

# The IEEE Electromagnetic Compatibility Society and the EMC-S Italy Chapter

**Sergio A. Pignari**  
(EMC-S IT Chapter Chair)

Meeting of the IEEE Student Branch at POLIMI  
**Celebrating 125 Years of the IEEE**  
May 13, 2009





## Presentation Outline

- The IEEE Emblem
- The IEEE Electromagnetic Compatibility (EMC) Society
- The IEEE EMC-S Italy Chapter
- The Subject of EMC—Basic Aspects, and Examples of Challenging Research Issues
- The EMC Group at the Politecnico di Milano

# IEEE - Institute of Electrical and Electronics Engineers

## *Brief History...*

1884 AIEE – American Institute of Electrical Engineers



1912 IRE – Institute of Radio Engineers



1963 IEEE – Institute of Electrical and Electronics Engineers

1999 IEEE Master Brand Developed



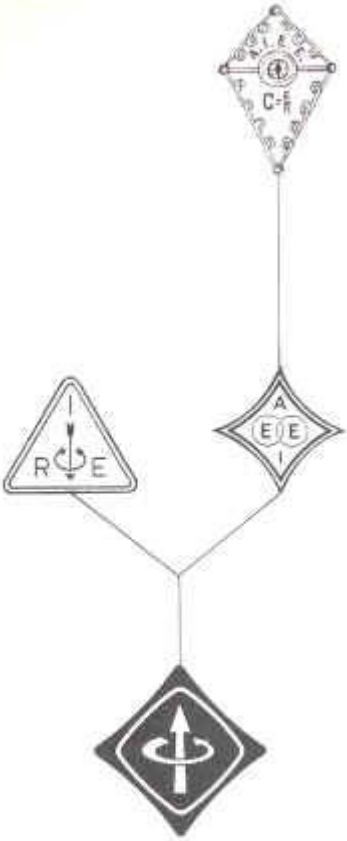
2009 125<sup>th</sup> Anniversary of IEEE



**Celebrating 125 Years**  
*of Engineering the Future*

# On the IEEE Emblem

*IEEE Student Journal, March 1963*



THE  
IEEE  
EMBLEM



**Celebrating 125 Years**  
*of Engineering the Future*

## IEEE – Contributions



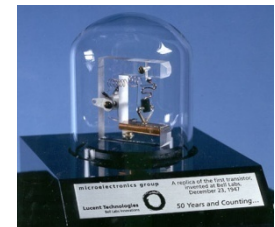
### 1920 - Guglielmo Marconi

“ In recognition of his pioneer work in radio telegraphy. ”



### 1980 - William Shockley

“ For the invention of the junction transistor, the analog and the junction field-effect transistor, and the theory underlying their operation. ”



### 1996 - Robert M. Metcalfe

“ For exemplary and sustained leadership in the development, standardization, and commercialization of Ethernet. ”



# IEEE – Electromagnetic Compatibility (EMC) Society

## *Brief History...*

**1957** **Founded by Way of the IRE**

[professional group on Radio Frequency Interference (RFI)]



**1963** **IEEE Formed Along with the EMC Society**



**2007** **EMC Society Celebrates its 50<sup>th</sup> Anniversary**

**2007** **EMC Society Rides the Space Shuttle**



This United States flag, crew patch, and anniversary pin were flown aboard the Space Shuttle *Endeavour*, STS-118, August 8 - 21, 2007.



Commemorating the ElectroMagnetic Compatibility (EMC) Society's 50th Anniversary on 10 October 2007, this pin is symbolic of the partnership NASA shares worldwide with members of the EMC Society and with members of their parent organization, the Institute of Electrical and Electronic Engineers (IEEE).

*Let us reach for the stars together!*

From the National Aeronautics and Space Administration

# EMC Society – Contributions



IEEE Standards Association

## Current EMC Society Published Standards Include:

**IEEE Standard 299-1997** – *IEEE Standard Method for Measuring the Effectiveness of Electromagnetic Shielded Enclosures*

**IEEE Standard 1128-1998** – *IEEE Recommended Practice for RF Absorber Performance Evaluation in the Range 30 MHz to 5 GHz*

## The Most Referenced EMC Society Transactions Technical Papers is:

**A. K. Agrawal *et Al.***, “Transient Response of Multiconductor Transmission Lines Excited by a Nonuniform Electromagnetic Field,” 1980.



