup>2</sup>

<sup>1</sup>Moscow Aviation Institute (National Research University), Russian Federation; <sup>2</sup>Technische Universität München, Germany

### Introduction of a nearfield component level test and application to an automotive communication system

Emanuel Panholzer<sup>1,2</sup>, Martin Aidam<sup>1</sup>, Walter Franz<sup>1</sup>, Simon Senega<sup>2</sup>, Stefan Lindenmeier<sup>2</sup>

<sup>1</sup>Dep. of EMC and Antennas, Daimler AG, Sindelfingen, Germany; <sup>2</sup>Institute of High Frequency Technology, University of Bundeswehr Munich, Germany

O\_We\_C\_3: Oral Session

14:00 - 15:20

## Metrology on EMC (I)

Session Chair Frederic Pythoud

Room 3

### The Consequences of Missing Specification for Coupling-Decoupling Networks

Emrah Tas<sup>1</sup>, Frédéric Pythoud<sup>1</sup>, Dongsheng Zhao<sup>2</sup>

<sup>1</sup>Swiss Federal Institute of Metrology METAS, Switzerland; <sup>2</sup>RHEA System B.V. for ESA, The Netherlands

### A Testbed for Static Electricity Meter Testing with Conducted EMI

Helko E. van den Brom, Zander Marais, Dennis Hoogenboom, Ronald van Leeuwen, Gert Rietveld

VSL, Dutch Metrology Institute, The Netherlands

## Low reflection and TEM mode preserving coaxial/non-coaxial adapting fixture

Wiktor Łodyga, Bartosz Chaber, Jan Sroka  
Warsaw University of Technology, Poland

## Waveform Characterization of Calibration-Pulse Generators for EMI Measuring Receivers

Marco A. Azpurua<sup>1</sup>, Marc Pous<sup>1</sup>, Ferran Silva<sup>1</sup>, Martin Hudlíčka<sup>2</sup>

<sup>1</sup>Universitat Politècnica de Catalunya; <sup>2</sup>Czech Metrology Institute

O\_We\_C\_4: Oral Session

14:00 - 15:20

### Shielding & Grounding (I)

Session Chair Andy Marvin

**Room 4**

## Two Sided Earthing Versus one Sided Earthing for Ethernet Cables

Wei Wang<sup>1,2,3</sup>, Tom Hartman<sup>1</sup>, Cees Keyer<sup>1,2</sup>, Jan-Kees van der Ven<sup>3</sup>

<sup>1</sup>University of Twente, Enschede, the Netherlands; <sup>2</sup>Amsterdam University of Applied Sciences, Amsterdam, the Netherlands; <sup>3</sup>Imtech Marine, Rotterdam, the Netherlands

## Random source coupling to shielded cable

HEMZA GHEDDAR, Mohamed Melit, Bchir NEKHOUL, flavio canavero  
Jijel university, Algeria

## SNR Kron-Branin Model of Braided Shielded Coaxial Cable under Burst Striking

Christel Cholachue<sup>1,2</sup>, Blaise Ravelo<sup>2</sup>

<sup>1</sup>Federal-Mogul Systems Protection SAS, France; <sup>2</sup>Normandy University UNIROUEN ESIGELEC, IRSEEM EA4353

## Screening effectiveness of unscreened balanced pairs

Bernhard Mund<sup>1</sup>, Thomas Hähner<sup>2</sup>, Thomas Schmid<sup>3</sup>

<sup>1</sup>bda connectivity GmbH, Germany; <sup>2</sup>Nexans France, France; <sup>3</sup>Rosenberger HF-Technik, Germany

S\_We\_D\_1: Oral Special Session

16:00 - 17:00

## **Magnetometric Instruments and New Methodologies of Calibration and Testing**

Session Chair Marina Díaz Michelena

**Room 1**

### **Design of a planetary protection cover for EMC testing of a spacial magnetic sensor**

**Sergio Fernández Romero<sup>1</sup>, María Concepción Parrondo Sempere<sup>1</sup>, Marina Díaz Michelena<sup>1</sup>, Ignacio Muñoz Rebate<sup>2</sup>, Marina León Calero<sup>2</sup>, Santiago Martín Iglesias<sup>2</sup>, Borja Plaza Gallardo<sup>3</sup>, David Escot Bocanegra<sup>3</sup>, David Poyatos Martínez<sup>3</sup>, María Jiménez Lorenzo<sup>4</sup>, Daniel López Sanz<sup>4</sup>**

<sup>1</sup>Payloads and Space Sciences Department, INTA, Spain; <sup>2</sup>Space Advanced Prototyping Laboratory, INTA, Spain; <sup>3</sup>Radiofrequency Area, INTA, Spain;

<sup>4</sup>Electromagnetic Compatibility Area, INTA, Spain

### **New magnetometric devices for planetary exploration**

**Jose Luis Mesa Uña<sup>1</sup>, Marina Pérez Jiménez<sup>2</sup>, Amanda Arlensiú Ordóñez Cencerrado<sup>1</sup>, Cristina Lavín García<sup>3</sup>, Reinel Marante<sup>3</sup>, Laura González Pérez<sup>3</sup>, Claudio Aroca Hernández-Ros<sup>2</sup>, Marina Díaz Michelena<sup>1</sup>**

<sup>1</sup>INTA, Spain; <sup>2</sup>GDM-ISOM, Universidad Politécnica de Madrid, Madrid, Spain.; <sup>3</sup>TTI, Santander, Spain.

### **New techniques of magnetic cleanliness for present and near future missions**

**Marina Diaz Michelena<sup>1</sup>, Amanda Arlensiú Ordóñez Cencerrado<sup>1</sup>, Javier de Frutos Hernansanz<sup>1</sup>, Miguel Ángel Rivero Rodríguez<sup>2</sup>**

<sup>1</sup>Payloads and Space Sciences Dept. INTA, Spain; <sup>2</sup>ISDEFE Consultant at Payloads and Space Sciences Dept. INTA, Spain

O\_We\_D\_2: Oral Session

16:00 - 17:00

## **Near-Field techniques (II)**

Session Chair Valter Mariani Primiani

**Room 2**

### **Reconstruction of Current Distribution on a Given Conductor Structure Using Frequency Domain Near-Field Data without Phase Information**

**Robert Jan Nowak, Stephan Frei**

TU Dortmund University, Germany

### **Different Test Site Analysis of Radiated Field Measurements of a Complex EUT**

**Dwi Mandaris<sup>1,2</sup>, Robert Vogt-Ardatjew<sup>1</sup>, Mohd Hafiz Baharuddin<sup>5,6</sup>, Zbigniew Jóskiewicz<sup>3</sup>, Monika Ewelina Szafranska<sup>3</sup>, Eugen Coca<sup>4</sup>, David Thomas<sup>5</sup>, Frank Leferink<sup>1,7</sup>**

<sup>1</sup>University of Twente, Enschede - The Netherlands; <sup>2</sup>Research Center for Quality System and Testing Technology, LIPI, Serpong - Indonesia; <sup>3</sup>Wrocław University of Science and Technology, Wrocław - Poland; <sup>4</sup>Stefan cel Mare University of



Suceava, Suceava - Romania; <sup>5</sup>University of Nottingham, Nottingham - U.K.;  
<sup>6</sup>Center of Advanced Electronic and Communication Engineering, Universiti  
Kebangsaan Malaysia - Malaysia; <sup>7</sup>Thales Netherlands, B.V, Hengelo - The  
Netherlands

### Sequential adaptive sampling algorithm to reduce the near field measurement time

**Sebastien Serpaud<sup>1,2</sup>, Alexandre Boyer<sup>2</sup>, Sonia Ben Dhia<sup>2</sup>**

<sup>1</sup>IRT Saint Exupéry, France; <sup>2</sup>CNRS, LAAS, Univ. de Toulouse, INSA

O\_We\_D\_3: Oral Session

16:00 - 17:00

### Metrology on EMC (II)

Session Chair Zbigniew Jóskiewicz

**Room 3**

#### A reference test setup to support research and development of HPEM testing schemes

**Thorsten Pusch<sup>1</sup>, Martin Willenbockel<sup>2</sup>, Tomas Hurtig<sup>3</sup>, Michael Suhrke<sup>1</sup>, Sven Ruge<sup>1</sup>, Michael Jöster<sup>4</sup>, Benjamin Jörres<sup>1</sup>**

<sup>1</sup>Fraunhofer INT, Germany; <sup>2</sup>Bundeswehr Research Institute for Protective Technologies and NBC-Protection; <sup>3</sup>FOI - Swedish Defence Research Agency; <sup>4</sup>Private

#### Influence of Power Line Termination Device Placed on Ground Plane to NSA Measurement

**Shinichi Okuyama<sup>1</sup>, Nobuo Kuwabara<sup>2</sup>, Hidenori Muramatsu<sup>3</sup>**

<sup>1</sup>VCCI Council / NEC Platforms, Ltd., Japan; <sup>2</sup>Kyushu Institute of Technology; <sup>3</sup>VCCI Council

#### Influence of Antenna Cabling on Measurement Results below 30 MHz in CISPR 25 Ed. 4 Annex J

**Takanori Uno<sup>1</sup>, Toshiyasu Tanaka<sup>3</sup>, Koji Maeda<sup>2</sup>, Hironori Okamoto<sup>4</sup>, Osami Wada<sup>5</sup>**

<sup>1</sup>DENSO EMC ENGINEERING SERVICE, Japan; <sup>2</sup>Aisin Seiki Co., Ltd.; <sup>3</sup>Microwave Factory Co., Ltd.; <sup>4</sup>Kansai Electronic Industry Development Center; <sup>5</sup>Kyoto University

O\_We\_D\_4: Oral Session

16:00 - 17:00

### Shielding & Grounding (II)

Session Chair Davy Pisssoort

**Room 4**

#### LF Scattering of a cylindrical shield in an alternating magnetic field

**Dick Harberts, Geran Peeren, Mark van Helvoort**

Philips, Netherlands, The

## Influence of Planar Material Size and Position on Shielding Effectiveness Measurements using the Dual Waveguide Method

Evangelia Tourounoglou<sup>1,2</sup>, Vasiliki Gkatsi<sup>1,2</sup>, Anne Roc'h<sup>3</sup>, Robert Vogt-Ardatjew<sup>4</sup>, Hans Schipper<sup>1</sup>, Frank Leferink<sup>1,4</sup>

<sup>1</sup>Thales Nederland B.V., Netherlands, The; <sup>2</sup>Aristotle University of Thessaloniki, Greece; <sup>3</sup>University of Eindhoven, Netherlands, The; <sup>4</sup>University of Twente, Netherlands, The

## Characterization of the Low Frequency Electric and Magnetic Shielding Effectiveness of On-Board Gaskets in the Stripline Set-up

