

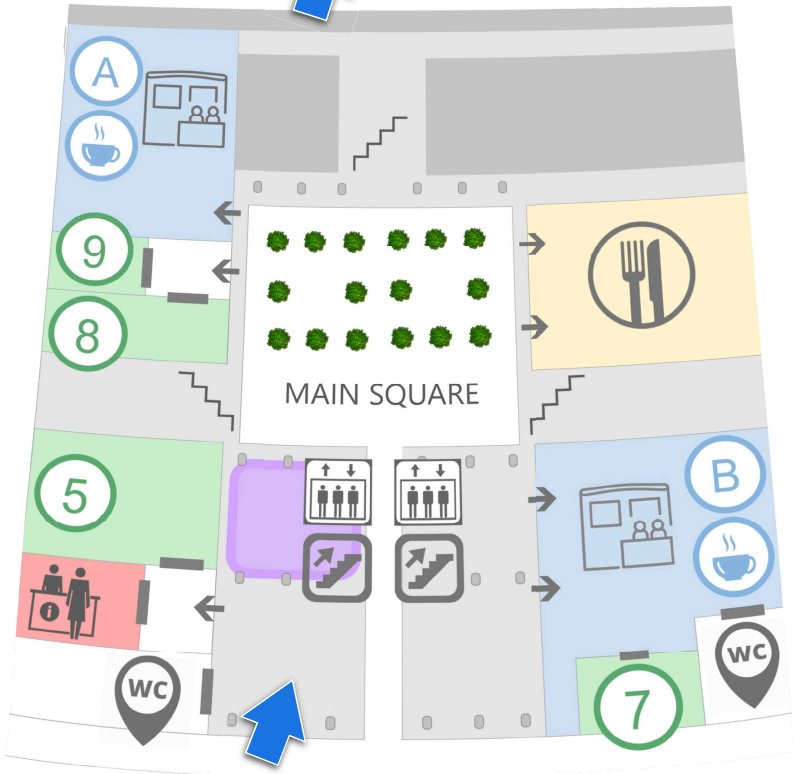
EMC Europe 2019 BARCELONA

SYMPOSIUM PROGRAMME

BARCELONA | 2-6 September 2019

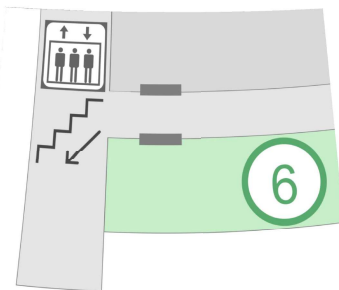


Venue MAP

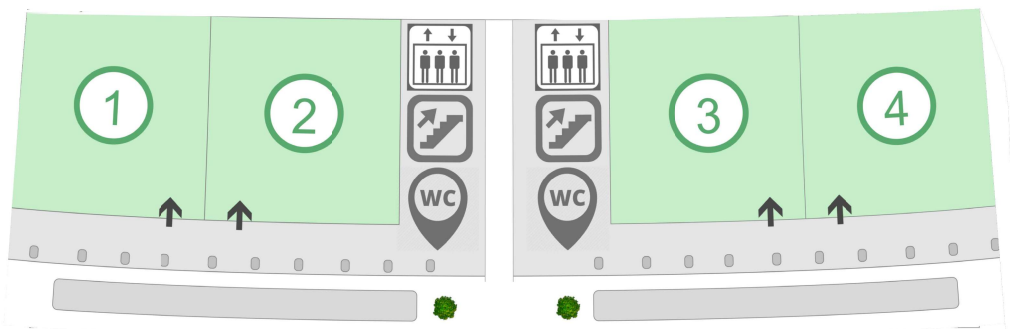


Street Level (-1)

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



Upper Level (2)



Terrace Level (0)

Indications to the opening session:

On Tuesday 9:00 at Auditori VERTEX (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 Arteché 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



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 Upper Diagonal

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

Hotel SOFIA Barcelona

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

Fairmont Rey Juan Carlos I

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

Hotel Bonanova Park

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

Arenas Atiram Hotel Barcelona

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

Hotel Catalonia Rigoletto

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



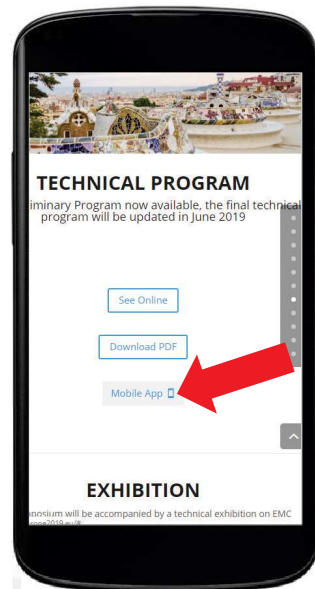
Otherwise, as the UPC is part of **Eduroam** network you can also use your regular connection.

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 Emergències 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.

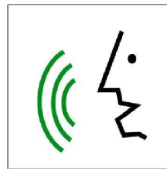
1 Don't leave the building.

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 Calibration, proficiency tests and interlaboratory comparisons	Low frequency and power quality topics	Power Integrity and Signal Integrity	Shielding & grounding
Frequency domain techniques	Near-field techniques	Radar systems	TEMPEST and Eavesdropping
Instrumentation, virtual instruments, and measurement automation	New materials: absorbers, composite, and metamaterials	Reverberation chambers	Time-domain and Transient analysis
	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 Schade¹, Frank Klotz¹, Stefan Jahn¹, Robert Weigel²
¹Infineon Technologies AG, Germany; ²Friedrich-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 Mordachev¹, Eugene Sinkevich¹, Dzmityr Tsyantenka¹, Yauheni Arlou¹, Aliaksandr Svistunou¹, Alexey Galenko¹, Andrey Polkanov¹, Andrey Krachko¹, Yingsong Li², Tao Jiang², Wei Xue²
¹EMC R&D Laboratory, Belarusian State University of Informatics and Radioelectronics, Minsk, Belarus; ²Harbin 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 Sassi¹, **Naseef Mahmud²**, Pascal Hervé³
¹Volkswagen AG, Germany; ²Rohde & Schwarz GmbH & Co. KG; ³CSA 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 Sassi¹, **Naseef Mahmud²**, **Pascal Hervé³**
¹Volkswagen AG, Germany; ²Rohde & Schwarz GmbH & Co. KG, Germany; ³CSA 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 Kuznetsov¹, **Andrey Baev¹**, **Anastasia Gorbunova¹**, **Maxim Konovalyuk¹**, **Johannes A. Russer²**, **Michael Haider²**, **Peter Russer²**
¹Moscow Aviation Institute (National Research University), Russian Federation; ²Technische 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 Naojima¹, Tadatoshi Sekine²
¹Graduate School of Integrated Science and Technology, Shizuoka University, Japan; ²Shizuoka 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 Successfully Adapted Cancellation Signals**
Andreas Bendicks¹, Timo Osterburg¹, Stephan Frei¹, Marc Wiegand², Norbert Hees²
¹TU Dortmund University, Dortmund, Germany; ²Leopold 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^{1,2}, Martin Aidam¹, Walter Franz¹, Simon Senega², Stefan Lindenmeier²
¹Dep. of EMC and Antennas, Daimler AG, Sindelfingen, Germany; ²Institute 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 already 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 make sure your presentation is well timed according to the allotted time-frame.

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 ahead of time and it fits within the allotted time.

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.

We kindly ask you to respect the allotted time.