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## EMC Society – EMC Journals



**IEEE Transactions on EMC**  
**IEEE EMC Newsletter**



## Other IEEE Journals Partially Related to Research in EMC

IEEE Transactions on Circuits and Systems  
IEEE Transactions on Advanced Packaging  
IEEE Transactions on Antennas and Propagation  
IEEE Transactions on Microwaves Theory and Techniques





# EMC Society – Technical Committees



## Current EMC Society Technical Committees Include:

- TC-1 – EMC Management
- TC-2 – EMC Measurements
- TC-3 – Electromagnetic Environment
- TC-4 – Electromagnetic Interference Control
- TC-5 – High Power Electromagnetics
- TC-6 – Spectrum Management
- TC-7 – Nonsinusoidal Fields
- TC-8 – Electromagnetic Product Safety
- TC-9 – Computational Electromagnetic
- TC-10 – Signal Integrity
- TC-11 – Nanotechnology



# EMC Society – How can I become Involved ?



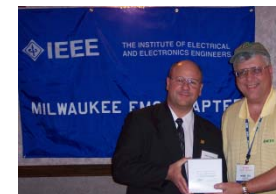
## International Symposium on EMC



## Sectional / Chapter EMC Seminars



## Chapter and Section Meetings



# EMC Society – How Do I Join the Fun of Being an IEEE EMC Society Member ?



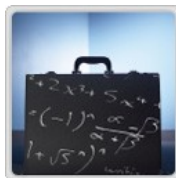
The EMC Society Offers...



Knowledge



Community



Profession

Consider Joining Today...

[www.ieee.org/web/membership/home/index.html](http://www.ieee.org/web/membership/home/index.html)





## IEEE EMC Society Italy Chapter

- **Started**

In 1991 as Central-South Italy; in 2007 became Italy Chapter

- **Members**

About 130 active members

- **Website**

<http://www.etec.polimi.it/emc-chap-it/>

- **Executive Committee**

Chairman:	<b>Sergio A. PIGNARI (POLIMI)</b>
Vice-Chairman:	<b>Giulio ANTONINI (Univ. L'Aquila)</b>
Treasurer:	<b>Flavia GRASSI (POLIMI)</b>
Secretary:	<b>Luca DI RIENZO (POLIMI)</b>
Webmaster:	<b>Giordano SPADACINI (POLIMI)</b>

# EMC-S IT Chapter – Website

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## IEEE EMC Society - Italy Chapter



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- » [Joining the Chapter](#)
- » [Students](#)
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### Events Calendar for 2009

You are invited to attend the forthcoming events:

#### 125th Anniversary of the IEEE

The IEEE Student Branch "I3Poli" at the Politecnico di Milano technical university celebrates the 125th anniversary of the IEEE with a meeting.

May 13, 2009, h. 9:00 - 13:00 - Politecnico di Milano

Dipartimento di Elettronica e Informazione (Sala Seminari) - Via Ponzio 34/5, 20133 Milano

If you require any further information on the EMC Chapter or any of these events, please contact Sergio A. Pignari by email: [s.pignari@ieee.org](mailto:s.pignari@ieee.org)