Yanling Wang<sup>1</sup>, Tim Claeys<sup>2</sup>, Davy Pissoot<sup>2</sup>

<sup>1</sup>Xi'an Microelectronics Technology Institute, China, People's Republic of; <sup>2</sup>KU Leuven Bruges Campus, Spoorwegstraat 12, Bruges, Belgium

Poster II      Poster Session

12:40 - 14:00

### Poster Session (II)

Session Chair      Pieter Gideon Wiid

**Poster Area**

## Experimental Investigation for Enhancement of Timing Margin of Single-ended Parallel Bus By Optimizing Phase Response of Signal Modes

Kyongsun Kim<sup>1,2</sup>, Dohyung Kim<sup>2</sup>, Junhee Han<sup>1</sup>, Jooyeon Lee<sup>1</sup>, Wansoo Nah<sup>1</sup>

<sup>1</sup>Sungkyunkwan University, Korea, Republic of (South Korea); <sup>2</sup>Samsung Electronics. Co., Ltd., Korea, Republic of (South Korea)

## Investigation of Magnetic Permeability of Toroidal Cores

Zviad Kutchadze<sup>1,2</sup>, Anna Gheonjian<sup>1,2</sup>, Roman Jobava<sup>1,2</sup>

<sup>1</sup>EMCoS LLC, Tbilisi, Georgia; <sup>2</sup>Tbilisi State University, Tbilisi, Georgia

## Implementation of laboratory test stand for EMC filter attenuation measurement

Leszek Nowosielski

Military University of Technology, Poland

## Analysis of RF Noise in LDO and Establishment of Noise Immunity

Takahiro Hino<sup>1</sup>, Hirobumi Watanabe<sup>2</sup>

<sup>1</sup>RICOH Electronic Devices Co., Ltd., Japan; <sup>2</sup>RICOH Co., Ltd., Japan

## Current-based EMF-assessment method for vehicles

Benjamin Willmann<sup>1,2</sup>, Hanno Rabe<sup>1</sup>, Christoph Leugers<sup>2</sup>, Oussama Sassi<sup>1</sup>, Christian Waldera<sup>1</sup>, Ralf Vick<sup>2</sup>

<sup>1</sup>VOLKSWAGEN AG, Germany; <sup>2</sup>Otto-von-Guericke University, Magdeburg, Germany

## Identification of Metallic Object in Soil in Order to Detect UXOs

Christian Siebauer, Markus Terres, Heyno Garbe

Leibniz Universität Hannover, Germany

### **Circuit Optimization and Analysis for Compatibility Assessment in Integrated Product Design**

**Félix Gómez Vidal<sup>2</sup>, Peio López Iturri<sup>1</sup>, Ana Belén Resano<sup>1</sup>, Francisco Falcone<sup>2</sup>**

<sup>1</sup>UPNA, Spain; <sup>2</sup>NAITEC

### **Harmonic generator for offsetting the harmonics caused by power electronic inverters**

**Tiejun Wang, M.S.Niroshan Silva, Fengbing Zhang**

Naval University of Engineering, China, People's Republic of

### **Understanding the IoT technology LoRa and its interference vulnerability**

**Kia Wiklundh**

Qamcom Research & Technology, Sweden

### **Low-Frequency Magnetic Shielding Analysis of a Metal Plate Without and With a Slot**

**Hyun Ho Park<sup>1</sup>, Jong Hwa Kwon<sup>2</sup>**

<sup>1</sup>The University of Suwon, Korea, Republic of (South Korea); <sup>2</sup>ETRI, Korea, Republic of (South Korea)

### **CISPR 32 - Conducted emissions test benchmarking using automated FFT & Stepped - based systems**

**John Hernandez, Matthew Owen**

UL VS Ltd, United Kingdom

### **Propagation of Harmonics of Return Traction Current in Rail lines**

**Tetiana Serdiuk<sup>1</sup>, Volodymyr Havryliuk<sup>1</sup>, Mauro Feliziani<sup>2</sup>, Kseniia Serdiuk<sup>1</sup>**

<sup>1</sup>Dnipropetrovsk National University of Railway Transport named after Academician V. Lazaryan; <sup>2</sup>University of L'Aquila

### **Direction Finding Technique Based on Poynting Vector Magnitude for Pantograph Arcing**

**Umberto Paoletti**

Hitachi, Ltd., R&D Group, Japan

### **Modeling of Contact Arcing for Transient Conducted Immunity Test**

**Jia Li<sup>1</sup>, Ahalya Srikanth<sup>1</sup>, Praveen Gurralla<sup>2</sup>, Nitin Parsa<sup>3</sup>, Isao Hoda<sup>4</sup>, Hiroki Funato<sup>4</sup>**

<sup>1</sup>Automotive Products Research Laboratory, Hitachi America, USA; <sup>2</sup>Dept. of Electrical and Computer Engineering, Iowa State University, USA; <sup>3</sup>Dept. of Electrical and Computer Engineering, University of Akron, USA; <sup>4</sup>Yokohama Research Laboratory, Hitachi Ltd., Japan

### **Extending Functionality of the IMEI DataBase: Clone Blocking System**

**Igor Gepko**

Ukrainian State Centre of Radio Frequencies, Ukraine



# **EMCoS Simulation Tools**

## **Simulation Has Never Been so Easy!**

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- Complex Harness Processing

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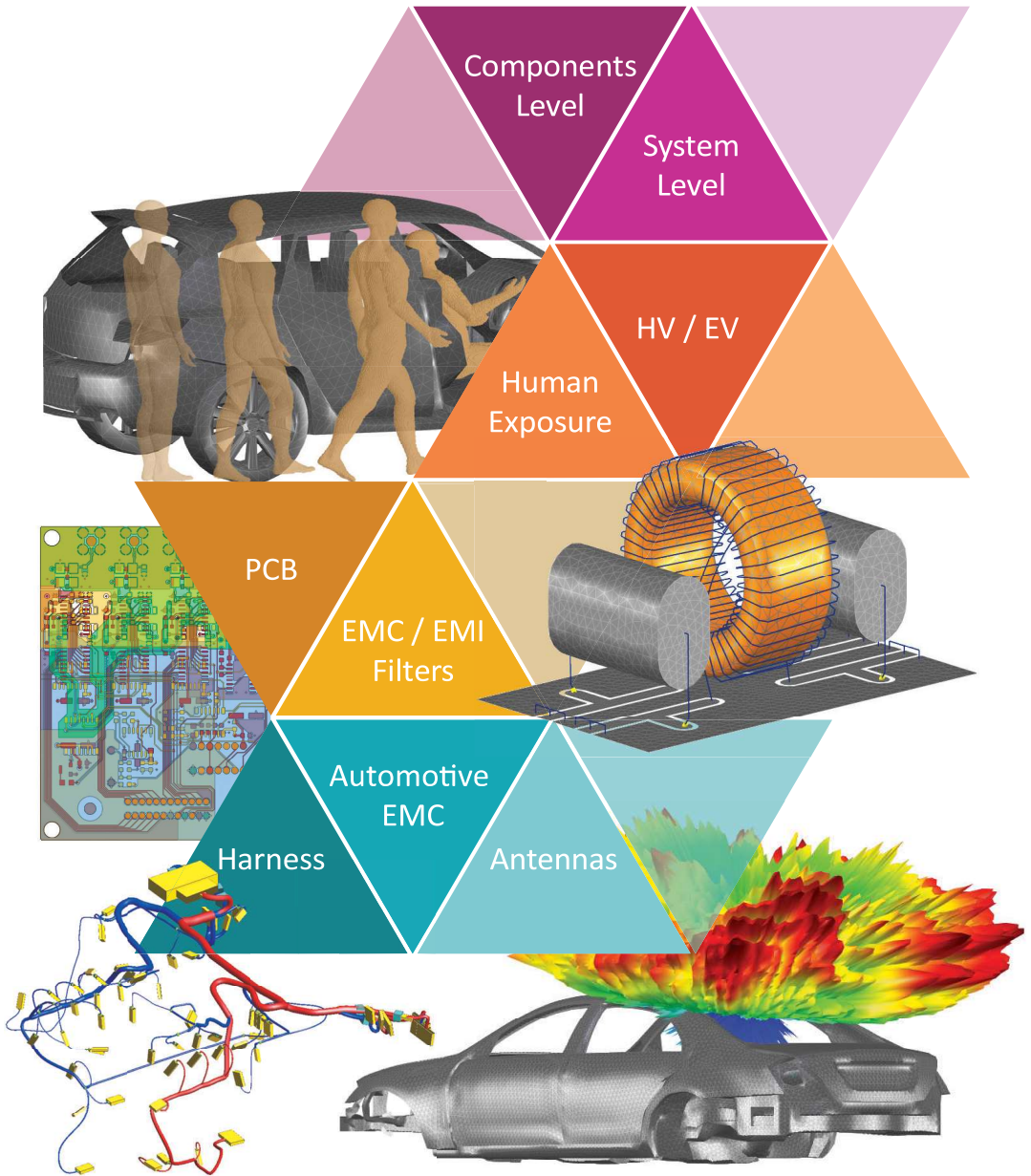
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Thursday

THURSDAY, SEPT. 5				
ROOM 1	ROOM 2	ROOM 3	ROOM 4	ROOM 5
8:00	REGISTRATION			
9:00	Automotive I	Components, Semiconductors and IC I	EMC in Physics Experiments and Particle Accelerators	Numerical Simulation Techniques for EMC Problems I
10:40	coffee break			
11:20	Automotive II	Components, Semiconductors and IC II	Communications I	Numerical Simulation Techniques for EMC Problems II
12:40	lunch			
14:00	Automotive III	Human Exposure & Health Protection I	Communications II	Numerical Simulation Techniques for EMC Problems III
15:20	coffee break			
16:00	Automotive IV	Human Exposure & Health Protection II	Intentional EMI	Education on EMC
17:00	MIL-STD461 Military EMC Tests and Challenges/Pitfalls I			

- Sessions
- Posters
- Workshops
- Special Sessions
- Tutorials

O\_Th\_A\_1: Oral Session

9:00 - 10:40

## Automotive (I)

Session Chair Marco Klingler

Room 1

### OTA Testing method for RED, Coexistence and EM Interference in Vehicle

Oussama Sassi<sup>1</sup>, Naseef Mahmud<sup>2</sup>, Pascal Hervé<sup>3</sup>

<sup>1</sup>Volkswagen AG, Germany; <sup>2</sup>Rohde & Schwarz GmbH & Co. KG; <sup>3</sup>CSA Group Bayern GmbH

