



Digital, 22 - 26 March 2021
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Workshop program



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Committee

Committee chair

Dipl.-Phys. Detlef Hoffmann Webasto Roof & Components SE

Committee members

Prof. Dr.-Ing. Sven Battermann	Fachhochschule Bielefeld
Dipl.-Ing. Holger Bentje	PHOENIX TESTLAB GmbH
Prof. Dr.-Ing. Ulrich Bochtler	Hochschule Aschaffenburg
Dr.-Ing. Christian Bornkessel	TU Ilmenau
Dipl.-Ing. Dirk Eyfrig	SICK AG
Prof. Dr.-Ing. Heyno Garbe	Leibniz Universität Hannover
Alexander Gerfer	Würth Elektronik eiSos GmbH & Co. KG
Dr. David Hamann	IAV GmbH
Dr.-Ing. Diethard Hansen	EURO EMC SERVICE
Dr.-Ing. Ralf Heinrich	AMETEK CTS Europe GmbH
Armin Hudetz	SGS Germany GmbH
Dr. Bernd Jäkel	Siemens AG
Jörg Jelen	Leutron GmbH
Jens Medler	Rohde & Schwarz GmbH & Co. KG
Dipl.-Ing. Gerhard Pohlmann	öffentlich bestellter und vereidigter Sachverständiger für EMV
Prof. Dr.-Ing. Matthias Richter	Westsächsische Hochschule
Dipl.-Ing. Karl Rippl	Dt. Gesellschaft für EMV-Technologie e.V.
Prof. Dr.-Ing. Ralf Vick	Otto-von-Guericke-Universität
Prof. Dr.-Ing. Matthias Wuschek	Hochschule Deggendorf
Ema Ziga	EMC Test NRW GmbH

Program overview (only English language workshops)

Monday 22 March 2021	
10 a.m. – 1 p.m.	<p>WORKSHOP 4</p> <p>Basics: Understanding EMC/Radio/Automotive Standards – Focus: Electromagnetic Field related testing -update Norms- Dr. Diethard Hansen, EURO EMC SERVICE (EES) Dr. Hansen Consulting</p>
1 p.m. – 3 p.m.	Networking time
Tuesday 23 March 2021	
9 a.m. – 12 a.m.	<p>WORKSHOP 11</p> <p>Advanced: Understanding EMC/Radio/ Automotive Standards – Focus: Electromagnetic Field related testing -Standards update- Dr. Diethard Hansen, EURO EMC SERVICE (EES) Dr. Hansen Consulting</p>
12 a.m. – 2 p.m.	Networking time / Lunch break
2 p.m. – 5 p.m.	<p>WORKSHOP 13</p> <p>EMC filters, design applications and tricks Prof. Dr. Frank Leferink, University of Twente</p>
Wednesday 24 March 2021	
10 a.m. – 1 p.m.	<p>WORKSHOP 17</p> <p>Radio Modules and Integration into Electronic Equipment for FCC, ISED and RED Michael Derby, Element Materials Technology</p>
1 p.m. – 2 p.m.	Networking time / Lunch break
2 p.m. – 5 p.m.	<p>WORKSHOP 19</p> <p>EMC in electrical drive systems Prof. Dr. Frank Leferink, University of Twente</p> <p>WORKSHOP 21</p> <p>EM Resilience: A Necessity for Safe and Reliable Electronic Systems! Prof. Dr. Davy Pissort, KU Leuven</p>
Thursday 25 March 2021	
9 a.m. – 12 a.m.	<p>WORKSHOP 24</p> <p>Shielding in practice Prof. Dr. Frank Leferink, University of Twente</p>
12 a.m. – 2 p.m.	Networking time / Lunch break
2 p.m. – 5 p.m.	<p>WORKSHOP 27</p> <p>Electromagnetic Compatibility of Switched-Mode Power Supplies Prof. Dr. Günter Keller, Technische Hochschule Deggendorf (THD)</p> <p>WORKSHOP 30</p> <p>Grounds in PC Boards and Cables. How to understand, find, fix, and avoid low and high frequency noise problems, including current probe demonstrations. Lee Hill, SILENT Solutions LLC</p>

As of January 2021. Subject to change without notice.

