

**IEEE TC-5: High Power Electromagnetics (HPEM)  
Meeting at the 2015 IEEE Symposium on EMC in Santa Clara, CA  
Wednesday, 18 March 2015 (Noon – 1:30 pm)**

**1. Opening of the meeting—W. Radasky, Chairman**

Chairman Dr. William (Bill) Radasky brought the meeting to order at 12:06 PM. Chairman Radasky welcomed the attendees, reviewed the agenda and asked for suggested changes; none were offered. Dr. Radasky made a motion to approve the agenda. MSC.

28 persons attended the meeting, although only 26 signed in. (See attachment.)

The following items were discussed.

**2. Minutes—M. McInerney, Vice Chairman**

Mr. McInerney reviewed the minutes of the 2014 meeting in Raleigh, NC. A motion was made to approve the minutes. MSC.

**3. Update TC-5 membership list--All**

The Vice Chairman circulated a roster, a summary of which is attached. The chairman commented that TC-5 has a “five-year of inactivity rule.” You remain a member-in-standing for five years since the last time you participated. Participation is not limited solely to symposium meeting attendance. Participation includes activities such as reviewing papers, organizing and/or chairing symposium sessions, and chairing subcommittees. The Vice Chairman mentioned that those who believe that they are not receiving Committee announcements via email should contact the Chairman or Vice Chairman; perhaps we have an incorrect address.

**4. Technical papers—W. Radasky**

Dr. Radasky reported that one (1) paper was submitted for TC-5 for Santa Clara. It was accepted.

39 papers were submitted for review for Dresden; three (3) were transferred to TC-7 because they dealt with the power grid; 6 papers were for the EM Leakage Special Session; seven (7) papers were for the IEMI Special Session; and 23 papers were submitted under various TC-5 subtopics (the largest number dealt with IEMI). At the time of this meeting, the paper review process for Dresden is ongoing, so a final status is not available. The details will be reported at the TC-5 meeting in Dresden.

TC-5 sponsored two (2) Tutorials at Santa Clara

- Lightning Protection of Wind Turbines on Monday morning (Rubinstein)
- IEMI Update on Monday afternoon (Sabath)

TC-5 is sponsoring one (1) Tutorial and two (2) special sessions at Dresden, which have all been accepted.

- Tutorial: IEC HPEM Standardization Update (Radasky)
- Special Session on EM Information Security and Countermeasures (Hayashi)
- Special Session on IEMI Protection of Critical Infrastructures (Sabath)

## 5. Report from the Lightning Subcommittee—M. Rubinstein

Professor Rubinstein reported on symposia and meetings in which lightning is a significant topic:

- 2015
  - AMS Annual Meeting, Phoenix, Jan 4-8
  - APEMC, Taipei, Taiwan, May 26-29
  - International Conference on Environment and Electrical Engineering (EEEIC) in Rome, Jun 10-13
  - APL, Nagoya, Japan, Jun 23-26
  - IEEE PES GM, Denver, Jul 26-30
  - ASIAEM, Jeju, South Korea, Aug 3-8
  - Joint IEEE EMC/EMC Europe, Dresden, Germany, Aug 16-22
  - ICOLSE, Toulouse France, Sep 9-11
  - SIPDA, Camboriú, Brazil, Sep-Oct
- 2016
  - ILDC/ILMC, (tentative: New Delhi, early Feb)
  - Ground conference, Brazil (venue and date not yet announced)
  - EUROEM, Imperial College, London, Jul 11-15
  - IEEE Symposium, Ottawa, Canada, Jul 25-29
  - ICLP, Estoril, Portugal, Sep 25-30

Professor Rubinstein also reported the following lightning workshops and special sessions:

- 2015
  - Workshop held at IEEE EMC&SI in Santa Clara on lightning protection of Wind Turbines
  - We are organizing a lightning session for ASIAEM, Jeju, South Korea
- 2016
  - We will organize a lightning session in for EUROEM in London

Professor Rubinstein noted the following CIGRE working groups:

- Working Group C4.23 “Guide to Procedures for Estimating the Lightning Performance of Transmission Lines” (2013, Chair: Christiaan Engelbrecht)
- Working Group C4.26 ” Evaluation of Lightning Shielding Analysis Methods for EHV and UHV DC and AC Transmission-lines" (2011, Chair: Jinliang He)
- Working Group C4.33 ” Impact of Soil-Parameter Frequency Dependence on the

Response of Grounding Electrodes and on the Lightning Performance of Electrical Systems" (2013, Chair: Silverio Visacro)

- Working Group C4.410 "Lightning Striking Characteristics for Very High Structures" (2010, Chair: Takatoshi Shindo)
- Working Group 4.36 "Winter Lightning – Parameters and Engineering Consequences for Wind Turbines" (2014, Chair: Masaru Ishii)
- Working Group 4.37 "Electromagnetic Computation Methods for Lightning Surge Studies with Emphasis on the FDTD Method" (2014, Chair: Yoshihiro Baba)