### Estimation approach of Packet error rate at wireless communication system in the vehicle

Oussama Sassi<sup>1</sup>, Naseef Mahmud<sup>2</sup>, Pascal Hervé<sup>3</sup>

<sup>1</sup>Volkswagen AG, Germany; <sup>2</sup>Rohde & Schwarz GmbH & Co. KG, Germany; <sup>3</sup>CSA Group Bayern GmbH, Germany

### Designing and Manufacturing of a Worst Case Communication Channel for Automotive Ethernet 100BASE-T1

Ting Sun<sup>1</sup>, Marius Vierheller<sup>2</sup>, Alexander Stieler<sup>1</sup>, Vincent Speckmann<sup>1</sup>, David Bollati<sup>2</sup>, Matthias Hampe<sup>1</sup>

<sup>1</sup>Ostfalia University of Applied Sciences, Germany; <sup>2</sup>C&S group GmbH, Germany

### Impact of WBG-Semiconductors on Automotive Communication Networks

Carina Austermann, Stephan Frei

TU Dortmund University, Germany

### Impact of HV Battery Cables' Emissions on the Signal Integrity of 2-Wire Ethernet Communication in Automotive Application

Sebastian Jeschke, Ali Razavi, Jan Loos, Jörg Bärenfänger

EMC Test NRW GmbH, Germany

O\_Th\_A\_2: Oral Session

9:00 - 10:40

## Components, Semiconductors and IC (I)

Session Chair Mohamed Ramdani

Room 2

### Enabling fast power integrity transient analysis through parameterized small-signal macromodels

Tommaso Bradde, Pedro Toledo, Marco De Stefano, Alessandro Zanco, Stefano Grivet-Talocia, Paolo Crovetto

Politecnico di Torino, Italy

### Electromagnetic Compatibility in Leakage Current of CMOS Integrated Circuits

Zahra Abedi<sup>1</sup>, Sameer Hemmady<sup>1</sup>, Thomas Antonsen<sup>2</sup>, Edi Schamiloglu<sup>1</sup>, Payman Zarkesh-Ha<sup>1</sup>

<sup>1</sup>University of New Mexico, United States of America; <sup>2</sup>University of Maryland, United States of America

## Analysis of Re-radiated RF Harmonic Disturbance Caused by Integrated Circuit Input Pin Nonlinearity

**Marko Magerl<sup>1</sup>, Christian Stockreiter<sup>1</sup>, Adrijan Baric<sup>2</sup>**

<sup>1</sup>ams AG, Austria; <sup>2</sup>University of Zagreb Faculty of Electrical Engineering and Computing, Croatia

## Modifying Noise Source Amplitude Modulation Technique to Estimate Magnitude and Phase of Emissions from Individual Integrated Circuits

**Kengo Iokibe, Shimpei Yoshino, Yusuke Yano, Yoshitaka Toyota**

Okayama University, Japan

## Destructive testing of electronic components based on absorption cross section RC measurements

**Niklas Wellander, Mattias Elfsberg, Hanna Sundberg, Tomas Hurtig**

Swedish Defence Research Agency, Sweden

S\_Th\_A\_3: Oral Special Session

9:00 - 10:40

## EMC in Physics Experiments and Particle Accelerators

Session Chair **Fernando Arteche**

**Room 3**

### EMC issues in RF stations for particle accelerators

**Claudio Rivetta**

Stanford Linear Accelerator Center, United States of America

### Susceptibility characterization of beam pipe radiated noise for the PXD detector in Belle II experiment

**Mateo Iglesias<sup>1</sup>, Philipp Leitl<sup>2</sup>, Felix MÜLLER<sup>2</sup>, Francisco Javier Arcega<sup>3</sup>, Hans-Günther Moser<sup>2</sup>, Christian Kiesling<sup>2</sup>, Alvaro Pradas<sup>1</sup>, Iván Echeverría<sup>1</sup>, Fernando Arteche<sup>1</sup>, Francisco Javier Piedrafita<sup>1</sup>**

<sup>1</sup>ITAINNOVA, Instituto Tecnológico de Aragón; <sup>2</sup>Max Planck Institute for Physics, Munich, Germany; <sup>3</sup>Universidad de Zaragoza, Spain

### E.M.C. concepts applied to the switching mode power converters supplying the superconductive magnets for the CERN LHC accelerator

**Yves Thurel<sup>1</sup>, Frederick Bordry<sup>1</sup>, Alain Charoy<sup>2</sup>**

<sup>1</sup>CERN, Switzerland; <sup>2</sup>AEMC, France

### Electromagnetic pulse in target area at CLPU

**Kwinten Nelissen<sup>4</sup>, Massimo De Marco<sup>1</sup>, Giancarlo Gatti<sup>1</sup>, Valeria Ospina<sup>1,2</sup>, Istrotz Dotr<sup>3</sup>, M Liszi<sup>2</sup>, Christos Kamperidis<sup>4</sup>, Luca Volpe<sup>1,2</sup>**

<sup>1</sup>Centro de laseres pulsados, Villamayor, Spain; <sup>2</sup>Universitá de Salamanca, Salamanca, Spain; <sup>3</sup>Radiofrequency Test Laboratory-Szchenyi Istvn University, Győr, Hungary; <sup>4</sup>ELI-ALPS, Szeged, Hungary

### EMC versus Safety in Physics Research

**Friedrich Szoncsó, Daniel Valuch**

CERN, Switzerland



S\_Th\_A\_4: Oral Special Session

9:00 - 10:40

## Numerical Simulation Techniques for EMC

### Problems (I)

Session Chair Salvador Gonzalez Garcia

Room 4

#### S-EHRFEM - Substrate Extraction using Highly Reduced FEM-meshes for Transient SPICE-simulation with Iterative Linear Solvers

Alexander Schade<sup>1</sup>, Frank Klotz<sup>1</sup>, Stefan Jahn<sup>1</sup>, Robert Weigel<sup>2</sup>

<sup>1</sup>Infiniteon Technologies AG, Germany; <sup>2</sup>Friedrich-Alexander Universität Erlangen-Nürnberg, Germany

#### Transport of power through networks of cables using quantum graph theory

Mubarak Ahmed, Gabriele Gradoni, Stephen Creagh, Chris Smartt, Steve Greedy, Gregor Tanner

University of Nottingham, United Kingdom

#### Stabilized Explicit Isogeometric Analysis (SE-IGA) for Efficient Modeling and Analysis of 2-D Curved Structures

Hayato Naojima<sup>1</sup>, Tadatoshi Sekine<sup>2</sup>

<sup>1</sup>Graduate School of Integrated Science and Technology, Shizuoka University, Japan; <sup>2</sup>Shizuoka University

#### Analysis of induced currents and voltages during an Air-to-Air Refueling operation due to on-board High Frequency radio transmissions using advanced simulations in time domain

Enrique Pascual Gil, David Garcia Gomez

AIRBUS DS, Spain

#### Low Frequency extrapolation for the FDTD method

Camille Bastard<sup>1</sup>, Marc Meyer<sup>1</sup>, Christophe Guiffaut<sup>2</sup>, Alain Reineix<sup>2</sup>

<sup>1</sup>Airbus Helicopters, France; <sup>2</sup>Xlim Institute, France

W\_Th\_A\_5: Workshop

9:00 - 12:40

## **Electromagnetic Interference on Static Electricity Meters**

Session Chair Paul Wright

**Room 5**

**Abstract** - The workshop will present challenges and results from EU project on the EMI effects on static electricity revenue meters. The project was proposed in response to the findings by the University of Twente which reported some serious (>500%) meter errors induced by fast current changes. The project will further investigate these effects using waveforms captured from mass market electrical products and waveforms reordered on-site at meter connection points; examples of captured waveforms and associated meter errors will be presented. New waveform analysis techniques will be given which can be used to identify the types of signal that induce meter errors and in-turn unambiguously specify new testing signals that can be used in future type-approval testing. These waveforms will be applied using test-beds used in testing labs and the challenges for developing/retro-fitting suitable laboratory apparatus will be presented. The project findings are expected to influence future normative standards and testing procedures and the outlook for future standardisation will be given.

### **Agenda:**

- Introduction to the problem (Paul Wright, NPL)
- Capturing real-world waveforms for meter testing. (Twente + VSL + UPC)
- Equipment to digitize waveforms (UPC) demonstration of measurement equipment and data capture and analysis software
- Measurements of Appliances in the lab to capture waveforms (Helko van den Brom, VSL)
- Waveform capture on-site (Bas Ten Have, University of Twente)
- Signal analysis techniques to unambiguously specify complex test waveforms. (NPL)
- Triggering and Analysis (Paul Wright, NPL)
- EMI Statistical characterization (UPC)
- Test Beds for approval of meters
- Testbed for normative approval of static electricity meters based on phantom power. (NPL/VSL)
- Testbed for normative approval of static electricity meters based on IEC61000-4-19 (Pavel Hamouz - CMI/ Jean-Pierre Braun - METAS)
- Future Type-tests and outlook for normative standards and testing procedures. (NPL)
- Latest findings on meter performance. (VSL/Twente Tom Hartman)
- Final discussions, feedback and stakeholder needs

**External Resource:** <http://empir.npl.co.uk/meteremi/>

O\_Th\_B\_1: Oral Session

11:20 - 12:40

## Automotive (II)

Session Chair Francesca Maradei

Room 1

### Simultaneous EMI Suppression of the Input and Output Terminals of a DC/DC Converter by Injecting Multiple Synthesized Cancellation Signals

Andreas Bendicks, Marvin Rübartsch, Stephan Frei

TU Dortmund University, Dortmund, Germany

### Noise Reduction in Periodically Switching MOSFET Circuits Using Iteratively Found Synthesized Control Signals

Tobias Dörlemann, Andreas Bendicks, Caroline Krause, Stephan Frei

TU Dortmund University, Germany

### Ground Bridge Effect on Reduction of Conducted Emission from Three-Phase Motor Drive System

Yuangdong Guo<sup>1</sup>, Srinath Penugonda<sup>1</sup>, Minh Kim<sup>2</sup>, Junesang Lee<sup>2</sup>, Jung-rae Ha<sup>2</sup>, Sangwon Yun<sup>2</sup>, Jun Fan<sup>1</sup>, Hongseok Kim<sup>1</sup>

<sup>1</sup>Missouri University of Science and Technology, United States of America;

<sup>2</sup>MANDO Co., Ltd., Republic of Korea

### Uncertainty of CAN RF Emission Test Results due to Common Mode Choke Asymmetry

Sergey Miropolsky, Marlon Roehl, Frank Klotz

Infineon Technologies AG, Germany

O\_Th\_B\_2: Oral Session

11:20 - 12:40

## Components, Semiconductors and IC (II)

Session Chair Richard Perdriau

Room 2

### Evaluation of Near-Field Undesired Radio Waves from Semiconductor Switching Circuits

Makoto Nagata<sup>1</sup>, Koh Watanabe<sup>1</sup>, Yoshifumi Sugimoto<sup>1</sup>, Noriyuki Miura<sup>1</sup>, Satoshi Tanaka<sup>2</sup>, Yasunori Miyazawa<sup>2</sup>, Masahiro Yamaguchi<sup>2</sup>

<sup>1</sup>Kobe University, Japan; <sup>2</sup>Tohoku University, Japan

### Using the Embedded Ceramic Dielectric Cylinders to Improve the Signal Integrity of Via Transition

Yusheng Hu, Tongyu Ding, Qiubo Ye

Jimei University, China, People's Republic of

### Chip-Level ESD Verification Using Graph Theory Based Approach

Vlatko Galic<sup>1</sup>, Aarnout Wieers<sup>2</sup>, Renaud Gillon<sup>2</sup>, Adrijan Barić<sup>1</sup>

<sup>1</sup>Faculty of Electrical Engineering and Computing, Unska 3, 10000 Zagreb,

Croatia; <sup>2</sup>ON Semiconductor, Westerring 15, 9700 Oudenaarde, Belgium

## Miniature Common-Mode Rejection Filter in Silicon-Based Integrated Passive Device Technology

Chung-Hsien Chan, Yo-Shen Lin

Department of Electrical Engineering, National Central University, Taiwan, R.O.C.