Visit: <http://www.etc.polimi.it/emc-chap-it/>



**Celebrating 125 Years**  
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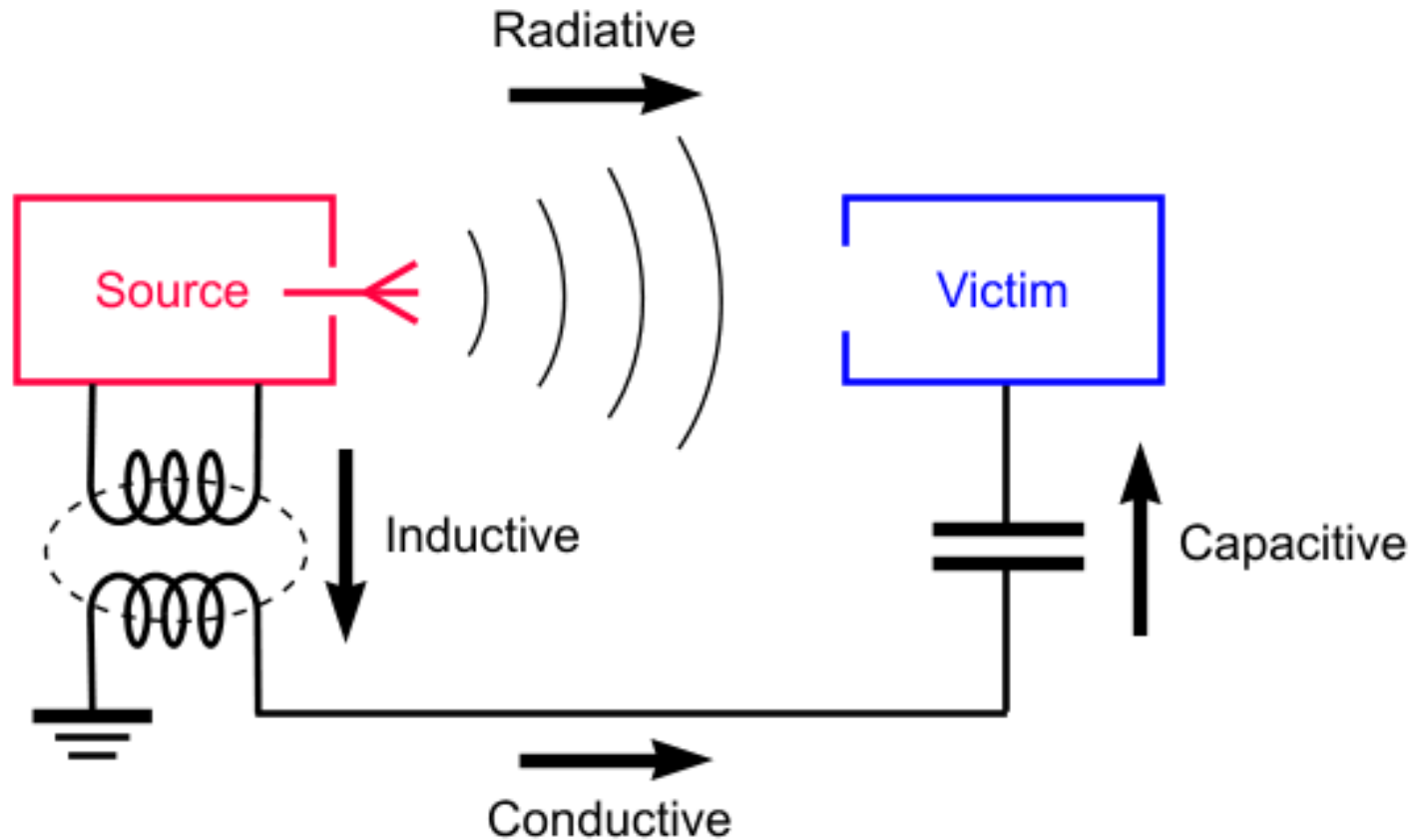
## EMC-S IT Chapter – Past Events

- **2009 ESA Workshop on Aerospace EMC**  
March 2009, Florence, Italy
  - 128 participants (16 Countries)
  - 2 invited lectures
  - 35 oral presentations
  - 25 posters
- **Giornata di Studio su: L'incertezza di Misura nella Compatibilità Elettromagnetica**  
Febbraio 2009, Politecnico di Milano
  - 103 participants
  - 3 exhibitors
- **EMC and New Technologies in Automotive Systems**  
Prof. Mark Steffka (University of Michigan –Dearborn and GM Powertrain EMC group), January 2009, Politecnico di Torino
- **International Meeting on Powerline Communication (PLC) for Automotive**  
Prof. F. Benzi and Dr. T. Facchinetti November 2008, University of Pavia
- **Giornata di Studio: Coesistenza e Compatibilità Elettromagnetica delle Tecnologie Wireless Emergenti**  
Maggio 2008, Università de L'Aquila
- **Use of Fast Digital Interfaces on Satellites and Their Relationship with EMC Aspects**  
Mr. Giorgio Magistrati (Technical Directorate, Digital Electronics Lead, Carlo Gavazzi Space S.p.A., Milan, Italy) April 2008, Politecnico di Milano, Milan, Italy
- **Electromagnetic Inverse Problems in Biomedical Applications**  
Prof. Dr. Jens Haueisen (Institute of Biomedical Engineering and Informatics, Technical University of Ilmenau, Germany, and Biomagnetic Center, Department of Neurology, University Jena, Germany), March 2008, Politecnico di Milano
- **Introduction to Nanotechnology and EMC Applications**  
Prof. Marco Rossi and Prof.ssa Maria Sabrina Sarto (University of Rome "La Sapienza", Italy), February 2008, University of Rome "La Sapienza"
- **EMI in the Railway Environment: The Experience of Rete Ferroviaria Italiana S.p.A.**  
Dr. Eugenio Fedeli (Rete Ferroviaria Italiana S.p.A., Rome, Italy), November 2007, Politecnico di Milano
- **Current and emerging EMC activities at THALES (& University Twente)**  
Prof. Frank Leferink (Thales & University of Twente, The Netherlands), October 2007, Politecnico di Torino