Special sessions, workshops & tutorials

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

Conference general information

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

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

Conference general information

Date	Tutorial
Sep. 2 14:00 - 18:00 Location <i>Chair:</i>	Analysis of Interference and Design Considerations in Internet of Things Applications Room 3 <i>Francisco Falcone</i>
Sep. 2 14:00 - 18:00 Location <i>Chair:</i>	Understanding EMC / Radio / Automotive Standards, Electromagnetic (EM)-Field-related Testing Room 4 <i>Diethard E.A. Hansen</i>
Sep. 2 14:00 - 18:00 Location <i>Chair:</i>	Near Field Probes: Useful tools for electronic engineers Room 5 <i>Arturo Mediano</i>
Sep. 3 11:40 - 17:00 Location <i>Chair:</i>	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 <i>Chair:</i>	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 <i>Chair:</i>	Paper Preparation for the IEEE EMC Transactions Room 2 <i>John Norgard</i> <i>Perry Wilson</i>
Sep. 6 9:00 - 10:40 Location <i>Chair:</i>	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
<i>Chair:</i>	<i>Fabian Vargas</i>
Sep. 6 11:20 - 18:00	EMI and power quality issues in Smart Cities and Transportation Systems
Location	Room 5
<i>Chair:</i>	<i>Flavia Grassi 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>http://www.emceurope2020.org/</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>https://apemc2020.org/</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>http://www.emc2020.emcss.org/</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>

Social Programme

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

Social Programme

Indications

Sant Pau Art Nouveau Site address:

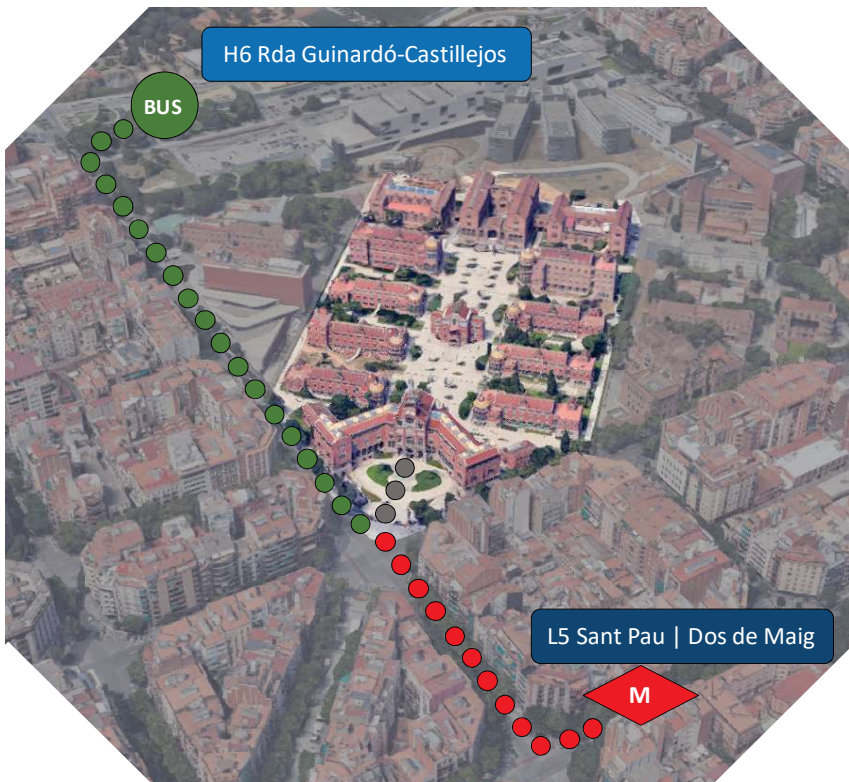
Sant Antoni Maria Claret, 167, 08025 Barcelona

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:


 >
  **H6** >
 

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


 >
  **L9S** >
  **L5** >
 

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	<i>20:00</i> <i>At your arrival, you will enjoy a glass of CAVA accompanied by live music performance</i>
Food served	<i>At 20:30</i> <i>The food will be served inside Les Drassanes</i>
Activities	<i>During the dinner</i> <i>Announcement of the Best Paper and Best Student Paper Award winners, speeches and music performance.</i>
Closing time	<i>22:45</i>

Indications

Les Drassanes address:

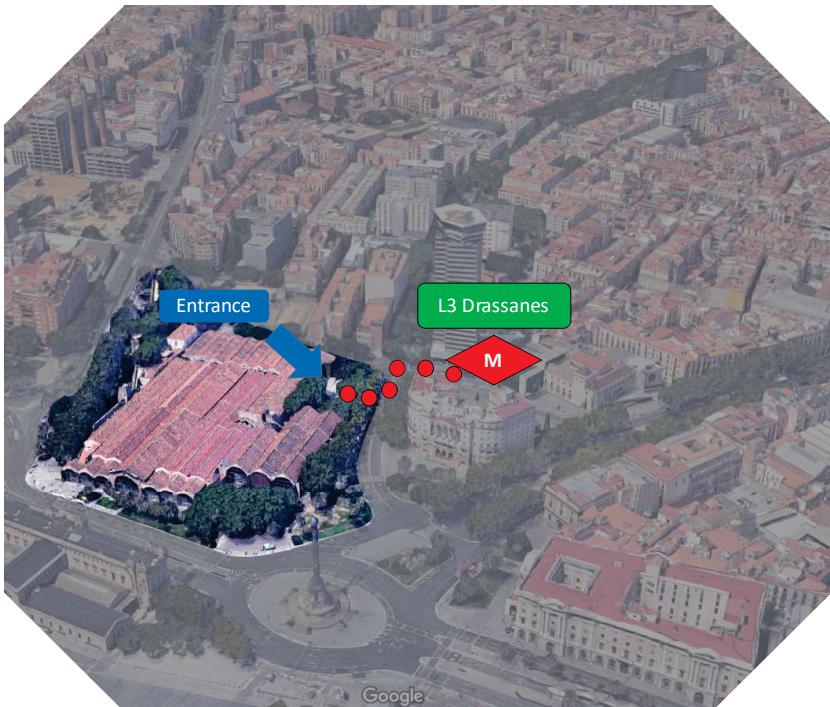
Av. de les Drassanes 1, 08001 Barcelona

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:










from Palau Reial **21 min**


 7 min every 4 min


 **Polytechnic University of Catalonia**
 Campus Nord, Carrer de Jordi Girona, 1, 3,
 08034 Barcelona


 Walk
 ∨ About 6 min , 550 m

 **Palau Reial**

  **Trinitat Nova**
 ∨ 14 min (9 stops) - 

 **Drassanes**

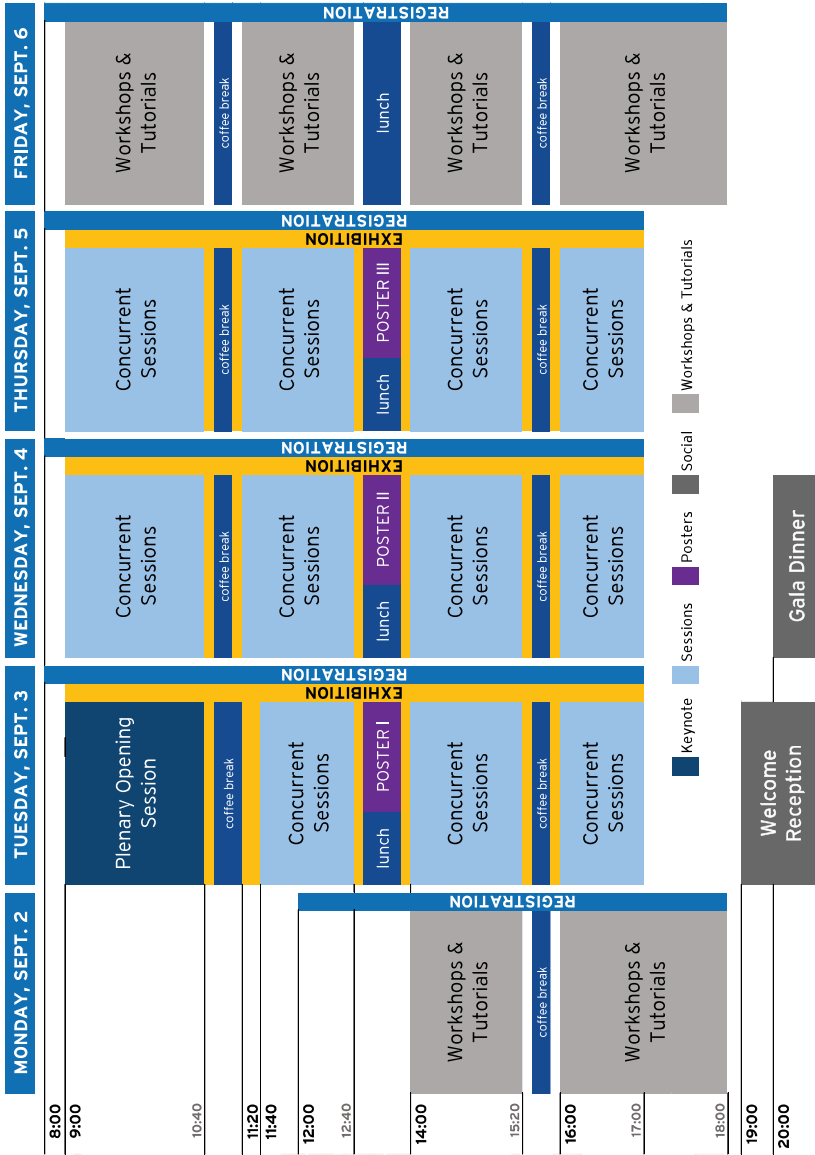
 Walk
 ∨ About 1 min , 94 m

 **Av. de les Drassanes, 2**
 08001 Barcelona

**Look for this
entrance**



Schedule at a glance



- Keynote
- Sessions
- Posters
- Social
- Workshops & Tutorials

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,

214	29	18	120
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.



Monday Schedule

	ROOM 1	ROOM 2	ROOM 3	ROOM 4	ROOM 5
12:00					
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	Understanding EMC / Radio / Automotive Standards, Electromagnetic (EM)-Field-related Testing, update I	Near Field Probes: Useful tools for electronic engineers I
15:20			coffee break		
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	Understanding EMC / Radio / Automotive Standards, Electromagnetic (EM)-Field-related Testing, update II	Near Field Probes: Useful tools for electronic engineers II
18:00					

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

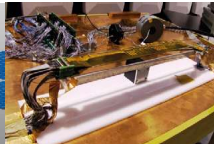
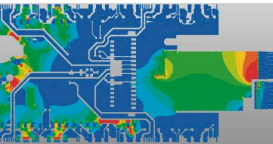
EMC
Electrical Safety

R&D

EMC
Simulation Models
Power Electronics

SECTORS

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



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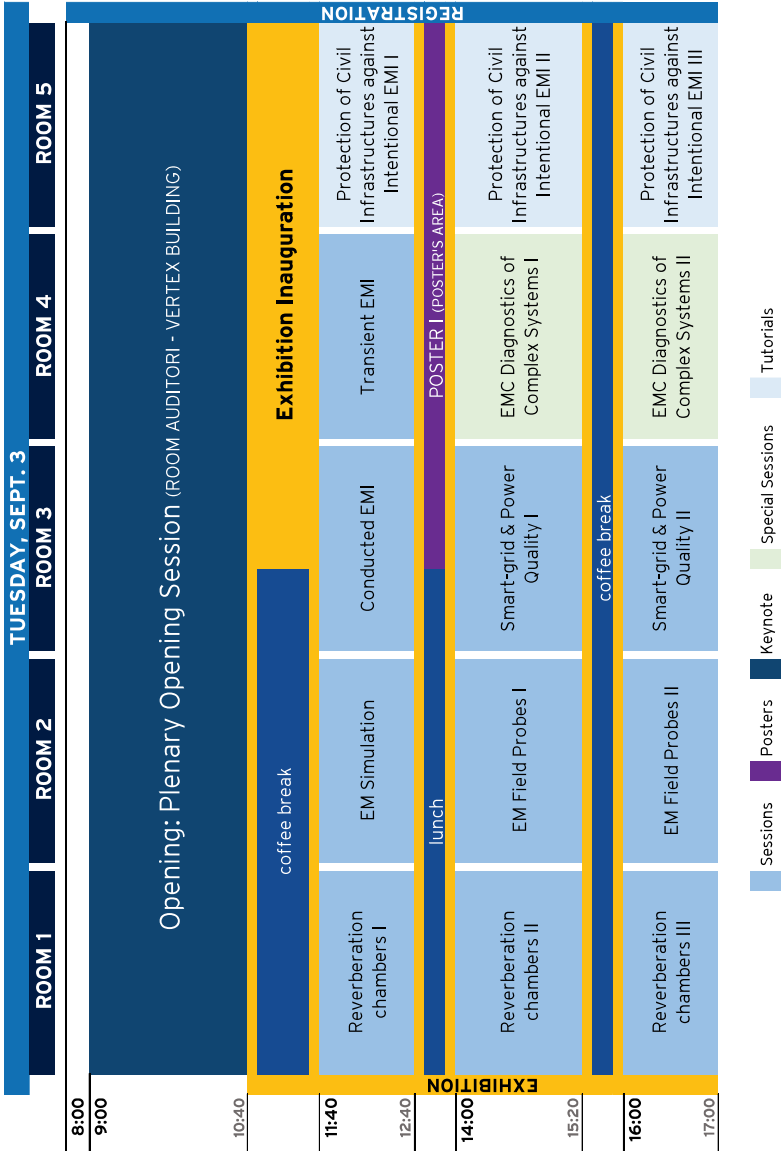
Aragon Institute of Technology

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



Opening	Oral session	9:00 - 10:40
Plenary Opening Session		
Session Chair	Ferran Silva Marc Pous	Auditori VERTEX

SPEECHES

Ferran Silva

Chair of EMC Europe 2019 Barcelona Local Organizing Committee

Jordi Berenguer Sau

Vice-rector for Knowledge Transfer and Innovation 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 Cotó

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

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.

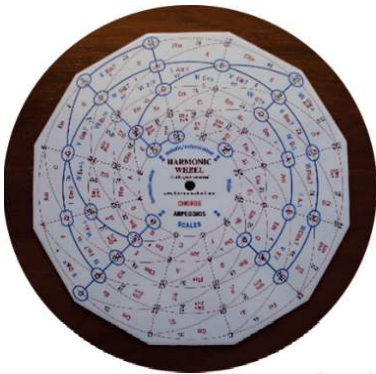
We will also present a number of curious examples, extracted from literature and cinema, that stress current misconceptions about electromagnetism. Finally, we will discuss possible electromagnetic-based threats faced by future astronauts in a manned-mission to Mars."

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 Cotoí.

www.harmonicwheel.com

TONI COTOLÍ

Toni Cotolí 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 Cotolí* (2003), *Entre Amigos* (2007), *Puesta de Sol* (2010), *Sueños* (2014), *Aromas de Guitarra - Oda* (2015) and *Rock Road* (2018).

www.tonicotoli.es



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. Hubrechs¹, L.A. Bronckers², K.A. Remley¹, R. Jones¹, R.D. Horansky¹, A.C.F. Reniers², A. Roc'h², A.B. Smolders²

¹NIST, United States of America; ²Eindhoven University of Technology, The Netherlands

Bayesian Analysis of Reverberation Chamber Measurement Data

Carlo Carobbi¹, Ramiro Serra²

¹Università degli Studi di Firenze, Italy; ²Eindhoven 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 Hackl¹, Martin Ibel^{1,3}, Bernhard Auinger¹, Christian Stockreiter², Bernd Deutschmann³

¹Silicon Austria Labs, Graz, Austria; ²ams AG, Premstätten, Austria; ³Institute 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^{1,2}, Bessem ZITOUNA¹, Jaleddine BEN HADJ SLAMA¹, Lionel PICHON²

¹Université de Sousse, Ecole Nationale d'Ingénieurs de Sousse, LATIS- Laboratory of Advanced Technology and Intelligent Systems, 4023, Sousse, Tunisia; ²Group 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 Bendicks¹, Timo Osterburg¹, Stephan Frei¹, Marc Wiegand², Norbert Hees²

¹TU Dortmund University, Dortmund, Germany; ²Leopold Kostal GmbH & Co. KG, Lüdenscheid, Germany

Comprehensive Analysis of Converter Output Voltage for Conducted Noise Simulation

Daniil 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 Michels¹, Martin Willenbockel², Frank Gronwald¹