O\_Th\_B\_3: Oral Session

11:20 - 12:40

### Communications (I)

Session Chair Kia Wiklundh

Room 3

#### Applications with a Rydberg Atom-based Radio Frequency Antenna/Receiver

Matthew Thomas Simons<sup>1</sup>, Abdulaziz Haddab<sup>2</sup>, Joshua Gordon<sup>3</sup>, Christopher Holloway<sup>3</sup>

<sup>1</sup>Department of Physics, University of Colorado, United States of America;

<sup>2</sup>Department of Electrical Engineering, University of Colorado, United States of America; <sup>3</sup>National Institute of Standards and Technology, Boulder, Colorado, United States of America

#### Evaluation of Electromagnetic Noise Radiated from Tube-type LED Lamps and Its Effect on Wireless Medical Telemetry Systems

Kai Ishida, Sazu Arie, Ifong Wu, Kaoru Gotoh, Yasushi Matsumoto

National Institute of Information and Communications Technology (NICT), Japan

#### Artificial Intelligence for Automatic Classification of Unintentional Electromagnetic Interference in Air Traffic Control Communications

Peter Frank Stenumgaard, Patrik Eliardsson

Swedish Defence Research Agency (FOI), Sweden

#### A Novel Intelligent Antenna Synthesis System Using Hybrid Machine Learning Algorithms

Mengtao Xue<sup>1</sup>, Dan Shi<sup>2</sup>, Yeyang He<sup>3</sup>, Chaoying Li<sup>4</sup>

<sup>1</sup>Beijing University of Posts and Telecommunications, China, People's Republic of;

<sup>2</sup>Beijing University of Posts and Telecommunications, China, People's Republic of;

<sup>3</sup>Beijing University of Posts and Telecommunications, China, People's Republic of;

<sup>4</sup>Beijing University of Posts and Telecommunications, China, People's Republic of

S\_Th\_B\_4: Oral Special Session 11:20 - 12:40  
**Numerical Simulation Techniques for EMC Problems (II)**  
 Session Chair Salvador Gonzalez Garcia **Room 4**

**Probabilistic Model of the Effect of a Ground Discontinuity on the Transmission of a Microstrip Interconnect**

Riccardo Trinchero, Flavio Canavero

Politecnico di Torino, Italy

**HPC Simulations of a Reverberation Chamber with Nonparallel Walls**

Luca Bastianelli<sup>1</sup>, Gabriele Gradoni<sup>2,3</sup>, Franco Moglie<sup>1</sup>, Valter Mariani Primiani<sup>1</sup>

<sup>1</sup>Universita' Politecnica delle Marche, Italy; <sup>2</sup>School of Mathematical Sciences, UK; <sup>3</sup>George Green Institute for Electromagnetics Research, UK

**Application of Stochastic FDTD to thin-wire analysis**

Miguel Ruiz Cabello, Luis Diaz Angulo, Amelia Rubio Bretones, Mario Fernandez Pantoja, Salvador Gonzalez Garcia

University of Granada, Spain

**Comparison of Predictions between Artificial Neural Networks and Gaussian Processes in EMC Investigations**

Felix Burghardt, Heyno Garbe

Leibniz Universität Hannover, Germany

O\_Th\_C\_1: Oral Session 14:00 - 15:20  
**Automotive (III)**  
 Session Chair Alastair Ruddell **Room 1**

**Reference Setup for RF Impedance Measurements with High DC Bias Currents**

Oliver Kerfin<sup>1</sup>, Martin Harm<sup>1</sup>, Benjamin Willmann<sup>2,3</sup>

<sup>1</sup>TU Braunschweig, Institute for Electromagnetic Compatibility, Germany;

<sup>2</sup>Volkswagen AG, Wolfsburg, Germany; <sup>3</sup>Otto-von-Guericke University, Magdeburg, Germany

**An Active Common Mode EMI Filter Approach introducing Predictive Pulsed Compensation**

Denis Mueller, Desirée Nadine Schweitzer, Michael Beltle, Stefan Tenbohlen

University of Stuttgart, Germany

## Modeling of conducted EMI noise in an Automotive LED Driver Module with DC/DC Converters

Chiuk Song, Hucksu Kweon, Unho Lee, Jonghyun Kim, Sieun Yang, Jonghyun Park

Hyundai Mobis Co., Korea, Republic of (South Korea)

## Analysis of Immunity Failures and Optimization Measures in Automotive Sensors

Jan Benz<sup>1</sup>, Andreas Klaedtke<sup>1</sup>, Jan Hansen<sup>1</sup>, Stephan Frei<sup>2</sup>

<sup>1</sup>Robert Bosch GmbH, Germany; <sup>2</sup>TU Dortmund University, Germany

O\_Th\_C\_2: Oral Session

14:00 - 15:20

## Human Exposure & Health Protection (I)

Session Chair Ernest Cid

**Room 2**

## Permissible SA and Radiant Exposure for Brief Exposure in GHz Region

Sachiko Kodera, Akimasa Hirata

Nagoya Institute of Technology, Japan

## Assesing the Electric Field Strength in the Vicinity of Devices Emitting Signals in the IEEE 802.11ac Standard of Communication

Andrei Cristian Bechet<sup>1</sup>, Robert Helbet<sup>1</sup>, Simona Miclaus<sup>2</sup>, Iulian Bouleanu<sup>2</sup>, Annamaria Sarbu<sup>2</sup>, Paul Bechet<sup>2</sup>

<sup>1</sup>Technical University of Cluj Napoca, Romania; <sup>2</sup>Land Forces Academy of Sibiu, Romania

## Radiofrequency electromagnetic exposures during the use of wireless links of portable computers inside trains without internal WiFi services

Krzysztof Krzysztof Gryz, Jolanta Karpowicz

Central Institute for Labour Protection - National Research Institute (CIOP-PIB), Poland

## New approach for human exposure assessment along a rail corridor

Oussama ALILOU<sup>1</sup>, François GRANGE<sup>2</sup>, Nabil ABDELLI<sup>1</sup>, Sébastien JOURNET<sup>2</sup>, José RIBEIRO<sup>1</sup>, Attibaud KOUASSI<sup>2</sup>, Cyril MANISCALCO<sup>1</sup>, Farid P. DAWALIBI<sup>3</sup>, Alexandre MACHET<sup>1</sup>

<sup>1</sup>SYSTRA, Paris, France; <sup>2</sup>SES-EUROPE, Vienne, France; <sup>3</sup>SES, Laval, Canada

O\_Th\_C\_3: Oral Session

14:00 - 15:20

## Communications (II)

Session Chair Marc Pous

**Room 3**

### Comparison Between Impulsive Noise Models Considering a Time Structure of LED Noise

Kenta Agari<sup>1,2</sup>, Kaoru Gotoh<sup>1</sup>, Yasushi Matsumoto<sup>1</sup>, Ryosuke Suga<sup>2</sup>, Osamu Hashimoto<sup>2</sup>

<sup>1</sup>National Institute of Information and Communications Technology, Japan;

<sup>2</sup>Aoyama Gakuin University, Japan

### Interference Impact from Solar-Panel Systems on Air Traffic Control Communications

Peter Frank Stenumgaard, Sara Linder

Swedish Defence Research Agency (FOI), Sweden

### On the Impact of CW interference on 5G NR

Karina Fors, Erik Axell, Sara Linder, Peter Stenumgaard

Swedish Defence Research Agency, Sweden

### Improved Electromagnetic Compatibility Standards for the Interconnected Wireless World

Marc Pous, Marco A. Azpurua, Ferran Silva

Universitat Politècnica de Catalunya, Spain

S\_Th\_C\_4: Oral Special Session

14:00 - 15:20

## Numerical Simulation Techniques for EMC Problems (III)

Session Chair Salvador Gonzalez Garcia

**Room 4**

### Shielding effectiveness assesement of a coaxial cable design with a combination of numerical and analytical solutions

Clement Pornin<sup>1</sup>, Tan Phu Vuong<sup>1</sup>, Gilbert Angenieux<sup>2</sup>, Pascal Xavier<sup>1</sup>

<sup>1</sup>Grenoble INP IMEP-LaHC, France; <sup>2</sup>Universite Savoie-Mont Blanc, IMEP LaHC, France

### Electromagnetic Pulse Propagation over Large Area Simulation through Massively Parallel Adaptive Mesh Refinement FDTD

Hanyu Li<sup>1</sup>, Xianfeng Bao<sup>2</sup>, Haijing Zhou<sup>1</sup>

<sup>1</sup>Institute of Applied Pysics and Computational Mathematics, China, People's Republic of; <sup>2</sup>Software Center for High Performance Numerical Simulation, CAEP

## Recent Advances to the Feko Integrated Cable Harness Modeling Tool

**Marlize Schoeman<sup>1</sup>, Elia A. Attardo<sup>2</sup>, Jordi Soler-Castany<sup>3</sup>**

<sup>1</sup>Altair Development SA (Pty) Ltd; <sup>2</sup>Altair Engineering GmbH; <sup>3</sup>Altair Engineering Inc

## A Simplified Modeling Of Transient Electromagnetic Coupling In Air Insulation Substation

**Bachir Nekhou<sup>1</sup>, Bochra Khelifi<sup>1</sup>, Kamal Kerroum<sup>2</sup>**

<sup>1</sup>Jijel university, Algeria; <sup>2</sup>Institut Pascal - Université Clermont Auvergne (UCA) 49, France

T\_Th\_A\_5: Tutorial

14:00 - 17:00

### **MIL-STD461 Military EMC Tests and Challenges/Pitfalls**

Session Chair  
Osman Sen  
Soydan Cakir

**Room 5**

**Abstract** - MIL STD-461 is a military standard that establishes interface and associated verification requirements for the control of the electromagnetic interference (EMI) emission and susceptibility characteristics of electronic, electrical, and electromechanical equipment and subsystems designed or procured for use by activities and agencies of the Department of Defense. Keeping EMI under control is critical for military applications. It can cause interference with other equipment and be detected by the enemy. The standard focuses on emissions generated by equipment as well as the susceptibility of equipment to degraded operation in the presence of external emissions. Tests procedures and limits are defined for EMI transferred via conducted and radiated means. The limits vary depending on the application (e.g. ground, air, ship, etc.) as well as the location of the equipment (e.g. above deck, below deck, flight-line, etc.). On the other hand, MIL-STD461 testing includes many challenges and pitfalls in the application and requires a good amount of experience and knowledge for correct testing.