# Electromagnetic Compatibility – Basic Aspects

## *EMI and Coupling Paths...*

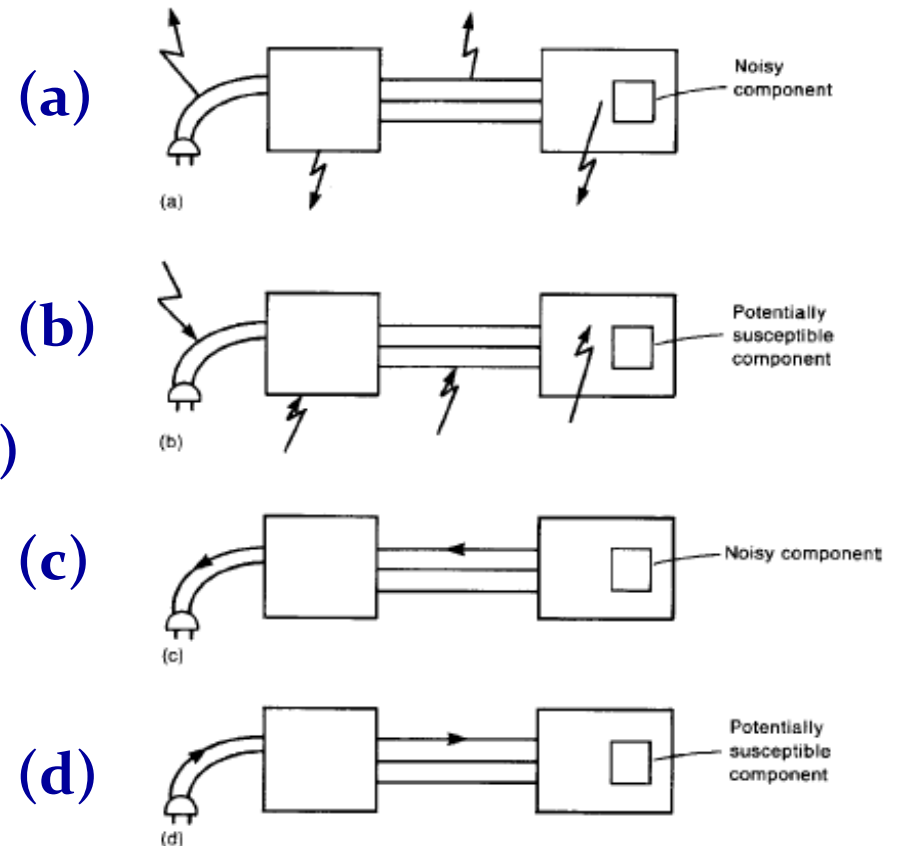
- **Electromagnetic Interference (EMI)**



# Electromagnetic Compatibility – Basic Aspects

## *The Four Basic EMC Sub-problems<sup>‡</sup>...*

- (a) Radiated emissions (RE)
- (b) Radiated susceptibility (RS)
- (c) Conducted emissions (CE)
- (d) Conducted susceptibility (CS)