Workshops

Workshop 4

Monday, 22 March 2021

Basics: Understanding EMC/Radio/ Automotive Standards – Focus: Electromagnetic Field related testing -updated Norms-

Dr. Diethard Hansen, EURO EMC SERVICE (EES) Dr.
Hansen Consulting (Schweiz)

Basic EMC/ Radio/Wireless/Automotive (ESA) lab testing background/knowledge. Focus: electromagnetic (EM) field related testing, mostly a less understood topic. Author has global industry and gov.-experience (25+Y) in auditing and consulting.

Understanding physics/history/common principles in testing, incl. Mil-STD; calibration, instruments, sensors, antennas, and EM test sites (radiated emissions, immunity). Standard's limitations and agreed Tech-Compromises in CE product compliance testing are 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, Standards updated, 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 (EM-Fields) 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. Time permitting: Demo on free internet "help tools".

Target group

Target group is all people involved in product approval (mainly CE) EMC/wireless testing, electronics design/development. It may also be helping Sales/Marketing as well as CEO/CTO.

Requirements for participants

This workshop starts at basic level, however fundamental understanding of electrical engineering (or similar physics) issues is recommended.

Workshop 11

Tuesday, 23 March 2021

Advanced: Understanding EMC/Radio/ Automotive Standards – Focus: Electro- magnetic Field related testing -Standards update-

Dr. Diethard Hansen, EURO EMC SERVICE (EES) Dr.
Hansen Consulting (Schweiz)

The WS builds on the Basics and provides advanced knowledge in latest EMC/ Radio/ Wireless and partly automotive (ESA) lab "EM-Field" testing of EU CE product compliance. EM- Field testing seems often complex. The author has assessed 400+ accredited test labs globally. Test standards and procedures change (e.g. CISPR 16, IEC 61000-4-x). Most is driven by the EU CE EMC-D and RE-D/ Blue Guide –product risk assessment/ maintaining quality over life-span of product.

Focus: Test Standards update, technically suitable calibration, instruments, field-sensors, antennas and EM test site related set-up (e.g. Absorber lined Chambers/Qualification testing e.g. NSA 30 to 1 GHz, SVSWR 1 to 18 GHz, TDR?, <30M, 40G+?), for radiated emissions (RE) and immunity (RI), will be highlighted in detail.

Case studies for commonly used lab equipment will be shown, including wrong applications. There are e.g. various antennas for radiated emissions and immunity like Bicone, Log-Per, stacks, horns and TEM Wave Guides, all with application limits.

Antenna factors vs. frequency, radiation pattern and sensitivity need to correspond with the chosen radiated emission standard and test distance. Broad-Band power amplifiers for RI will be assessed based on frequency, CW, pulse power specs, harmonics, and noise-floor. "Field"-relevant technical test cases with typical limitations/compromises get elucidated. Are all operational modes of the EUT correctly addressed? What is needed below 30 MHz? Pitfalls in EM- testing, imperfections in norms.

Target group

Target group is all people involved in product approval (mainly CE) EMC/wireless testing, electronics design/development. It may also be helping responsible QA, Sales/Marketing as well as CEO/CTO.

Requirements for participants

This workshop starts at basic level, however fundamental understanding of electrical engineering (or similar physics) issues is recommended. It is however assumed participants of this advanced workshops are already familiar with Basics.

Workshops

Workshop 13

Tuesday, 23 March 2021

EMC filters, design, applications and tricks

Prof. Dr. Frank Leferink, University of Twente
(Niederlande)

The lecture will start with basic filtering concepts, common mode, differential mode and normal mode (asymmetric, symmetric and non-symmetric) and the issue of impedance (mis)match. The mains impedance, AMN and LISN, but also as a function of the time will be shown, using T-F spectrograms, and also for EUT.

An ideal power supply filter will be designed. The effects of parasitic effects will be discussed and shown: self-parasitic, like parasitic inductance of a capacitor, as well as mutual-parasitic for the unwanted coupling between components. Also mounting and saturation.

Most engineers are not allowed to design and produce a filter, but have to deal with available filters on the market. We will discuss how to select filters and what are important parameters. We will show the effect of Cx capacitors at mains or at EUT side (different!), the effect of multiple filter stages, virtual ground in three phase filters. All data are with circuit diagrams, simulation, measurements and adaptations to deal with parasitics.

After the power line filters we will discuss filters for frequency converters: dV/dt , sine filters and EMI filters. For input or for output.