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

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

Younghun Lee¹, Youngyu Kim¹, Sunguk Choi², Youngduk Park¹, Junho Choi¹

¹Hanonsystems, Korea, Republic of (South Korea); ²KAIST, 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 Bars¹, Jean-François Rosnarho¹, Philippe Besnier², Jérôme Sol², François Sarrazin³, Elodie Richalot³

¹SIEPEL : Société Industrielle d'Etudes et Protections Electroniques, Impasse de la Manille, F-56470 La Trinité-sur-Mer, France; ²INSA Rennes, CNRS, IETR - UMR 6164, F-35000 Rennes, France; ³Université 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 Bars¹, Jean-François Rosnarho¹, Philippe Besnier², Jérôme Sol², François Sarrazin³, Elodie Richalot³

¹SIEPEL: Société Industrielle d'Etudes et Protections Electroniques, France; ²INSA Rennes, CNRS, France; ³Université 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 (I)

Session Chair Flavia Grassi

Room 3

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

Tom Hartman¹, Marc Pous², Marco Azpúrua², Ferran Silva², Frank Leferink^{1,3}
¹University of Twente, Enschede, the Netherlands; ²Universitat Politècnica de Catalunya, Barcelona, Spain; ³THALES Nederlands B.V., Hengelo, the Netherlands

Low Frequency Conducted Emissions Caused by Series Arc Faults

Christopher James Rose¹, David W P Thomas¹, Christopher Smartt¹, Peipei Meng²

¹University of Nottingham, United Kingdom; ²Wuhan University of Technology, China

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

Zander Marais^{1,2}, Helko van den Brom¹, Gert Rietveld¹, Ronald van Leeuwen¹, Dennis Hoogenboom¹, Johan Rens²

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

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

Bas ten Have¹, Tom Hartman¹, Niek Moonen¹, Frank Leferink^{1,2}

¹University of Twente, Netherlands, The; ²THALES 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 Mordachev¹, Eugene Sinkevich¹, Dzmityr Tsyaneuka¹, Yauheni Arlou¹, Aliaksandr Svistunou¹, Alexey Galenko¹, Andrey Polkanov¹, Andrey Krachko¹, Yingsong Li², Tao Jiang², Wei Xue²

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

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

VALERY TIKHVINSKIY^{1,3}, VIKTOR KOVAL², PAVEL KORCHAGIN², ALTAY AITMAGAMBETOV⁴

¹NIITC LLC, Russian Federation; ²GEYSER-TELECOM Ltd.; ³MOSCOW TECHNICAL UNIVERSITY OF COMMUNICATIONS AND INFORMATICS; ⁴IITU

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

Ivan Shakinka, Dzmityr 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 Andrieu¹, Nicolas Ticaud²

¹XLIM Laboratory, University of Limoges, France; ²CISTEME 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 Rothenhaeusler¹, Alexander Schoisl¹, Martin Schwarz²

¹Airbus Defence and Space GmbH, Germany; ²Wehrtechnische 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 Taue¹, Nao Arita¹, Yoshitaka Toyota²

¹Kochi University of Technology, Japan; ²Okayama University, Japan

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

Hugo Ragazzo¹, Daniel Prost¹, François Issac¹, Stephane Faure², Julian Carrey², Jean-François Bobo³

¹Université de Toulouse; ²INSA; ³CEMES

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 Kuwabara¹, Tohlu Matsushima¹, Yuki Fukumoto¹, Hiroyuki Okumura²
¹Kyushu Institute of Technology, Japan; ²Panasonic Corporation, Japan

Detection Methods for Current Signals Causing Errors in Static Electricity Meters

Fani Barakou¹, Paul Wright¹, Helko van den Brom², Gertjan Kok², Gert Rietveld²
¹National Physical Laboratory, United Kingdom; ²VSL, 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 Mordachev¹, Eugene Sinkevich¹, Dzmitry Tsyankenka¹, Oleg Mikheev², Konstantin Sakharov², Alexander Sukhov², Vladimir Turkin², Wen-Qing Guo³, Xie Ma³, Hao-Yue Zheng³

¹Belarusian State University of Informatics and Radioelectronics, Belarus; ²All-Russian Scientific Research Institute for Optical and Physical Measurements (VNIIOFI); ³China 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 Pous¹, Marco Azpúrua¹, Soydan Çakir², Osman Şen², Ferran Silva¹

¹Universitat Politècnica de Catalunya, Spain; ²TUBITAK UME, Turkey

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

Adnan Carsimamovic¹, Adnan Mujezinovic², Zijad Bajramovic², Irfan Turkovic², Nedis Dautbasic², Milodrag Kosarac¹

¹Independent System Operator in Bosnia and Herzegovina, Bosnia and Herzegovina;

²University 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 Suarez¹, Jorge Victoria^{1,2}, Pedro A. Martinez¹, Antonio Alcarria², Jose Torres¹, Ismael Molina²

¹Department of Electronic Engineering, University of Valencia, Spain; ²Würth

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 González¹, Manuel Lamich Arocas¹, Carlos Bernal Ruiz²

¹Universitat Politècnica de Catalunya, Spain; ²Universidad de Zaragoza, Spain

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

Bas ten Have¹, Tom Hartman¹, Niek Moonen¹, Frank Leferink^{1,2}

¹University of Twente, Netherlands, The; ²THALES 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 Ural¹, Can Bayseferogullari²

¹ASELSAN Inc. Turkey, Turkey; ²ASELSAN Inc. Turkey, Turkey

Autonomous electromagnetic mapping system in augmented reality

RIOULT Jean¹, DEGRANDE Samuel², BREMARD Nicolas², COPIN Gregoire³, DENIAU Virginie¹

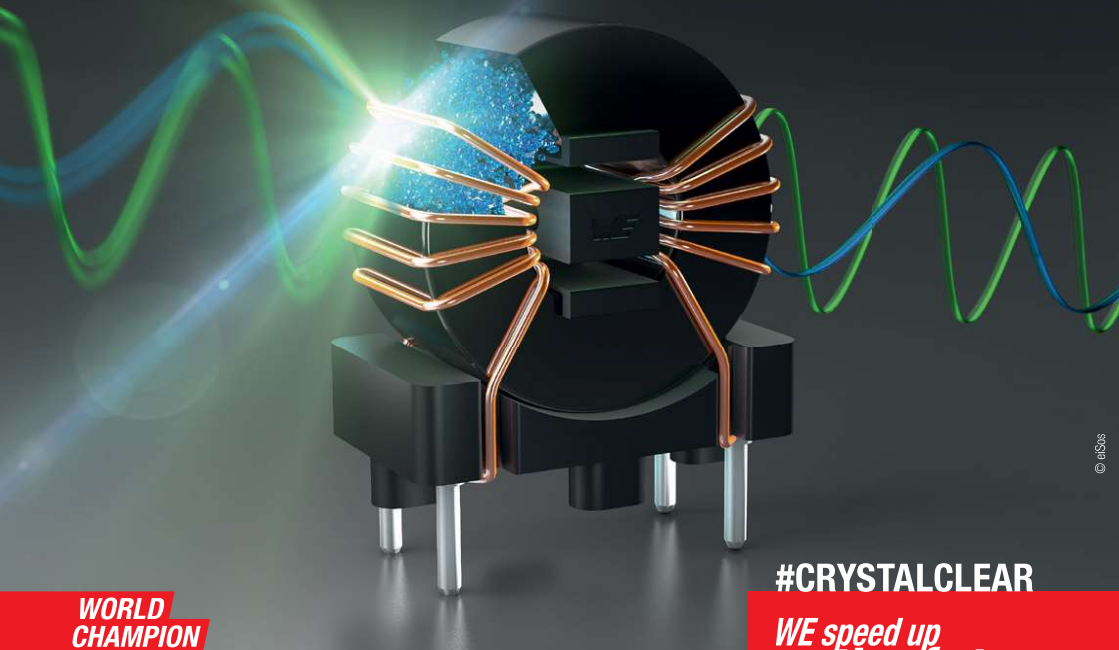
¹IFSTTAR, France; ²IRCICA/CRISTAL; ³LUXONDES