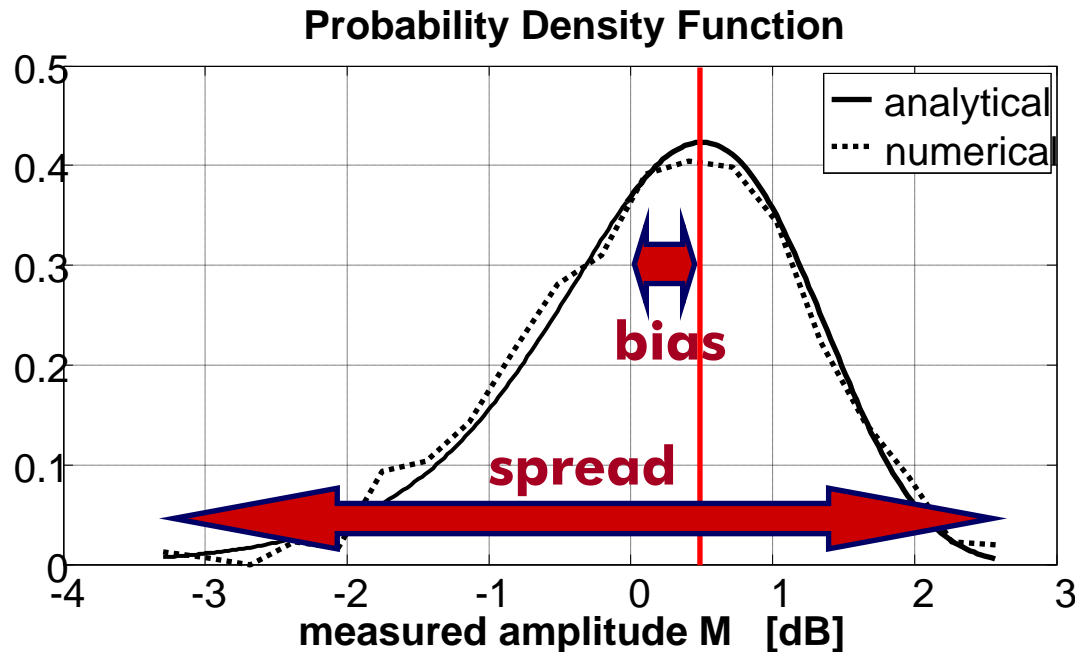
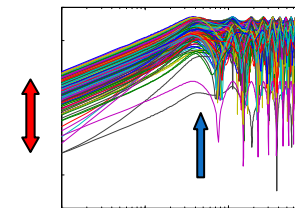
<sup>‡</sup> C. R. Paul, *Introduction to EMC*, 2nd Ed., John Wiley & Sons, Inc., 2006, [ch. 1, p. 5]



# Research Issues – Wiring Harness

## Statistical models for EMC...

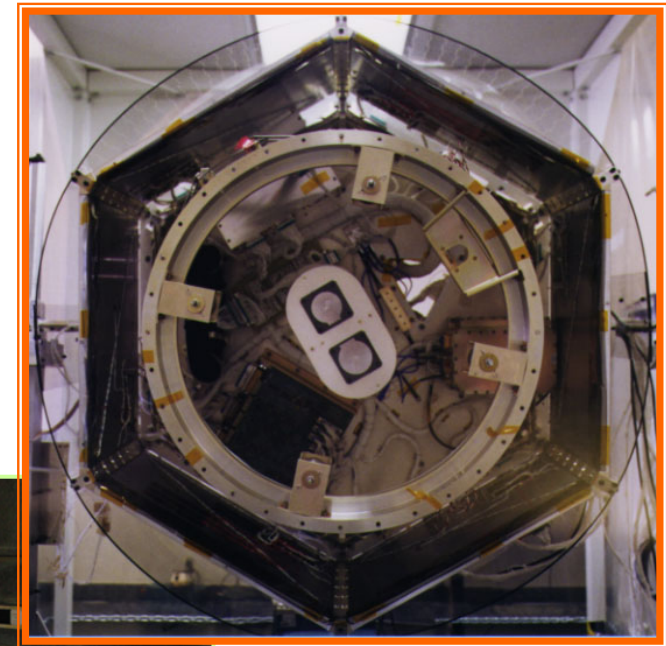
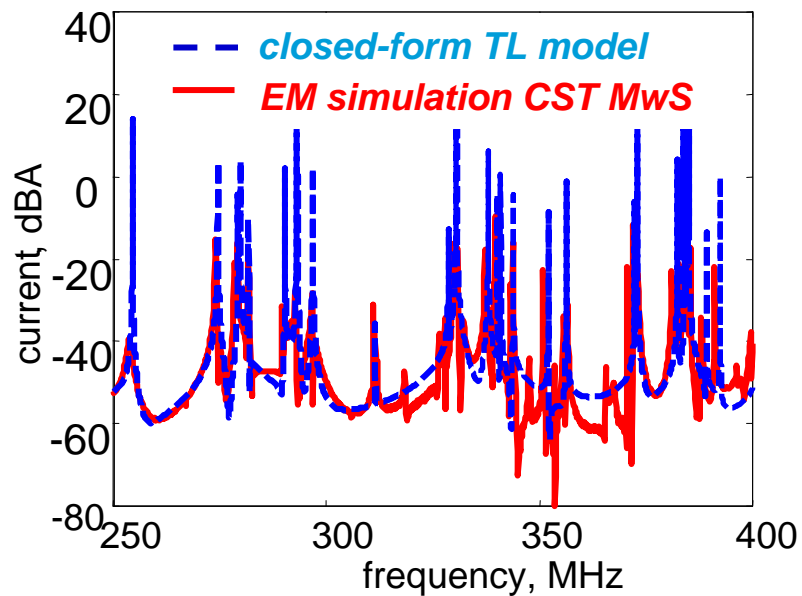
- Estimation of field-to-wire coupling and crosstalk in terms of mean value, standard deviation, pdfs, upper bounds, etc.