Target group

Electronic design engineers, electrical system.
Engineers.

Requirements for participants

Electrical engineering degree.

Workshop 17

Wednesday, 24 March 2021

Radio Modules and Integration into Electronic Equipment for FCC, ISED and RED

Michael Derby, ABC EUROPE LIMITED (Großbritannien und Nordirland)

This presentation covers the testing and regulatory requirements for radio modules, and equipment containing radio modules, for compliance with the FCC, ISED and RED. We will go through the process of approvals for the module and also the requirements for anyone installing a radio module to create connected technology. Equipment manufacturers and test labs are faced with radio modules already certified for the USA and Canada, and CE Marked for the EU. This presentation explains the compliance status of the module, and what the installer and test lab must do when the module is installed into other equipment. This will be a mixture of EMC and radio testing, and regulatory compliance.

Target group

EMC and Radio test labs, manufacturers of radio modules, and manufacturers wishing to install radio modules into their products.

Requirements for participants

Attendees can have any level of knowledge, but it would be useful if they have some general understanding of product compliance for the USA, Canada and the EU.

Workshops

Workshop 19

Wednesday, 24 March 2021

EMC in electrical drive systems

Prof. Dr. Frank Leferink, University of Twente (Niederlande)

Power drive systems (PDS) are used in all kind of mechatronic applications for speed control. The drawback of these power electronic components is that high electromagnetic interference levels on power lines, motor cables and via radiated electromagnetic fields are generated. Many EMC measures have been developed in recent years, ranging from filtering and screening to rise-time control, DC bus filtering and noise modulation. We will discuss the design of electrical drive systems from an EMC point of view. We will discuss the design of filters.

The second part describes in detail the optimization and use of filters, commercial of the shelf as well as novel designs. The problems due to design constraints will be explained in detail. New materials, applied in a novel way, as well as measurement techniques will be described. Simulation and measurements results of actual drive systems will be used many times to explain and prove the concepts applied.

Target group

Electronic design engineers, electrical system engineers.

Requirements for participants

Electrical engineering degree.

Workshop 21

Wednesday, 24 March 2021

EM Resilience: A Necessity for Safe and Reliable Electronic Systems!

Prof. Dr. Davy Pissort, KU Leuven (Belgien)

Everyone has already been confronted with Electro-magnetic Interference (EMI), ranging from an annoying buzz in a stereo when receiving a phone call to a computer crashing during a lightning storm. Frustrating, but not life threatening.

However, two trends warrant appropriate concern: (i) high-tech electronics is being used more and more for safety-related functions, (ii) electronic devices are increasingly vulnerable to EMI because of a lower intrinsic immunity and an increasingly severe electromagnetic environment.

Combined expertise in Electro-Magnetic Compatibility (EMC) and Functional Safety (FS) will gain huge importance in many sectors like automotive, robotics medical, railways, avionics,... Unfortunately, EMC and FS have evolved separately and share no concepts nor terminology.

Target group

Electronic designers, EMC Engineers, EMC Test Engineers, Safety Engineers, Safety Assessors.

Requirements for participants

Basic EMC knowledge. Some notion of functional safety is handy, but not required.

Workshops

Workshop 24

Thursday, 25 March 2021

Shielding in practice

Prof. Dr. Frank Leferink, University of Twente (Netherlands)

We will discuss briefly the standard shielding theory, but then many practical applications will be shown. The different shielding performance of conductive materials as well as mechanical and climatological aspects, i.e. corrosion, will be discussed. We will have a look at composite panels with metal fibers, carbon fibers, metal paint and conductive cloth. The main problem is the conductive connection between the conducting parts. Some practical guidance and applications will be presented. The effects of cable feed-throughs which can destroy the shielding performance of a cabinet or Faraday cage, the size and number of holes, the influence of seams, number of screws or rivets and the advantages of gaskets will be shown. We will also discuss the advantages and disadvantages of various types of gaskets.

During the course many practical situations (drawings, pictures), design rules and do's and don'ts will be shown. Shielding effectiveness measurement techniques, procedures and standards will be briefly discussed, as well as measurement results obtained with various metal and composite panels, gaskets, feedthroughs and cabinets.

Target group

Electronic design engineers, electrical system engineers, mechanical design engineers.

Requirements for participants

Electrical engineering degree.