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	EXHIBITION				
9:00	Aeronautics	Power Electronics I	Electromagnetic Eavesdropping TEMPEST	New materials for EMC	Challenges in Special Applications of Electrically Small, HF Vehicular Antennas I
10:40	coffee break				
11:20	Statistics on EMC	Power Electronics II	Standards & Regulations	Transmission lines	Challenges in Special Applications of Electrically Small, HF Vehicular Antennas II
12:40	lunch				
14:00	Electromagnetic Environmental Effects on Aircrafts	Near-Field techniques I	Metrology on EMC I	Shielding & grounding I	Challenges in Special Applications of Electrically Small, HF Vehicular Antennas III
15:20	coffee break				
16:00	Magnetometric Instruments and New Methodologies of Calibration and Testing for Space Magnetism	Near-Field techniques II	Metrology on EMC II	Shielding & grounding II	Challenges in Special Applications of Electrically Small, HF Vehicular Antennas IV
17:00	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 Monferran¹, Christophe Guiffaut¹, Alain Reineix¹, Fabian Fustin², Fabrice Tristant²

¹XLIM laboratory, Limoges, France; ²Dassault Aviation Company, Saint-Cloud, France

Characterization at High Frequencies of Planar Transformers for Aeronautical Converters

Carlos Dominguez-Palacios, Joaquin Bernal, Mariangeles Mart n-Prats

University of Seville, Spain

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

Daniel Prost¹, Fran ois Issac¹, Maxime Romier²

¹ONERA, France; ²CNES, France

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

Jan  ckerseifer¹, Martin Aidam², Markus Rothenh usler³, Frank Gronwald¹

¹University of Siegen, Germany; ²Daimler AG, Germany; ³Airbus 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-N reimberg, 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 Birukawa¹, Yu-ichi Hayashi², Takaaki Mizuki³, Hideaki Sone³

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

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

Ireneusz Kubiak, Artur Przybysz

Military Communication Institute, Poland

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

Kimihito 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 Hamid¹, Dirk Heberling^{1,2}

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

Lightning Direct Effect and Electromagnetic Shielding Analysis of Conductive Aircraft Composite

Richard Xian-Ke Gao¹, Hui Min Lee¹, Zaifeng Yang¹, Warintorn Thitsartarn², Si-Ping Gao³, En-Xiao Liu¹

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

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

Alessandro Giuseppe D'Aloia^{1,2}, Marcello D'Amore^{1,2}, Maria Sabrina Sarto^{1,2}

¹DI/AEE - Sapienza University of Rome; ²Research Center for Nanotechnology applied to Engineering of Sapienza University

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

Liping Yan¹, Liuliu Xu¹, Xiang Zhao¹, Richard Xian-Ke Gao²

¹Sichuan University, China, People's Republic of; ²Institute 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^{1,2}, Philippe BESNIER¹, Stéphane VAUCHAMP², Philippe Pouliguen³

¹INSA Rennes,CNRS,IETR, France; ²CEA DAM, Gramat, France; ³DGA, 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^{1,2}, Philippe BESNIER¹, Béatrice AZANOWSKY²

¹IETR CNRS, France; ²Thales, France

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

Oussama Gassab¹, Liang Zhou¹, Wen-Yan Yin^{1,2}

¹Key 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; ²Information 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 Wunsch¹, Skibin Stanislav¹, Thomas Christen¹, Ville Forsstrom²

¹ABB Corporate Research, Switzerland; ²ABB 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 Fisahn¹, Hoang Duc Pham¹, Sebastian Koj², Sergei Sandmann¹, Heyno Garbe¹

¹Leibniz Universität Hannover, Germany; ²IAV GmbH, Gifhorn

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

Younghun Lee¹, Keunsu Kim¹, Jeonggil Heo¹, Youngduk Park¹, Ickjae Yoon²

¹Hanonsystems, Korea, Republic of (South Korea); ²Chungnam 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 Pissoor^t, 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^L, 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

Ihssane 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 Cano¹, Guadalupe Gutierrez¹, Raul Molero¹, Hugo Tavares², Angel Ramirez³

¹Airbus, Spain; ²ISQ, Portugal; ³LCOE, Spain

Lightning Strike Protection of Radomes

Christian Karch², Christian Paul¹, Fridolin H. Heidler¹

¹University of the Federal Armed Forces Munich, Germany; ²Airbus Defence and Space GmbH, Mancingh, Germany

A refresh on HIRF Equipment susceptibility above 8GHz

Frédéric THEROND¹, Didier DE-MATA², Marc MEYER³, Marc PONCON³, Fabrice TRISTANT⁴, Eric LACAM⁵, Franck FLOURENS¹, Alain SAUVAGE¹

¹Airbus Operations SAS, France; ²Liebherr-Aerospace Toulouse SAS, France;

³Airbus Helicopters SAS, France; ⁴Dassault Aviation, France; ⁵DGA-Aeronautical Systems, France

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

PATRICIA GÓMEZ¹, DAVID ESCOT¹, BORJA PLAZA², SERGIO FERNÁNDEZ¹, DAVID POYATOS¹

¹INTA, Spain; ²ISDEFE, 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 Kuznetsov¹, Andrey Baev¹, Anastasia Gorbunova¹, Maxim Konovalyuk¹, Johannes A. Russer², Michael Haider², Peter Russer²

¹Moscow Aviation Institute (National Research University), Russian Federation; ²Technische 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 Baev¹, Yury Kuznetsov¹, Anastasia Gorbunova¹, Maxim Konovalyuk¹, Johannes A. Russer², Michael Haider², Peter Russer²

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

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

Emanuel Panholzer^{1,2}, Martin Aidam¹, Walter Franz¹, Simon Senega², Stefan Lindenmeier²

¹Dep. of EMC and Antennas, Daimler AG, Sindelfingen, Germany; ²Institute 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 Tas¹, Frédéric Pythoud¹, Dongsheng Zhao²

¹Swiss Federal Institute of Metrology METAS, Switzerland; ²RHEA 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. Azpurua¹, Marc Pous¹, Ferran Silva¹, Martin Hudlička²
¹Universitat Politècnica de Catalunya; ²Czech 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^{1,2,3}, Tom Hartman¹, Cees Keyer^{1,2}, Jan-Kees van der Ven³

¹University of Twente, Enschede, the Netherlands; ²Amsterdam University of Applied Sciences, Amsterdam, the Netherlands; ³Imtech 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^{1,2}, Blaise Ravelo²

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

Screening effectiveness of unscreened balanced pairs

Bernhard Mund¹, Thomas Hähner², Thomas Schmid³

¹bda connectivity GmbH, Germany; ²Nexans France, France; ³Rosenberger 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 Romero¹, María Concepción Parrondo Sempere¹, Marina Díaz Michelena¹, Ignacio Muñoz Rebate², Marina León Calero², Santiago Martín Iglesias², Borja Plaza Gallardo³, David Escot Bocanegra³, David Poyatos Martínez³, María Jiménez Lorenzo⁴, Daniel López Sanz⁴

¹Payloads and Space Sciences Department, INTA, Spain; ²Space Advanced Prototyping Laboratory, INTA, Spain; ³Radiofrequency Area, INTA, Spain; ⁴Electromagnetic Compatibility Area, INTA, Spain

New magnetometric devices for planetary exploration

Jose Luis Mesa Uña¹, Marina Pérez Jimenez², Amanda Arlensú Ordoñez Cencerrado¹, Cristina Lavín García³, Reinel Marante³, Laura González Pérez³, Claudio Aroca Hernández-Ros², Marina Díaz Michelena¹

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

New techniques of magnetic cleanliness for present and near future missions

Marina Diaz Michelena¹, Amanda Arlensú Ordoñez Cencerrado¹, Javier de Frutos Hernansanz¹, Miguel Ángel Rivero Rodríguez²