# Research Issues – Aerospace EMC

## *Intra-system EMC Verification of Spacecraft...*

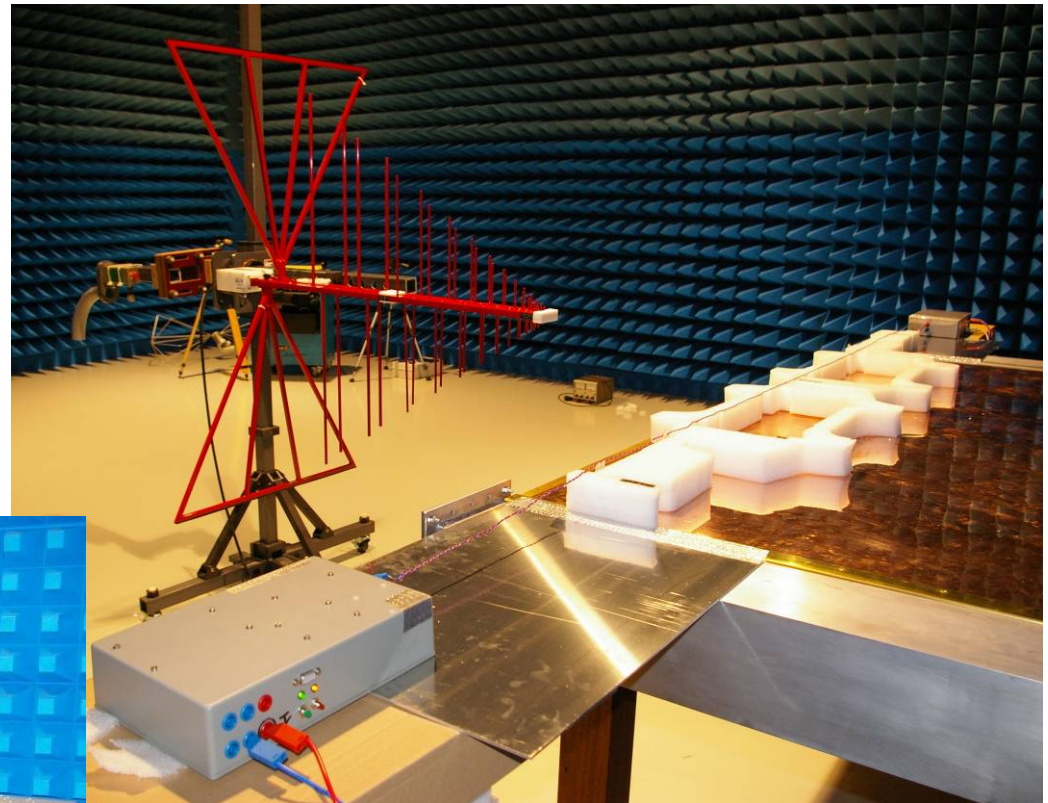
- New methodologies for radiated susceptibility (RS) Testing
- Prediction of conducted emissions due to DC/DC converters