This tutorial session intends to instructively present details of prominent military EMC tests and to inform the audience of potential challenges and pitfalls faced during military tests. This tutorial will also acquaint the audience with workable solutions to these challenges and insidious pitfalls of MIL-STD461.

#### **Agenda:**

- MIL-STD461G: Introduction and Differences from Previous Versions. Prof. Dr. Frank LEFERINK; University of Twente, The Netherlands
- Low Frequency Military Immunity Test: CS101 and Challenges & Pitfalls. Dr. Soydan ÇAKIR; TÜBİTAK UME, Turkey
- Military Conducted Immunity Tests: CS114, CS115, CS116. Dr. Soydan ÇAKIR; TÜBİTAK UME, Turkey



- Military Conducted Emission Tests: CE101, CE102. Osman ŞEN. TÜBİTAK UME, Turkey;
- Military Radiated Emission Tests: RE101, RE102. Osman ŞEN. TÜBİTAK UME, Turkey;
- Military Radiated Immunity Tests: RS101, RS103. Osman ŞEN. TÜBİTAK UME, Turkey;

O\_Th\_D\_1: Oral Session

16:00 - 17:00

## **Automotive (IV)**

Session Chair Stephan Frei

**Room 1**

### **Experimental Validation of Electromagnetic Models for a Simple Multi-Cell, Multi-Module Battery**

Yu Xian Teo, Jiaqi Chen, Alastair R. Ruddle  
HORIBA MIRA Ltd, United Kingdom

### **Simulation and Measurement of Narrowband Susceptibilities of Digital Automotive Sensors**

**Jan Benz<sup>1</sup>, Jan Hansen<sup>1</sup>, Stephan Frei<sup>2</sup>**

<sup>1</sup>Robert Bosch GmbH, Germany; <sup>2</sup>TU Dortmund University, Germany

### **Experimental Study of the Effect of High DC Bias Currents on the Measurement Performance of Impedance and Current Probes**

**Martin Harm, Oliver Kerfin**

TU Braunschweig, Institute for Electromagnetic Compatibility, Germany

### **Investigation of Possible EMC Interferences between Multi-Gig Communication link and RF Applications in Vehicle**

**Sanaz Mortazavi<sup>1</sup>, Detlef Schleicher<sup>1</sup>, Diana Eremyan<sup>2</sup>, Anna Gheonjian<sup>2</sup>, Roman Jobava<sup>2</sup>, Ali Sinai<sup>3</sup>, Friedel Gerfers<sup>4</sup>**

<sup>1</sup>Volkswagen AG, Germany; <sup>2</sup>EMCoS Ltd., Georgia; <sup>3</sup>University of Applied Sciences Berlin, Germany; <sup>4</sup>Technische Universität Berlin, Germany

### **Vehicle Electromagnetic Emissions: Challenges and Considerations**

**Konstantinos Pliakostathis, Marco Zanni, Germana Trentadue, Harald Scholz**  
Joint Research Centre, European Commission (JRC), Ispra, Italy

O\_Th\_D\_2: Oral Session

16:00 - 17:00

## Human Exposure & Health Protection (II)

Session Chair Pere J Riu

Room 2

### Study of Body Position Dependence on Human Exposure in the 2.4 GHz Band

Silvia Miguel-Bilbao<sup>1</sup>, Juan Blas<sup>2</sup>, Jolanta Karpowicz<sup>3</sup>, Victoria Ramos<sup>1</sup>

<sup>1</sup>Instituto de Salud Carlos III, Spain; <sup>2</sup>University of Valladolid, Spain; <sup>3</sup>Central Institute for Labour Protection- National Research Institute

### Wireless Charging of Electric Vehicles: Planar Secondary Coil Position vs. Magnetic Field

Tommaso Campi<sup>1</sup>, Silvano Cruciani<sup>1</sup>, Francesca Maradei<sup>2</sup>, Mauro Feliziani<sup>1</sup>

<sup>1</sup>University of L'Aquila, Italy; <sup>2</sup>Sapienza University of Rome, Italy

### The Height Scan Method Accuracy in Rural and Suburban Areas

Georgij Jefimovic Leontjev

Communications Regulatory Authority of the Republic of Lithuania, Lithuania

### A Radiation-Based Drive-Level ESD Test Method in Solid-State Drives

Jungho Jin, Byungjin Kwon, Jaeyoung Heo, Choongpyo Jeon, Jungki Kim, Kangyong Cho

Samsung Electronics, Korea, Republic of (South Korea)

O\_Th\_D\_3: Oral Session

16:00 - 17:00

## Intentional EMI

Session Chair Marco Azpúrua

Room 3

### IEMI Resilience Assessment of Critical Infrastructures

Thorsten Pusch, Marian Lanzrath, Michael Suhrke

Fraunhofer INT, Germany

### LTE Physical Layer Vulnerability Test to Different Types of Jamming Signals

Grecia Romero<sup>1</sup>, Virginie Deniau<sup>2</sup>, Olivier Stienne<sup>3</sup>

<sup>1</sup>Railenium, France; <sup>2</sup>IFSTTAR, Railenium; <sup>3</sup>ICAM, France

### Electromagnetic Watermarking: exploiting IEMI effects for forensic tracking of UAVs

José Lopes Esteves

ANSSI, France

### Validation of Electromagnetic model for an Aircraft Under HIRF Condition With the Non-Intrusive Polynomial Chaos Methods

Yueqian WU<sup>1,2</sup>, Haijing ZHOU<sup>1</sup>, Hanyu LI<sup>1</sup>, Xianfeng BAO<sup>1,2</sup>, Longquan ZHONG<sup>3,4</sup>

<sup>1</sup>CAEP Software Center for High Performance Numerical Simulation;

<sup>2</sup>Institute of Applied Physics and Computational Mathematics; <sup>3</sup>CAEP

Complicated Electromagnetic Environment Laboratory; <sup>4</sup>Institute of Applied Electronics

O\_Th\_D\_4: Oral Session

16:00 - 17:00

## Education on EMC

Session Chair Arturo Mediano

Room 4

### On the limits to measure small leakage currents with current clamps

Avinash V. Nayak, Chiel Ton, Alexander P.J. van Deursen

Eindhoven University of Technology, Netherlands, The

### Experiment to educate ESD phenomena to engineers

Frits Buesink<sup>1</sup>, Robert Vogt-Ardatjew<sup>1</sup>, Frank Leferink<sup>1,2</sup>

<sup>1</sup>University of Twente, Netherlands, The; <sup>2</sup>Thales Netherlands B.V. Hengelo

### Co-Design and Co-Analysis for Noise Optimization of Switching Mode Power Supply Circuit Board

Narimasa Takahashi<sup>1</sup>, Masato Shobayashi<sup>2</sup>, Masato Higashi<sup>2</sup>, Eriko Yamato<sup>3</sup>, Robert Carter<sup>3</sup>, Yoshi Fukawa<sup>4</sup>

<sup>1</sup>TOTAS Co.,Ltd., Japan; <sup>2</sup>Kinki Polytechnic College; <sup>3</sup>Oak-Mitsui Technologies LLC; <sup>4</sup>TOYOTech LLC

## Poster Session

12:40 - 14:00

Poster III

### Poster Session (III)

Session Chair Marcos Quílez Figuerola

Poster Area

#### Analysis of Availability and Safety Considerations in EM-Diverse Systems

Jonas Lannoo<sup>1</sup>, Jonas Van Waes<sup>2</sup>, Dries Vanoost<sup>1</sup>, Jeroen Boydens<sup>2</sup>, Davy Pissoot<sup>1</sup>

<sup>1</sup>KU Leuven, Department of Electrical Engineering; <sup>2</sup>KU Leuven, Department of Computer Science

#### Topology-Optimization-Based EMC Design

Katsuya Nomura<sup>1</sup>, Atsuhiko Takahashi<sup>1</sup>, Takashi Kojima<sup>1</sup>, Shintaro Yamasaki<sup>2</sup>, Kentaro Yaji<sup>2</sup>, Hiroki Bo<sup>2</sup>, Kikuo Fujita<sup>2</sup>

<sup>1</sup>Toyota Central R&D Labs., Inc.; <sup>2</sup>Department of Mechanical Engineering, Osaka University

#### Comparison of voltages induced in an electronic equipment during far field and near field normative radiated immunity tests

ANDRE DURIER<sup>1,2,3</sup>, SONIA BENDHIA<sup>2,3</sup>, TRISTAN DUBOIS<sup>4</sup>

<sup>1</sup>IRT SAINT EXUPERY, France; <sup>2</sup>LAAS-CNRS, France; <sup>3</sup>INSA TOULOUSE, France; <sup>4</sup>IMS BORDEAUX, France

#### Design of Vialess Open-stub EBG Structure by Using Preference Set-based Design Method

Yoshitaka Toyota, Sho Kanao, Kengo Iokibe

Okayama University, Japan

#### Study of feasibility of building materials electromagnetic characterization

Jérémie Corsi, Frédéric Puybaret, Stéphane Vauchamp, Isabelle Lachaud, Philippe Viars

CEA, France

#### Phase Measurement Techniques for Detecting the Defective Elements of an Array Antenna at 28GHz

Kyungho Yoo<sup>1</sup>, Tongho Chung<sup>1</sup>, Namkyoung Kim<sup>1</sup>, Byongsu Seol<sup>1</sup>, Young-pyo Hong<sup>2</sup>, Dong-joon Lee<sup>2</sup>

<sup>1</sup>Samsung Electronics Co., Ltd., Korea, Republic of (South Korea); <sup>2</sup>Korean Research Institute of Science and Standard, Korea, Republic of (South Korea)