¹Payloads and Space Sciences Dept. INTA, Spain; ²ISDEFE 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^{1,2}, Robert Vogt-Ardatjew¹, Mohd Hafiz Baharuddin^{5,6}, Zbigniew Jóskiewicz³, Monika Ewelina Szafranska³, Eugen Coca⁴, David Thomas⁵, Frank Leferink^{1,7}

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

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

Sequential adaptive sampling algorithm to reduce the near field measurement time

Sebastien Serpaud^{1,2}, Alexandre Boyer², Sonia Ben Dhia²

¹IRT Saint Exupéry, France; ²CNRS, 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 Pusch¹, Martin Willenbockel², Tomas Hurtig³, Michael Suhrke¹, Sven Ruge¹, Michael Jöster⁴, Benjamin Jörres¹

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

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

Shinichi Okuyama¹, Nobuo Kuwabara², Hidenori Muramatsu³

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

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

Takanori Uno¹, Toshiyasu Tanaka³, Koji Maeda², Hironori Okamoto⁴, Osami Wada⁵

¹DENSO EMC ENGINEERING SERVICE, Japan; ²Aisin Seiki Co., Ltd.; ³Microwave Factory Co., Ltd.; ⁴Kansai Electronic Industry Development Center; ⁵Kyoto 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^{1,2}, Vasiliki Gkatsi^{1,2}, Anne Roc'h³, Robert Vogt-Ardatjew⁴, Hans Schipper¹, Frank Leferink^{1,4}

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

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

Yanling Wang¹, Tim Claeys², Davy Pissoort²

¹Xi'an Microelectronics Technology Institute, China, People's Republic of; ²KU 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

Kyoungsun Kim^{1,2}, Dohyung Kim², Junhee Han¹, Jooyeon Lee¹, Wansoo Nah¹

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

Investigation of Magnetic Permeability of Toroidal Cores

Zviad Kutchadze^{1,2}, Anna Gheonjian^{1,2}, Roman Jobava^{1,2}

¹EMCoS LLC, Tbilisi, Georgia; ²Tbilisi 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 Hino¹, Hirobumi Watanabe²

¹RICOH Electronic Devices Co., Ltd., Japan; ²RICOH Co., Ltd., Japan

Current-based EMF-assessment method for vehicles

Benjamin Willmann^{1,2}, Hanno Rabe¹, Christoph Leugers², Oussama Sassi¹, Christian Waldera¹, Ralf Vick²

¹VOLKSWAGEN AG, Germany; ²Otto-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 Vidal², Peio López Iturri¹, Ana Belén Resano¹, Francisco Falcone²
¹UPNA, Spain; ²NAITEC

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 Park¹, Jong Hwa Kwon²

¹The University of Suwon, Korea, Republic of (South Korea); ²ETRI, 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 Serdiuk¹, Volodymyr Havryliuk¹, Mauro Feliziani², Kseniia Serdiuk¹

¹Dnipropetrovsk National University of Railway Transport named after Academician V. Lazaryan; ²University 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 Li¹, Ahalya Srikanth¹, Praveen Gurrala², Nitin Parsa³, Isao Hoda⁴, Hiroki Funato⁴

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

Extending Functionality of the IMEI DataBase: Clone Blocking System

Igor Gepko

Ukrainian State Centre of Radio Frequencies, Ukraine



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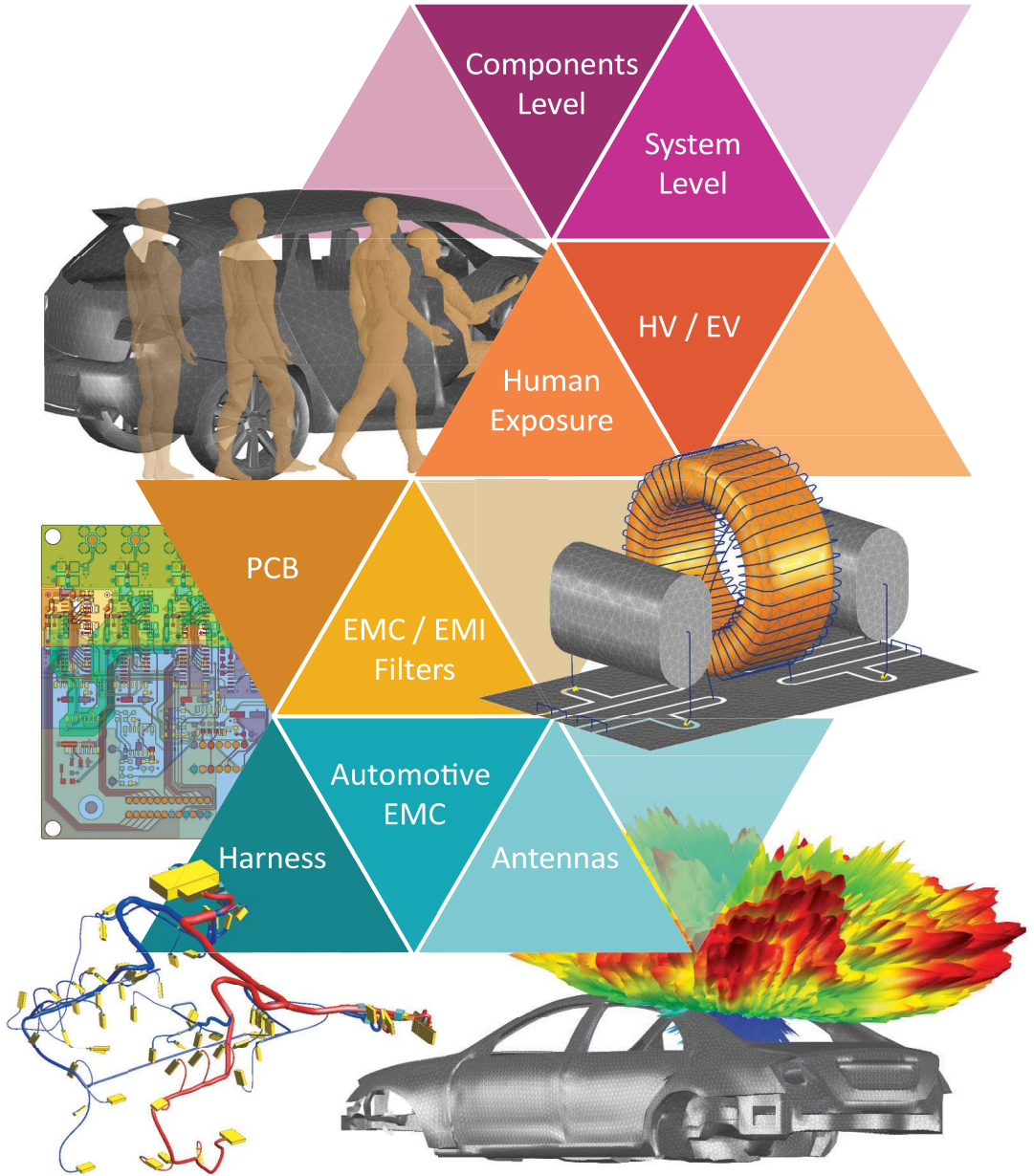
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Thursday

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

- 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 Sassi¹, Naseef Mahmud², Pascal Hervé³

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

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

Oussama Sassi¹, Naseef Mahmud², Pascal Hervé³

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

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

Ting Sun¹, Marius Vierheller², Alexander Stieler¹, Vincent Speckmann¹, David Bollati², Matthias Hampe¹

¹Ostfalia University of Applied Sciences, Germany; ²C&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 Abedi¹, Sameer Hemmady¹, Thomas Antonsen², Edl Schamiloglu¹, Payman Zarkesh-Ha¹

¹University of New Mexico, United States of America; ²University of Maryland, United States of America

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

Marko Magerl¹, Christian Stockreiter¹, Adrijan Baric²

¹ams AG, Austria; ²University 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 Iglesias¹, Philipp Leitl², Felix MÜLLER², Francisco Javier Arcega³, Hans-Günther Moser², Christian Kiesling², Alvaro Pradas¹, Iván Echeverría¹, Fernando Arteche¹, Francisco Javier Piedrafita¹