## Research Issues – Aerospace EMC

*Integration of power and data (Powerline Comm.)...*

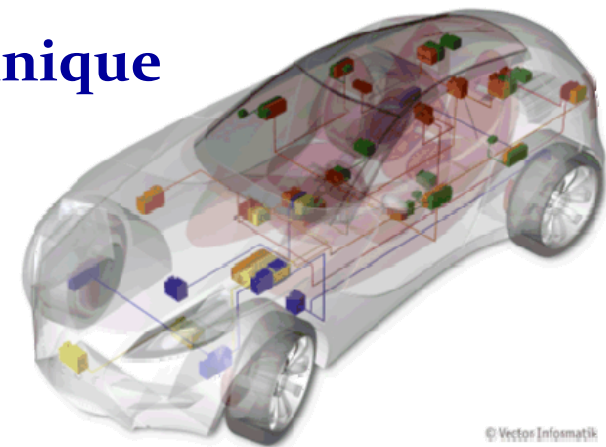
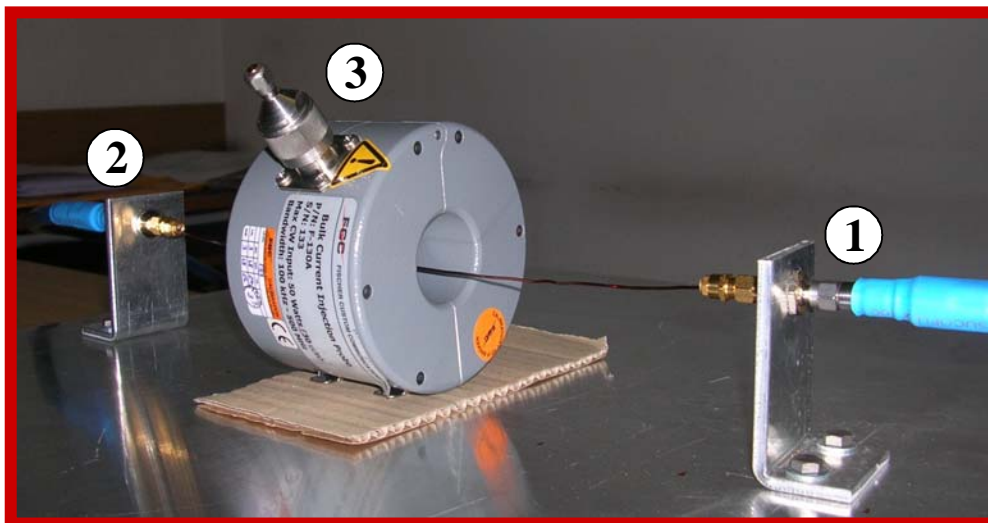
- Test procedures and setups for PLC
- RE verification as per MIL-STD-461E



# Research Issues – Automotive EMC

## *Intra-system EMC Verifications...*

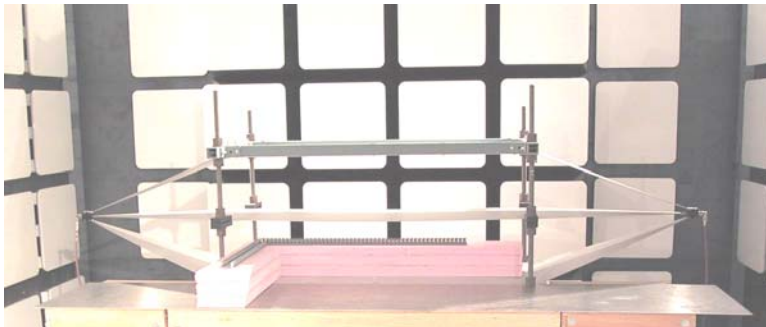
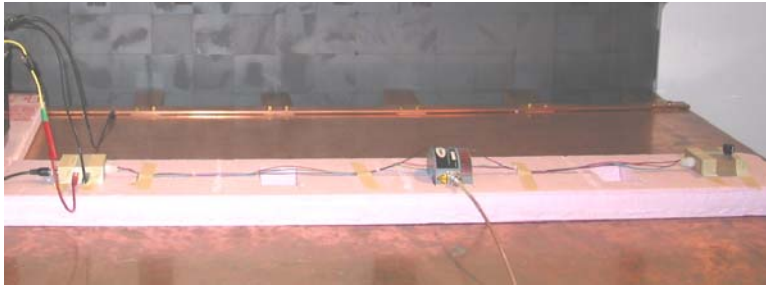
- Streamlined experimental procedures and setups for EMC testing
- The Bulk Current Injection (BCI) technique