#### EMC "Black Box" model for imbalanced power electronic converters

Amina GAHFIF<sup>1</sup>, Pierre-etienne LEVY<sup>1</sup>, Francois COSTA<sup>2</sup>, Mounira BERKANI<sup>2</sup>, Marwan ALI<sup>1</sup>

<sup>1</sup>SAFRAN SA, France; <sup>2</sup>Université Paris Est Créteil, France

#### Coupled Inductors for Smooth EMC Power Supplies

Heinz Zenkner

Würth Elektronik eiSos GmbH & Co. KG, Germany

### **Radiation of Low Frequency Magnetic Field from High Voltage Powertrain Systems of Electric**

**Giorgi Chiqovani<sup>1</sup>, Irina Oganezova<sup>1,2</sup>, Giga Gabriadze<sup>1,2</sup>, Michael Kuehn<sup>3</sup>, Marcel Messer<sup>3</sup>, Roman Jobava<sup>1,2</sup>**

<sup>1</sup>EMCoS, Georgia; <sup>2</sup>Tbilisi State University, Tbilisi, Georgia; <sup>3</sup>I/EE-25 AUDI AG, Germany

### **Interlaboratory Comparison of Radiated Immunity in Automotive EMC**

**Andrei-Marius Silaghi<sup>1</sup>, Relu-Adrian Aipu<sup>2</sup>, Aldo De Sabata<sup>1</sup>, Catalin Balan<sup>1</sup>, Petre-Marian Nicolae<sup>2</sup>**

<sup>1</sup>University Politehnica Timisoara, Romania; <sup>2</sup>University of Craiova, Romania

### **Fabrication process effects on power cable parameters**

**Francisco Javier Arcega<sup>1</sup>, Adilson Alberto Moyses<sup>1</sup>, Mateo Iglesias<sup>2</sup>, Fernando Arteche<sup>2</sup>**

<sup>1</sup>University of Zaragoza, Spain; <sup>2</sup>ITAINNOVA · Instituto Tecnológico de Aragón

### **EMC Tents for precompliance testing and reverberating chambers**

**Ivano Soliani**

SOLIANI EMC SRL, Italy

### **Protection of a Buried Telecommunication Cable against Lightning using Follow-on Earth Wire**

**Sabrina Mezoued<sup>1</sup>, Abdelmalek Laissaoui<sup>1</sup>, Bachir Nekhoul<sup>2</sup>, Kamal Kerroum<sup>3</sup>, Khalil El Khamlichi Drissi<sup>3</sup>**

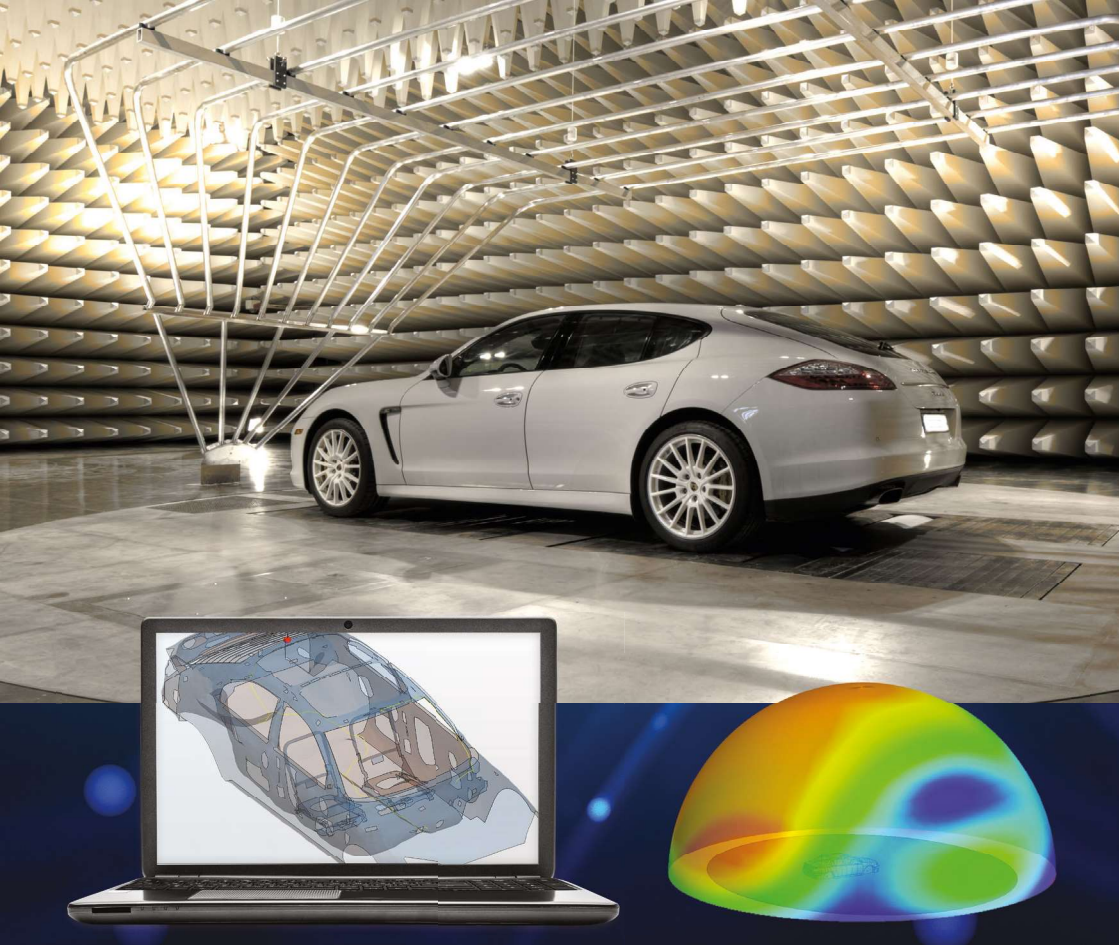
<sup>1</sup>USTHB, Algeria; <sup>2</sup>Jijel University, Jijel, Algeria; <sup>3</sup>Blaise Pascal University, Clermont Ferrand, France

### **Study on Grounding Ways of Secondary Cable in UHVDC Converter Substation**

**Lei Yan<sup>1</sup>, Weidong Zhang<sup>1</sup>, Jianfei Ji<sup>2</sup>, Zhaohua Zhang<sup>3</sup>, Weidong Shi<sup>3</sup>**

<sup>1</sup>North China Electric Power University, China, People's Republic of; <sup>2</sup>State Grid Jiangsu Electric Power Company Research Institute; <sup>3</sup>China Electric Power Research Institute

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## Friday

FRIDAY, SEPT. 6				
ROOM 1	ROOM 2	ROOM 3	ROOM 4	ROOM 5
8:00				
9:00	Automotive EMC I	Paper Preparation for the IEEE EMC Transactions	Uncertainty about uncertainties along the EMC-compliance chain	Measurements of conducted emissions in time domain and power-line filter design
10:40				Ionizing Radiation & Electromagnetic Interference on Integrated Circuits: from the need of combined tests to current solutions
11:20	Automotive EMC II	Computational Electromagnetics and Multiphysics Methods for Simulating Complex Electromagnetic Environment Effects I	Protecting Against the Risks of Lightning and EMI in Systems and Components I	Components and topologies for passive EMI/EMC filters useful in conducted emissions: a practical approach I
12:40				EMI and power quality issues in Smart Cities and Transportation Systems I
14:00	Automotive EMC III	Computational Electromagnetics and Multiphysics Methods for Simulating Complex Electromagnetic Environment Effects II	Protecting Against the Risks of Lightning and EMI in Systems and Components II	Components and topologies for passive EMI/EMC filters useful in conducted emissions: a practical approach II
15:20				EMI and power quality issues in Smart Cities and Transportation Systems II
16:00	Automotive EMC IV	Computational Electromagnetics and Multiphysics Methods for Simulating Complex Electromagnetic Environment Effects III	Protecting Against the Risks of Lightning and EMI in Systems and Components III	Components and topologies for passive EMI/EMC filters useful in conducted emissions: a practical approach III
18:00				EMI and power quality issues in Smart Cities and Transportation Systems III

REGISTRATION

coffee break

lunch

coffee break

Workshops Tutorials



W\_Fr\_A\_1: Workshop

9:00 - 18:00

## Automotive EMC

Session Chair Marco Klingler

Room 1

**Abstract** - Automotive electric / electronic systems are endlessly growing in complexity with a permanent constraint of a constant or reduced time-to-market. Therefore, there is a strong need to improve constantly the efficiency of the EMC related tasks throughout the entire development process, starting from the design phase until the full-vehicle validation phase. This workshop intends to present an overview of the most recent industrial advances in the field of automotive EMC design, modeling and simulation as well as in the field of automotive standards, testing and measurements. The presentations in this workshop will cover EMC issues at system, subsystem, equipment, and component levels. In particular, topics addressed by the speakers will include hybrid power-train systems EMC analysis, antenna implementation, equipment design, printed-circuit-board optimization, and electric/electronic component characterization.

### Agenda:

- Global Methodology for Electrical Component Tests to Reproduce Wideband Modulated Pulse Interferences on Vehicle. Thomas Picon (1,2), Marco Klingler (1), Tristan Dubois (2) & Geneviève Duchamp (2). (1) *PSA Group, France* (2) *IMS, University of Bordeaux, France*
- Simulating and Resolving EMC/EMI Issues in Electric Vehicles. Matthias Troescher, Dassault Systèmes SIMULIA, Germany
- PEEC Based Modeling of Inductive Components for Power Electronics Applications. Anna Gheonjian, Diana Eremyan, Zviad Kutchadze, Badri Khvitia, Roman Jobava. EMCoS Ltd., Tbilisi, Georgia
- Fast analysis of component and vehicle level conducted and radiated emissions on new electric powertrains. Jordi Soler, Philippe Le Marrec. Altair Engineering GmbH Böblingen, Germany
- EMC simulation workflow for Power Electronics in the Automotive Industry. Flavio Calvano, Samuel Lopez, Frédéric Bocquet. ANSYS Inc, Italy
- Modelling and simulation of a vehicle with an IPT (Inductive Power Transfer) system to see magnetic field inside and outside the vehicle for different chassis material etc. Peter Ankarson and Urban Lundgren. Research Institutes of Sweden (RISE), Sweden
- Noise Reduction in Stationary Operating Automotive Power Electronic Systems using Signal Synthesis. Stephan Frei, Andreas Bendicks, Tobias Dörlemann, Caroline Krause. TU Dortmund University, Germany
- EMC root causes and optimization of pressure sensors. Jan Benz, Jan Hansen (1), Stephan Frei (2). (1) *Robert Bosch GmbH, Germany*, (2) *TU Dortmund University, Germany*
- Switching Regulators in Automotive System Designs with Power and Data over Shared Cabling: Conducted and Radiated Emissions Prediction via