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

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

Yves Thurel¹, Frederick Bordry¹, Alain Charoy²

¹CERN, Switzerland; ²AEMC, France

[Electromagnetic pulse in target area at CLPU](#)

Kwinten Nelissen⁴, Massimo De Marco¹, Giancarlo Gatti¹, Valeria Ospina^{1,2}, Istrotz Dotr³, M Liszi², Christos Kamperidis⁴, Luca Volpe^{1,2}

¹Centro de laseres pulsados, Villamayor, Spain; ²Universitá de Salamanca, Salamanca, Spain; ³Radiofrequency Test Laboratory-Szchenyi Istvan University, Gyor, Hungary; ⁴ELI-ALPS, Szeged, Hungary

[EMC versus Safety in Physics Research](#)

Friedrich Szonco, 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](#)¹, [Frank Klotz](#)¹, [Stefan Jahn](#)¹, [Robert Weigel](#)²

¹Infiniteon Technologies AG, Germany; ²Friedrich-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](#)¹, [Tadatoshiki Sekine](#)²

¹Graduate School of Integrated Science and Technology, Shizuoka University, Japan; ²Shizuoka 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](#)¹, [Marc Meyer](#)¹, [Christophe Guiffaut](#)², [Alain Reineix](#)²

¹Airbus Helicopters, France; ²Xlim 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

Yuangong Guo¹, Srinath Penugonda¹, Minh Kim², Junesang Lee², Jung-rae Ha², Sangwon Yun², Jun Fan¹, Hongseok Kim¹

¹Missouri University of Science and Technology, United States of America;

²MANDO Co., Ltd., Republic of Korea

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

Sergey Miropolsky, Marlon Roebi, Frank Klotz

Infinion 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 Nagata¹, Koh Watanabe¹, Yoshifumi Sugimoto¹, Noriyuki Miura¹, Satoshi Tanaka², Yasunori Miyazawa², Masahiro Yamaguchi²

¹Kobe University, Japan; ²Tohoku 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 Galic¹, Aarnout Wieers², Renaud Gillon², Adrijan Barić¹

¹Faculty of Electrical Engineering and Computing, Unska 3, 10000 Zagreb, Croatia; ²ON 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 Simons¹, Abdulaziz Haddab², Joshua Gordon³, Christopher Holloway³

¹Department of Physics, University of Colorado, United States of America;

²Department of Electrical Engineering, University of Colorado, United States of America; ³National 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 Xue¹, Dan Shi², Yeyang He³, Chaoying Li⁴

¹Beijing University of Posts and Telecommunications, China, People's Republic of;

²Beijing University of Posts and Telecommunications, China, People's Republic of;

³Beijing University of Posts and Telecommunications, China, People's Republic of; ⁴Beijing 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 Trincherò, Flavio Canavero

Politecnico di Torino, Italy

HPC Simulations of a Reverberation Chamber with Nonparallel Walls

Luca Bastianelli¹, Gabriele Gradoni^{2,3}, Franco Moglie¹, Valter Mariani Primiani¹

¹Universita` Politecnica delle Marche, Italy; ²School of Mathematical Sciences, UK; ³George 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 Ruddle

Room 1

Reference Setup for RF Impedance Measurements with High DC Bias Currents

Oliver Kerfin¹, Martin Harm¹, Benjamin Willmann^{2,3}

¹TU Braunschweig, Institute for Electromagnetic Compatibility, Germany; ²Volkswagen AG, Wolfsburg, Germany; ³Otto-von-Guericke University, Magdeburg, Germany

An Active Common Mode EMI Filter Approach introducing Predictive Pulsed Compensation

Denis Mueller, Desirée Nadine Schweitzer, Michael Bettle, 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 Benz¹, Andreas Klaedtke¹, Jan Hansen¹, Stephan Frei²

¹Robert Bosch GmbH, Germany; ²TU 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 Bechet¹, Robert Helbet¹, Simona Miclaus², Iulian Bouleanu², Annamaria Sarbu², Paul Bechet²

¹Technical University of Cluj Napoca, Romania; ²Land 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 ALILOU¹, François GRANGE², Nabil ABDELLI¹, Sébastien JOURNET², José RIBEIRO¹, Attibaud KOUASSI², Cyril MANISCALCO¹, Farid P. DAWALIBI³, Alexandre MACHET¹

¹SYSTRA, Paris, France; ²SES-EUROPE, Vienne, France; ³SES, 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^{1,2}, Kaoru Gotoh¹, Yasushi Matsumoto¹, Ryosuke Suga², Osamu Hashimoto²

¹National Institute of Information and Communications Technology, Japan;

²Aoyama 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 Pornin¹, Tan Phu Vuong¹, Gilbert Angenieux², Pascal Xavier¹

¹Grenoble INP IMEP-LaHC, France; ²Universite Savoie-Mont Blanc, IMEP LaHC, France

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

Hanyu Li¹, Xianfeng Bao², Haijing Zhou¹

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

Recent Advances to the Feko Integrated Cable Harness Modeling Tool

Marlize Schoeman¹, Elia A. Attardo², Jordi Soler-Castany³

¹Altair Development SA (Pty) Ltd; ²Altair Engineering GmbH; ³Altair Engineering Inc

A Simplified Modeling Of Transient Electromagnetic Coupling In Air Insulation Substation

Bachir Nekhou¹, Bochra Khelifi¹, Kamal Kerroum²

¹UJijel university, Algeria; ²Institut 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 Benz¹, Jan Hansen¹, Stephan Frei²

¹Robert Bosch GmbH, Germany; ²TU 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 Mortazavi¹, Detlef Schleicher¹, Diana Eremyan², Anna Gheonjian², Roman Jobava², Ali Sinai³, Friedel Gerfers⁴

¹Volkswagen AG, Germany; ²EMCoS Ltd., Georgia; ³University of Applied Sciences Berlin, Germany; ⁴Technische 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-Bilbao¹, Juan Blas², Jolanta Karpowicz³, Victoria Ramos¹

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

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

Tommaso Campi¹, Silvano Cruciani¹, Francesca Maradei², Mauro Feliziani¹

¹University of L'Aquila, Italy; ²Sapienza 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 Azpúrúa

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 Romero¹, Virginie Deniau², Olivier Stienne³

¹Railenium, France; ²IFSTTAR, Railenium; ³ICAM, 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^{1,2}, Haijing ZHOU¹, Hanyu LI¹, Xianfeng BAO^{1,2}, Longquan ZHONG^{3,4}

¹CAEP Software Center for High Performance Numerical Simulation;

²Institute of Applied Physics and Computational Mathematics; ³CAEP Complicated Electromagnetic Environment Laboratory; ⁴Institute 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 Buesink¹, Robert Vogt-Ardatjew¹, Frank Leferink^{1,2}

¹University of Twente, Netherlands, The; ²Thales Netherlands B.V. Hengelo

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

Narimasa Takahashi¹, Masato Shobayashi², Masato Higashi², Eriko Yamato³, Robert Carter³, Yoshi Fukawa⁴

¹TOTAS Co.,Ltd., Japan; ²Kinki Polytechnic College; ³Oak-Mitsui Technologies LLC; ⁴TOYOTech 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 Lannoo¹, Jonas Van Waes², Dries Vanoost¹, Jeroen Boydens², Davy Pissoort¹

¹KU Leuven, Department of Electrical Engineering; ²KU Leuven, Department of Computer Science

Topology-Optimization-Based EMC Design

Katsuya Nomura¹, Atsuhiko Takahashi¹, Takashi Kojima¹, Shintaro Yamasaki², Kentaro Yaji², Hiroki Bo², Kikuo Fujita²

¹Toyota Central R&D Labs., Inc.; ²Department 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^{1,2,3}, SONIA BENDHIA^{2,3}, TRISTAN DUBOIS⁴

¹IRT SAINT EXUPERY, France; ²LAAS-CNRS, France; ³INSA TOULOUSE, France; ⁴IMS 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 Yoo¹, Tongho Chung¹, Namkyoung Kim¹, Byongsu Seo¹, Young-pyo Hong², Dong-joon Lee²