© Vector Informatik

# Research Issues – Automotive EMC

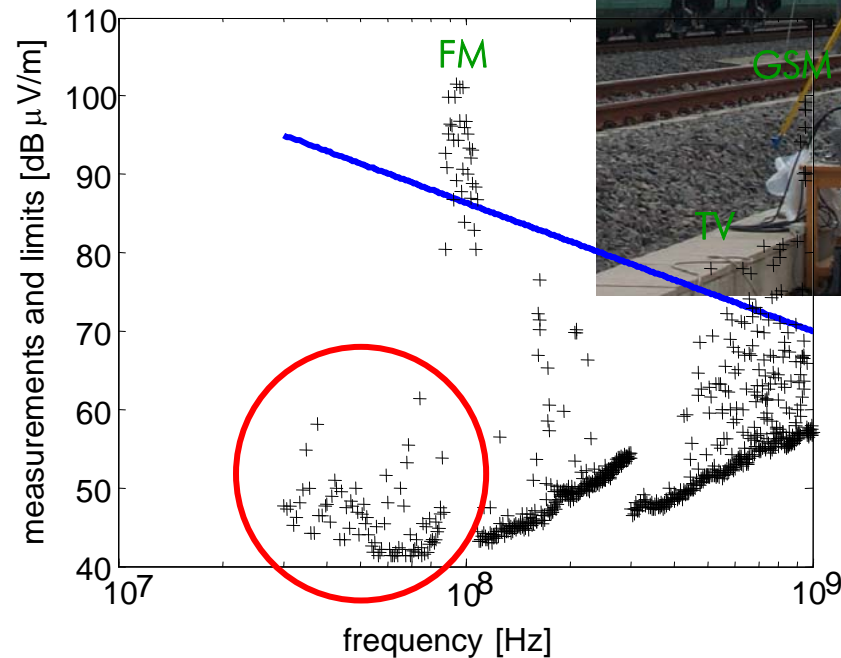
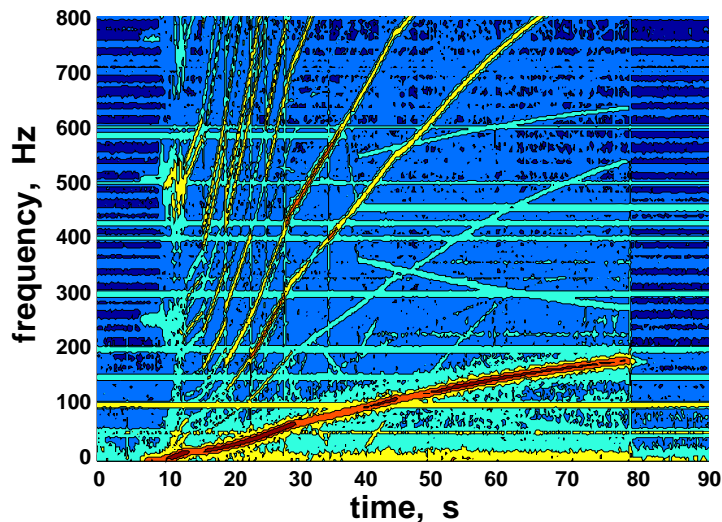
## *Test Setups for Radiated Susceptibility Assessment...*



# Research Issues – Railway EMC

## *Experimental Procedures and Setups for the Rail Environment...*

- Human exposure to EM fields
- Emission of the whole railway system
- Optimized meas. procedures and systems (9kHz – 1GHz)



## EMC Group at POLIMI – Staff

<http://www.etec.polimi.it/ind31/emcgroup/>



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Phone: +39 02 2399 3726
  
- **Assistant professors:** **Diego BELLAN**  
**Luca DI RIENZO**  
**Flavia GRASSI**  
**Giordano SPADACINI**
  
- **PhD students:** **Houriyeh SHADMEHR (2009-2011)**  
**Zichi ZHANG (2007-2009)**

# EMC Group at POLIMI – Research Projects

## *Sponsors and Partners...*



### **Outside Europe**

**BOSCH - Robert Bosch LLC, Automotive Group, Plymouth, USA**

North Atlantic Treaty Organization (NATO)

EM Software & Systems-S.A. (Pty) Ltd, Stellenbosch, South Africa

### **In Europe**

**The European Space Agency (ESA/ESTEC), Noordwijk, The Netherlands**

TERMA, Lystrup, Denmark

### **In Italy**

**The Italian State Railways: RFI SpA, Trenitalia SpA, Rome and Florence, Italy**

Carlo Gavazzi Space S.p.A., Milan, Italy

The Italian Ministry of University and Research (MUR), Rome, Italy