Co-Simulation. Abhishek Ramanujan, Patrick DeRoy, Joseph Tarkoff.  
Analog Devices

- Challenges for Automotive Electro Magnetic Compatibility Applications.  
Jean-Roger K. Kuvedu-Libla. Delphi Technologies, Bascharage,  
Luxembourg

T\_Th\_A\_5: Tutorial

9:00 - 10:40

## **Paper Preparation for the IEEE EMC Transactions**

Session Chair     John Norgard  
                             Perry Wilson

**Room 2**

**Abstract** - This tutorial is on the IEEE Transactions on Electromagnetic Compatibility (EMCT).

Presentations on EMCT include

1. How to publish a paper in the EMCT.
2. How to prepare and write a good technical paper for the EMCT.

The presentation for part i), by Prof. Norgard, entitled "Publishing a Paper in the EMCT", will cover the initial paper preparation process (topic & text), the submission process, the review cycle (Reviewers, Associate Editors, and the Editor-in-Chief), and final paper publication procedures for the IEEE Transactions on EMC. In addition, acceptance criteria are covered, along with style guides, online web support and help-aids, and proper paper organization. The presentation for part ii), by Dr. Wilson, entitled "Writing a Good EMCT Paper: My Perspective" will cover aspects of writing a good paper for submission to the IEEE Transactions on EMC. Topics to be covered include goals, hints, and dos and don'ts for the abstract, index terms, main text, and conclusions of a paper. The material is very much from the personal perspective of the presenter based on his experience as both a reviewer and a former Editor-in-Chief of the Transactions.

This EMCT tutorial, which is sponsored by the IEEE EMC Society Board of Directors, is intended for anyone and everyone interested in publishing a paper in the EMCT, especially for the first time.

### **Speakers:**

- Dr. John Norgard, National Aeronautics and Space Administration - NASA, USA
- Dr. Perry Wilson, National Institute of Standards and Technology - NIST, USA

T\_Th\_A\_5: Tutorial

9:00 - 10:40

## Uncertainty about uncertainties along the EMC-compliance chain

Session Chair Pierre Beeckman

**Room 3**

**Abstract** - Compliance with requirements for EMC is subject to many types and levels of uncertainty. In this tutorial, all categories of uncertainty that may be involved in compliance with EMC regulations and standards will be reviewed. The uncertainties that will be explained are due to measurement instrumentation and sites, product sampling but also because many standards allow alternative methods for the same requirement in a certain frequency region. Also, the significant level of intrinsic uncertainty resulting from limitations in standards specifications (e.g. the setup of units and routing and termination of cables) is addressed. Furthermore, the uncertainty (mismatch) between the compliance with a regulation or standard and the actual risk of interference will be discussed. Each category of uncertainty will be explained and supported by examples. The relevance and responsibilities of the distinct categories of uncertainty in different applications will be given.

### Learning objectives:

This tutorial will give better awareness on the many categories of uncertainties involved in standardized EMC testing, compliance demonstration with EMC regulations and the actual risk of interference in practice. Attendees will get a more balanced view of the uncertainty categories that really matter in practice.

W\_Fr\_A\_2: Workshop

9:00 - 10:40

## Measurements of conducted emissions in time domain and power-line filter design

Session Chair Albert-Miquel Sánchez  
F. Javier Pajares

**Room 4**

**Abstract** - Electromagnetic compatibility (EMC) measurements usually consume a significant amount of time in any development project of electrical or electronic equipment, especially when problems arise, and the project enters in a redesign and retest loop not expected beforehand. Therefore, the EMC community devotes significant efforts to reduce the measurement time of regulated tests and to provide techniques that help on the solution design. This workshop has been focused on three techniques that can speed up the conducted-emission measurements and, eventually, can provide a solution. These techniques are:

- Measurements in the time domain.
- Measurements of CM and DM.
- Power-line filter design techniques.

When doing time-domain measurements, all frequencies are measured simultaneously. This is a very different situation with respect to traditional spectrum analyzers or electromagnetic interference (EMI) receivers, where the spectra are sequentially measured at several frequency steps. Thus, the reduction of measurement time in the first case with respect to the second one is significant. In this workshop, some technical issues that must be considered when performing time-domain measurements according to CISPR 16-1-1 will be covered, as for instance, the necessary dynamic range, the signal filtering, and the signal processing. Every electric or electronic device needs a power-line filter to be compliant with any EMC regulation around the world. Knowing the modal nature of the conducted emissions (that is, knowing if the predominant mode is the CM, the DM, or a combination of both) becomes fundamental to improve the design of the power-line filter. In this workshop, different techniques to separate the CM and the DM will be analyzed, either by using analogic circuits or by signal processing in the digital domain. For the optimal design of a power-line filter, the whole circuit information that intervenes in the system device-under-test (DUT), power-line filter and power-line network must be known. That means that the measurement of the input impedance of the DUT and the power-line network is needed. In this workshop, a measurement setup to measure the input impedance of DUTs connected to the power-line network, and the input impedance of the power-line network will be presented and used to develop a power-line filter design technique.

## Speakers:

- Dr. Albert Miquel Sanchez, Emzer Technological Solutions, Spain
- Dr. Joan Ramon Regué, Emzer Technological Solutions, Spain
- Dr. Miquel Ribó, Emzer Technological Solutions, Spain
- Dr. F. Javier Pajares, Emzer Technological Solutions, Spain
- Dr. Arturo Mediano, Universidad de Zaragoza, Zaragoza, Spain

T\_Th\_A\_5: Tutorial

9:00 - 10:40

## **Ionizing Radiation and Electromagnetic Interference on Integrated Circuits: from the need of combined tests to current solutions**

Session Chair Fabian Vargas

**Room 5**

**Abstract** - Technology scaling, which made electronics accessible and affordable for everyone on the globe, has advanced IC and electronics since the sixties. Nevertheless, it is well recognized that such scaling has introduced new (and major) reliability challenges to the semiconductor industry. This tutorial addresses the background mechanisms impacting the reliability of very deep submicron (VDSM) integrated circuits (ICs). In more detail, topics such as the basics about EMC and ionizing radiation, the mechanisms by which they affect ICs, the current standards and laboratory test setup for electromagnetic compatibility (EMC), total-ionizing dose (TID) and single-event effects (SEEs) on ICs are presented and their combined effects on the

reliability of modern ICs are discussed. Moreover, reliability failure mechanisms for (ionizing and non-ionizing) radiation, the way they are modeled and how they are impacting IC lifetime will be covered. Laboratory test setup and recent results from experimental measurements are described. Classic design solutions to counteract with TID, SEEs and EMI in VDSM ICs, as well as the recent achievements on the development of on-chip sensors to monitor EM conducted noise on IC power supply lines of ICs, are introduced. A YouTube video is presented to illustrate the effectiveness of such on-chip sensors. Finally, Spice simulations are used to demonstrate the combined effect of ionizing radiation with power supply noise on SRAM cells followed by the presentation of some measures to counteract with it..

#### Speakers:

- Dr. Fabian Vargas, Catholic University - PUCRS, Brazil
- Dr. Bernd Deutschmann, University of Technology, Austria
- Dr. Sonia Ben Dhia, Université de Toulouse, LAAS-CNRS, France

W\_Fr\_B\_2: Workshop

11:20 - 18:00

### **Computational Electromagnetics and Multiphysics Methods for Simulating Complex Electromagnetic Environment**

Session Chair Wenyan Yin

**Room 2**

**Abstract** - Computational Electromagnetics (EM) and Multiphysics (MP) methods for simulating complex electromagnetic environment effects (E3) remain challenging tasks even nowadays. This workshop hosts a series of speakers that have made recent contributions to the field of computational EM/MP methods applied to problems relevant to various complex EMC/EMI/IEMI problems. The presentations will give both a review of the state of the art in the respective fields and show more recent progress. Topics that will be addressed include general computational EM/MP methods, numerical efficiency, and accuracy, handling of complex 3-D multiscale structures, validation of simulated results, and even high-performance computational EM/MP methods and their applications for characterizing complex E3 problems for further electromagnetic protection design. All these are important for the development of warship-, aircraft-, and aerospace-based platforms as well as communication and radar systems. The workshop is provided for both research engineers and scientists who are active in CEM and EMC/EMI/IEMI studies and applications.

#### Agenda:

- Multiphysics (MP) Methods for Modeling and Simulating RF Devices/circuits Under Intentional Electromagnetic Interference (IEMI), Prof. Liang Zhou

- High-Performance Electromagnetic Simulation for Solving E3 Problems on a Supercomputer Platform, Prof. Haijing Zhou
- Determination and Assessment of the Human Exposure to Magneto-Quasistatic Fields of Wireless Power Transfer Systems in Electric Vehicles Using High-Resolution Two-Step Simulation Methods, Martin Zang
- Time-Domain Integral Equation Method for Simulating EMP Effects of Multiscale Complex Structures, Prof. Wen-Yan Yin

W\_Fr\_B\_3: Workshop

11:20 - 18:00

## **Protecting Against the Risks of Lightning and EMI in Systems and Component**

Session Chair Andy Plumber

**Room 3**

**Abstract** - Lightning and Electromagnetic Interference (EMI) are both a complex phenomenon. With the transfer of immense amounts of energy of short periods of time (microseconds), the "direct effects" of lightning can cause severe damage if not addressed. Fortunately, the effects of lightning on many common materials are well understood, and common protection strategies - terminals, diverters, expanded foils, proper bonding, and earthing can mitigate these physical damage effects.

The other and more complex consequence of lightning are the "indirect effects". Due to the flow of current through structures that have been struck by lightning, transient currents and voltages are often conducted or induced into system cabling and components. These can cause system functional upsets, destroy system components, and produce other hazards that impact safety and operability of systems. In parallel, systems and components are also faced with tolerating EMI, which can be as harmful as the lightning transients. Protection design approaches of shielding, transient voltage suppression, filtering, and circuit architecture are presented.

Protecting against the effects of indirect effects of and other electromagnetic effects is a multi-stage process. The currents and voltages need to be quantified, protection needs to be designed, and then it needs to be verified that the system and components can tolerate these currents and voltages.

With the advent of modern numerical simulation techniques, these effects can accurately be quantified through simulation and analysis. This provides an opportunity to evaluate and understand multiple design iterations rapidly, explore various protection designs, and determine what the system and components need to tolerate. Once the environment is known, it simply becomes an exercise of evaluating the performance of the system in the presence of these transients.

This workshop will review the lightning environment, protection design, and methods. Examples will include wind turbines, aircraft, and commercial and industrial facilities.