Professor Rubinstein noted other working groups on lightning:

- International project on EM Radiation from Lightning to Tall Structures  
Next meeting in conjunction with ICLP in Portugal, Sep 2016
- IEEE PES Lightning Performance of Overhead Lines Working Group  
Annual meeting in conjunction with IEEE PES GM, July 2015

## **6. Report from the EM Information Leakage Subcommittee—Y. Hayashi**

Professor Hayashi is planning a special session on EM Information leakage for EMC 2015 Dresden. It is titled "EM Information Security and Countermeasures." (See attachment.)

In order to promote the field of information leakage, Professor Hayashi would like to have a workshop/special session(s) at future EMC symposiums. Some possible topics are:

- Recent research trends in information leakage
- Typical measurement and analysis methods for information cryptographic devices
- Countermeasures
- EM information security education

Professor Hayashi also reported on two recent research findings (See attachments):

- Spellcheck Increases Electromagnetic Fields Emitted during Computer Activity
- A Threat for Tablet PCs in Public Space: Remote Visualization of Screen Images Using EM Emanation

## **7. Report from the IEMI Subcommittee—F. Sabath**

Dr. Frank Sabath reported on activities of the IEMI subcommittee.

- A special session on the critical infrastructures is planned for the Dresden Symposium
- Reports on three European projects
- IEEE 1642 standard was published
- Technical Forum at Dresden for IEMI?

## **8. Coordination with SC-1, Smart Grid—All**

Dr. Radasky attended the SC-1 meeting at this symposium on Monday. The committee is chaired by Don Heirman and Dr. Radasky is the vice chair. The purpose of the committee is to coordinate activities of other committees working on the smart grid. There were no actions for TC-5 resulting from this meeting.

### **9. Status of the IEMI standard practice activities and possible future HPEM IEEE standards—W. Radasky**

Dr. Radasky reported that IEEE Standard 1642, Recommended Practice for Protecting Public Accessible Computer Systems from Intentional EMI, has been published. (See attachment.)

### **10. Status of the TC-5 web page—M. McInerney**

The technical committee is now able to edit our own web page. Changes should be communicated to the vice chairman or chairman.

### **11. Review of HPEM activities since the last TC-5 meeting—W. Radasky**

Dr. Radasky presented the following international HPEM activities:

- Since 2014 IEEE EMC Raleigh there have been several conferences with HPEM papers;
  - International Conference on Electromagnetics in Advanced Applications (ICEAA), Aruba (Aug 2014)
  - URSI General Assembly, Beijing (Aug 2014)
  - Cigré 2014 Session, Paris (Aug 2014)
  - EMC Europe, Gothenburg (Sep 2014)
  - International Conference on Lightning Protection, Shanghai (Sep 2014)
  - GlobeSPACE 2014, Tel Aviv (Dec 2014)
  - 2015 IEEE EMC, Santa Clara (Mar 2015)
- US FERC is requiring US power companies to address security threats (some are including IEMI).
- European activity in IEMI is continuing.
- Several major standards/reports/articles were recently published and another should be recognized for its importance;
  - “Lightning Parameters for Engineering Applications,” Cigré TB 549, August 2013
  - “Fear of Frying: Electromagnetic weapons threaten our data networks. Here’s how to stop them,” IEEE Spectrum, September 2014 (See attachment)
  - “Protection of High Voltage Power Network Control Electronics Against Intentional Electromagnetic Interference (IEMI),” Cigré TB 600, November 2014
  - IEC 61000-4-36 Ed. 1.0 (2014-11): Electromagnetic compatibility (EMC) - Part 4-36: Testing and measurement techniques – IEMI immunity test methods for equipment and systems
  - “IEEE Recommended Practice for Protecting Publicly Accessible Computer Systems from Intentional Electromagnetic Interference (IEMI),” IEEE-Std-

2015, January 2015

- Upcoming Conferences;
  - 1st URSI Atlantic Radio Science Conference (URSI AT-RASC), Gran Canaria (May 2015)
  - APEMC 2015, Taipei (May 2015)
  - ASIAEM 2015, Jeju, Korea (Aug 2015)
  - IEEE EMC/EMC Europe Dresden (Aug 2015)
  - IECAA 2015, Torino (Sep 2015)
  - Conference on Environmental Electromagnetics (CEEM) 2015, Hangzhou (Nov 2015)
  - Inaugural IEEE Global EMC Conference, Adelaide (Nov 2015) – F. Heather
- US FERC and European IEMI activities are expected to continue.
- IEC SC 77C is updating standards for testing to conducted and radiated environments and is planning to develop a comprehensive protection guideline document.