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

EMC "Black Box" model for imbalanced power electronic converters

Amina GAHFIF¹, Pierre-etienne LEVY¹, Francois COSTA², Mounira BERKANI², Marwan ALI¹

¹SAFRAN SA, France; ²Université 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 Chigovani¹, Irina Oganezova^{1,2}, Giga Gabriadze^{1,2}, Michael Kuehn³, Marcel Messer³, Roman Jobava^{1,2}

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

Interlaboratory Comparison of Radiated Immunity in Automotive EMC

Andrei-Marius Silaghi¹, Relu-Adrian Aipu², Aldo De Sabata¹, Catalin Balan¹, Petre-Marian Nicolae²

¹University Politehnica Timisoara, Romania; ²University of Craiova, Romania

Fabrication process effects on power cable parameters

Francisco Javier Arcega¹, Adilson Alberto Moyses¹, Mateo Iglesias², Fernando Arteche²

¹University of Zaragoza, Spain; ²ITAINNOVA · 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 Mezoued¹, Abdelmalek Laissaoui¹, Bachir Nekhoul², Kamal Kerroum³, Khalil El Khamlichi Drissi³

¹USTHB, Algeria; ²Jijel University, Jijel, Algeria; ³Blaise Pascal University, Clermont Ferrand, France

Study on Grounding Ways of Secondary Cable in UHVDC Converter Substation

Lei Yan¹, Weidong Zhang¹, Jianfei Ji², Zhaohua Zhang³, Weidong Shi³

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

EMC SHIELDING SOLUTIONS



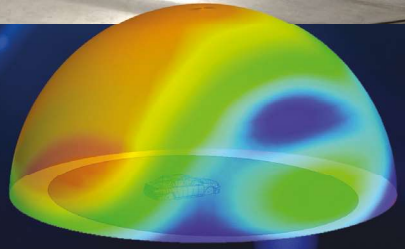
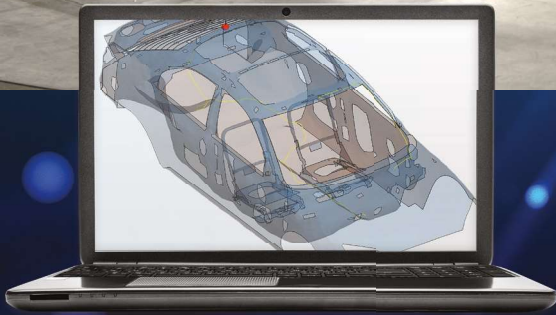
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FRIDAY, SEPT. 6		ROOM 1	ROOM 2	ROOM 3	ROOM 4	ROOM 5
8:00	9:00	Automotive EMC I	Paper Preparation for the IEEE EMC Transactions	Uncertainty about uncertainties along the EMC-compliance chain	Measurements of conducted emissions in time domain and power-line filter design	Ionizing Radiation & Electromagnetic Interference on Integrated Circuits: from the need of combined tests to current solutions
	10:40					
11:20	12:40	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	EMI and power quality issues in Smart Cities and Transportation Systems I
14:00	15:20	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	EMI and power quality issues in Smart Cities and Transportation Systems II
16:00	18:00	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	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:

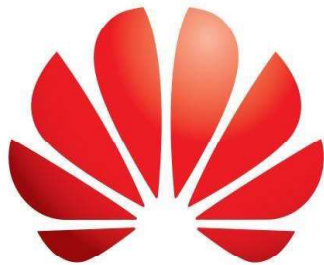
- EM Interferences caused by power converting systems in automotive applications, Sven Fisahn, Leibniz Universität Hannover, Hannover, Germany.
- Conducted EMI Research in Europe: Why, and How SCENT and ETOPIA projects, Frank Leferink, University of Twente, Enschede, The Netherlands.
- EMC testing in 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 Trincherio, Politecnico di Torino, Italy.
- EMI in a Smart Grid containing different power sources, Petre-Marian Nicolae, Ileana-Diana Nicolae, University of Craiova, Romania..

A dark blue background featuring a glowing hexagonal network pattern. A central hexagon contains the text "5G" in a light blue font. To its right is a blue padlock icon. The background is filled with a grid of small white dots, and a faint world map outline is visible. In the bottom right corner, the Huawei logo and the word "HUAWEI" are displayed in white.

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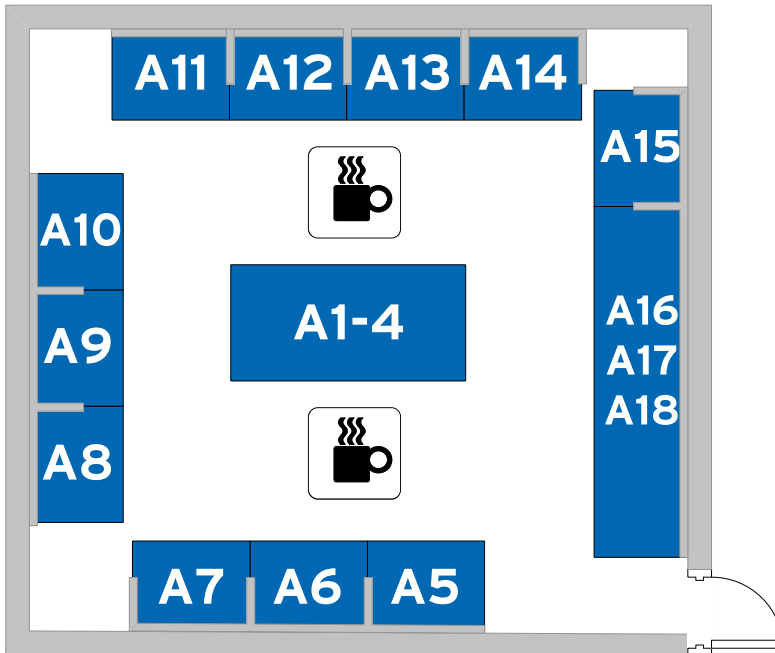
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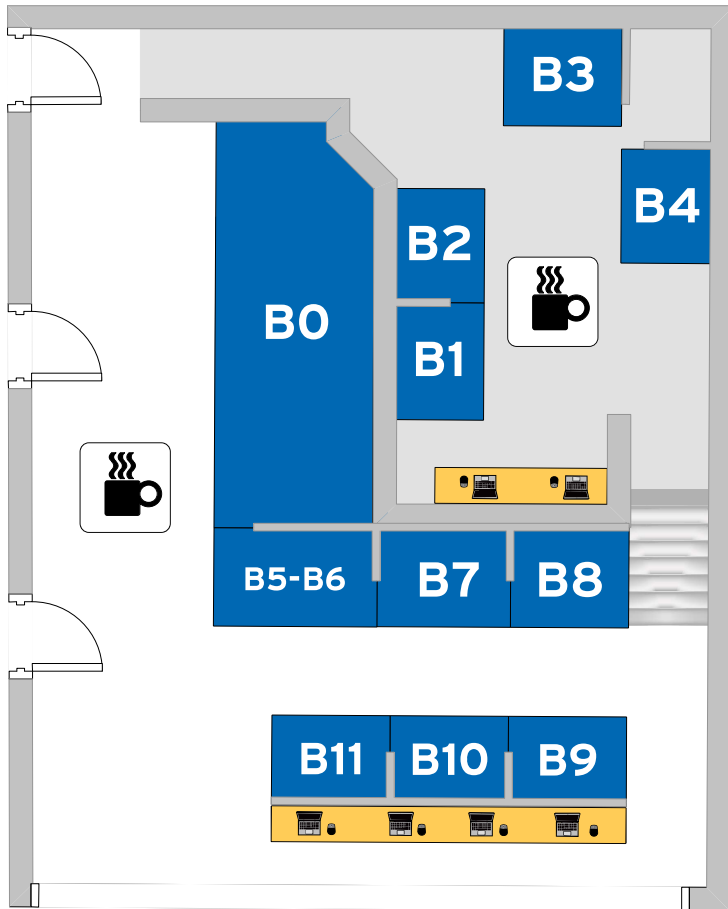
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