Attendees are encouraged to bring real-life problems for consideration and resolution

W\_Fr\_B\_4: Workshop

11:20 - 18:00

**Components and topologies for passive  
EMI/EMC filters useful in conducted  
emissions: a practical approach**

Session Chair Ismael Molina Alba

**Room 4**

**Abstract** – This workshop is intended to give a general view of the design and evaluation of passive filters to be used in EMC conducted emissions with a practical approach in mind. First, the problem of conducted emissions is presented so attendees understand the problem to be solved including typical topologies. Then, the typical components used in those filters are reviewed: capacitors, chokes, and ferrites. Different technologies and state of the art solutions will be introduced including strategies to choose practical components for specific cases. With the chosen components, a simple evaluation of the filter can be done with simulation including parasitic components affecting the behavior of the filter. Finally, a set of simple experiments to demonstrate those techniques will be presented.

**Agenda:**

- Introduction.
- The need for filters.
- Topologies for filters in conducted emissions.
- Components and technologies: chokes, capacitors, and ferrites.
- Choosing components for a filter.
- Design and simulation of filters.
- How to evaluate a filter in the laboratory.
- How to destroy a filter.
- Practical demonstrations.

**Speakers:**

- Ismael Molina, WÜRTH ELEKTRONIK EISOS GMBH & CO. KG,
- Dr. Arturo Mediano, Universidad de Zaragoza, Spain

T\_Th\_A\_5: Tutorial

11:20 - 18:00

## **EMI and power quality issues in Smart Cities and Transportation Systems**

Session Chair Flavia Grassi

Petre-Marian Nicolae

**Room 5**

**Abstract** - The global vision of Smart and Sustainable Cities is restricted by the rapid increase of interference and interoperability problems, which occur through the interaction of electrical power with information technology and communications equipment. This tutorial aims at surveying technical challenges and recent findings in modelling, measurement, and mitigation of electromagnetic interference in modern power distribution networks in the Smart Grid context, including transportation systems. Related discussion includes the definition of proper emission limits in the related frequency range, adequate immunity of equipment to low-frequency disturbance, effective filter-design strategies, ad hoc measurement techniques and instrumentation, numerical modeling, and statistical techniques.

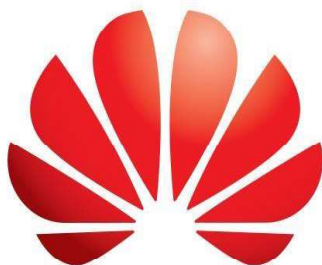
### **Agenda:**

- EM Interferences caused by power converting systems in automotive applications, Sven Fisahn, Leibniz Universität Hannover, Hannover, Germany.
- Conducted EMI Research in Europe: Why, and How SCENT and ETOPIA projects, Frank Leferink, University of Twente, Enschede, The Netherlands.
- EMC testing in automotive. Sebastian Koj, IAV GmbH, Germany.
- On the low frequency physical mechanism and modeling of cable common mode current including skin effect. Umberto Paoletti, Hitachi, Ltd. Research & Development Group, Yokohama, Japan.
- Interoperability of power electronic interfaces and advanced metering infrastructure - Selected EMC issues, Robert Smolenski, University of Zielona Góra, Poland.
- Multi-channel time-domain current and voltage measurements for EMI investigation, Niek Moonen, University of Twente, Enschede, The Netherlands.
- Predicting conducted emissions in the presence of uncertainty, David Thomas, University of Nottingham, United Kingdom.
- EMI modeling of switching circuits via augmented equivalents, Riccardo Trinchero, Politecnico di Torino, Italy.
- EMI in a Smart Grid containing different power sources, Petre-Marian Nicolae, Ileana-Diana Nicolae, University of Craiova, Romania..





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# EMC EUROPE 2020

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## Important Dates

### SPECIAL SESSIONS

15 January 2020

### PROPOSAL FOR WORKSHOPS, TUTORIALS

15 March 2020

### FINAL PAPER SUBMISSION

20 May 2020

### PAPER SUBMISSION

15 February 2020

### NOTIFICATION OF ACCEPTANCE

20 April 2020

## Contacts

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EMC EUROPE



# EMC EUROPE 2020

## CALL FOR PAPERS



## International Symposium on Electromagnetic Compatibility

Rome, Italy, September 7-11, 2020



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During the Conference, an exhibition of software, hardware, equipment, materials, services and literature is planned. EMC Europe 2020 welcomes sponsorship from companies and other organizations.

The Conference has 3 sponsorship packages, Gold, Silver and Bronze. The information for exhibitors and sponsors will appear on the website.

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Sapienza University of Rome  
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# Call for Papers

## 2020 Asia-Pacific International Symposium on Electromagnetic Compatibility & Signal Integrity and Technical Exhibition

The **2020 Asia-Pacific International Symposium on Electromagnetic Compatibility & Signal Integrity and Technical Exhibition (APEMC2020)** will be held in Sydney, Australia, May 19 to 22, 2020. APEMC originated in Singapore in 2008. It has become one of the premier international conferences of EMC community. After APEMC was held in Melbourne in 2013, the event is now back in Australia. Sydney has the world's most beautiful harbour and is proud to be selected to host the APEMC 2020.

Continuing APEMC spirit and addressing the global EMC challenges and explorations, APEMC 2020 will offer a rich and diverse scientific program of the highest quality, with invited speakers from all over the world and serve as a broad exchange platform for both academia and industry. The symposium will recognize innovations and technology leaderships through the Best Symposium Paper Award, the Best Student Paper Award, and other recognitions. The symposium will cover the entire scope of electromagnetic compatibility, electromagnetic environment, signal integrity issues and feature emerging EMC technologies. Prospective authors are invited to submit original papers on their latest research results. Proposals for special sessions, industrial forums, workshops and tutorials are also cordially solicited.

We welcome you to join this unique symposium, meet international peers, present your latest research findings, share your insight and perspectives, discuss with experts and innovators, explore collaborations, visit exhibitions and catch up new products.

### Important Dates

■ Proposals for Special Sessions, Workshops and Tutorials	<b>Jun. 06, 2019 – Nov. 29, 2019</b>
■ <b>3-page</b> Preliminary Paper Submissions	<b>Jun. 06, 2019 - Nov. 29, 2019</b>
■ Or <b>One-page</b> Abstract Submission (not be included in IEEE Xplore)	<b>Jun. 06, 2019 - Nov. 29, 2019</b>
■ Notification of Acceptance	<b>Jan. 22, 2020</b>
■ Final Paper Submission	<b>Feb. 18, 2020</b>

*All accepted and presented full papers will be included in IEEE Xplore.*

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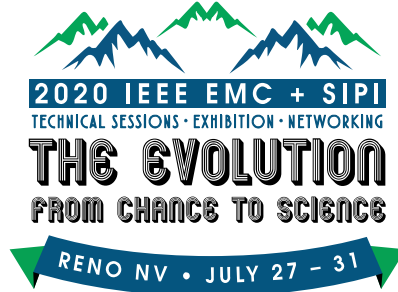
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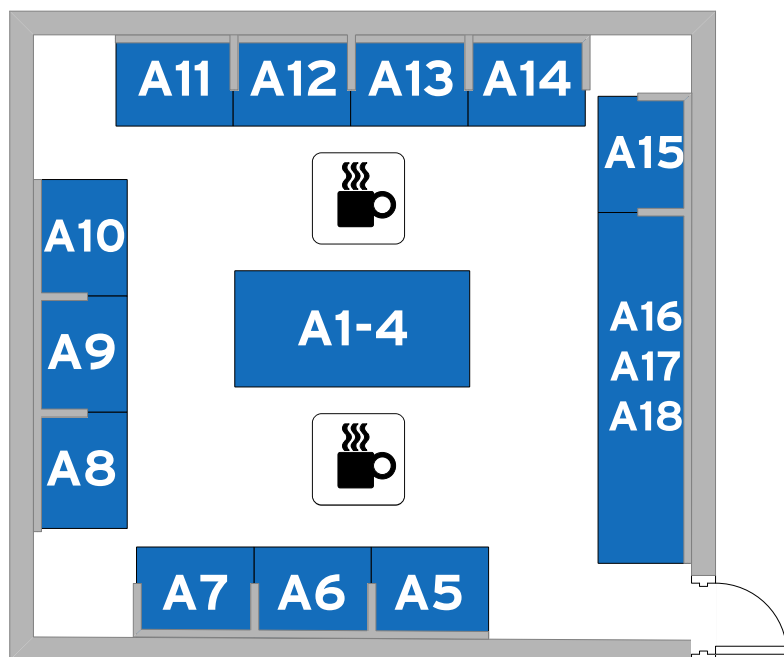
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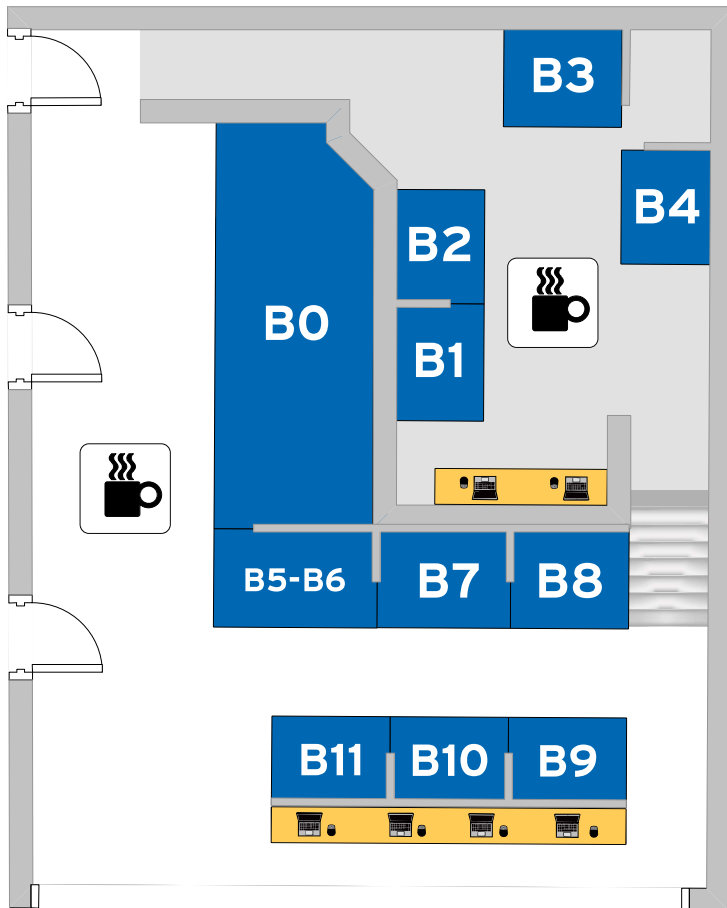
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