Workshop 27

Thursday, 25 March 2021

Electromagnetic Compatibility of Switched – Mode Power Supplies

Prof. Dr. Günter Keller, Technische Hochschule Deggendorf (THD)

The topic is subdivided into several sections. Starting with a brief overview of legal regulations and standards some emission measurements and immunity tests including background and test set-ups are presented. After that the four coupling mechanisms (impedance, capacitive, magnetic and radiated) are discussed including countermeasures. Signal description (common-mode, differential-mode, Fourier Transform) is explained in detail with a number of examples related to switched-mode power supplies.

The next section discusses the origin of electromagnetic interferences referring to the previous sections. Here normal operating modes are taken into account as well as parasitic characteristics of semiconductors and passive components and their packages. In frequency domain low, medium and high frequencies are distinguished.

The second half of the presentation deals with EMC design of switched-mode power supplies. Starting with power factor correction circuits EMC filters are discussed in detail, followed by suitable components, like transformers and their construction, and shielding methods. One core area is the PCB layout completed by component placing as well as component selection. Against this background grounding and current return paths are discussed. A brief overview to immunity completes the presentation.

Each aspect is explained by measured, simulated or worked examples. Also the relation to efficiency and control aspects are discussed.

Target group

Target audience are development engineers, field application engineers, layout designers, EMC test laboratory staff, plant designers, plant supervisors, product designers and decision-makers.

Requirements for participants

The workshop addresses all necessary aspects of the topic. The attendees should have a basic understanding of electrical circuits and components. Ideally the participants have already first contact with EMC topics or switched-mode power supplies or experience in that field.

Workshops

Workshop 30

Thursday, 25 March 2021

Grounds in PC Boards and Cables. How to understand, find, fix, and avoid low and high frequency noise problems, including current probe demonstrations.

Lee Hill, SILENT Solutions LLC (USA)

A clear, precise discussion with many live hardware demonstrations of EMI problems with grounds & grounding by an EMC troubleshooter & university instructor with over 25 years of practical experience.

Most electrical engineers have never attended a university class or seminar where electrical grounds or grounding were clearly discussed in a way that is useful in practical electronic design and troubleshooting situations. This presentation will describe the electrical requirements and functions of "ground" in printed circuit board and system cable assembly design. Hardware demonstrations at low and high frequencies, will be used to illustrate concepts in an easy-to-understand manner.

Specific design examples and popular integrated circuit applications notes will be used to illustrate the following applications:

- low and high frequency regulatory issues, such as radiated emissions and susceptibility
- low frequency signal integrity problems
- design of PCB "ground" planes
- electrical connections (terminations) for the shields of cables
- using current probes to verify proper circuit operation

This workshop will provide attendees with practical knowledge that will help them understand grounds and grounding in PCBs and in system cable design.

Practical application examples, hardware demonstrations with current and magnetic field probes, and "myth busting" will ensure that attendees learn while enjoying this fun presentation.

Target group

The target group of this workshop consists of Electrical and Electronic Design and Development Engineers, System Design and Development Engineers, EMC Engineers, EMC Technicians, and Educators, as well as anyone concerned with the proper operation of data acquisition over long cables as well as low frequency analog and digital signal integrity.

Requirements for participants

A familiarity with electronic product design, principles of electrical engineering, and at least 3 years of practical experience in the transport and measurement of low voltage digital and analog signals.

Services and prices

Prices

Type of participation	Price
Event ticket (excl. fee required workshops)	free of charge
Regular price for each workshop until 15 March 2021	295 Euro
Last minute price for each workshop from 16 March 2021	395 Euro

Save 10% on each booked workshop when booking three or more workshops.
All prices plus 19% VAT.

Services

The **event ticket** includes the following services:

- Access to the event platform incl. networking with all participants: via chat, call or video call (individual appointments possible)
- Access to exhibitor, speaker and participant profiles
- Job advertisements
- Interest-based matchmaking
- Participation in keynotes (in German)
- Participation in exhibitor round tables
- Participation in speed dating

If you have booked one or more **workshops**, the following services are included in addition to the services listed above for the event ticket:

- Participation in your booked workshop(s) via Zoom
- Digital documentation(s) of the booked workshop(s)
- Participation in the digital beer tasting (optional, after prior registration; limited)

Contact



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