## **12. Discussion concerning whether a tutorial, workshop, and/or special session should be organized for next year in Ottawa—All**

- It was decided to postpone this item until Dresden when TC-5 will meet again.

## **13. Other business**

- iNARTE—Postponed until Dresden.
- Fred Heather recommended development of a standard on the direct effects for lightning protection testing of aircraft. Perhaps begin with an exploratory committee to gather relevant testing information. Perhaps also include the launch vehicle community. Chuck Bunting mentioned coordinating with SC-6 UAS.

## **14. Adjournment**

The committee adjourned at 1:35 PM.

## ATTENDEES

NAME	AFFILIATION
Mr. Stu Benner	EM Consulting
Dr. Chuck Bunting	Oklahoma State University
Mr. Conan Boyle	TUV Rheinland
Mr. Bob Davis	Lockheed Martin
Mr. Daniel Elliott	Gemmill, Inc.
Mr. Glen Gassaway	Southwest EMI
Mr. Nelson Green	Jet Propulsion Laboratory
Dr. Yu-ichi Hayashi	Tohoku University
Mr. Fred Heather	USN
Dr. Thomas Jerse	The Boeing Company
Ms. Irina Kasperovich	Andro Computational Solutions
Mr. Matthias Kreitlow	Bundeswehr Research Institute (WIS)
Mr. Adam LaCourse	Curtis Instruments
Dr. ErPing Li	A*Star
Mr. Jim Lukash	Lockheed Martin
Mr. Mike McInerney	Mac and Ernie
Mr. Alireza Nezamzadeh	Schweitzer Engineering Labs
Dr. William Radasky	Metatech Corp.
Dr. Vignesh Rajamani	Oklahoma State University
Dr. Marcos Rubinstein	Univ. of Applied Science, Switzerland
Dr. Frank Sabath	Bundeswehr Research Institute (WIS)
Mr. Jeffrey Silberberg	FDA
Mr. Abtin Spantman	Dan Foss Power Electronics
Mr. Ben Westin	The Boeing Company
Mr. Kim Williams	IEEE
Dr. Perry Wilson	NIST

# Special session on EM Information leakage planned in EMC 2015 Dresden

**Title: EM Information Security and Countermeasures**

**Abstract:**

This invited special session presents an overview of the recent research related to information security and shows several distinguished studies, which introduce different kinds of information leakage from commercial IT devices via electromagnetic fields. Evaluation/analysis methods of EM information leakage focusing on EM radiation/interference are presented. Moreover, countermeasures against EM information leakage are also introduced.

Silicon

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*'Where Baroque meets High-Tech...'*

# Recent research trends in EM information leakage

## -The Cyber Risks of Off-Line Leaks in Actual Commercial Devices-

### Spellcheck Increases Electromagnetic Fields Emitted during Computer Activity



Key typing



General CPUs

EM emanation



Keystroke detection easily

The research discovered if a computer runs a program with spellcheck turned off, it will emit less signals than a computer with spellcheck turned on.

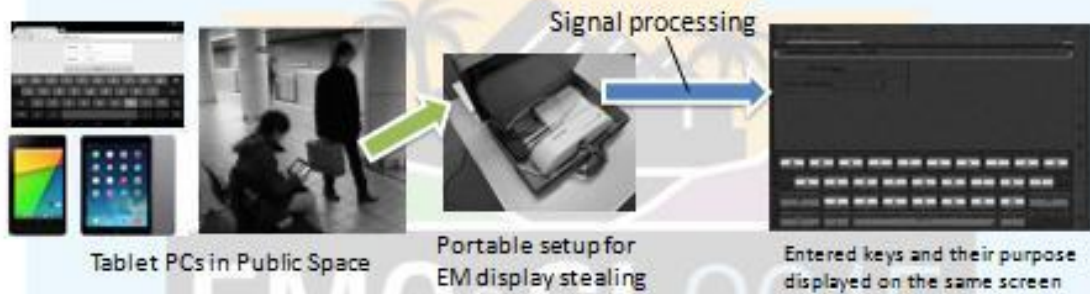
Each keystroke causes the spellchecker to look up the word in a dictionary to try to catch a mistake and flag it. It turns out that spellchecking is orders of magnitude more activity than you would normally get for just a simple key press.



# Recent research trends in EM information leakage

## -The Cyber Risks of Off-Line Leaks in Actual Commercial Devices-

-A Threat for Tablet PCs in Public Space: Remote Visualization of Screen Images Using EM Emanation



The research group showed the threat of display stealing through the EM field emitted from tablet PCs. A portable setup with profiling and signal processing techniques enables such EM display stealing in a general and real-time manner.

# IEEE Recommended Practice for Protecting Publicly Accessible Computer Systems from Intentional Electromagnetic Interference (IEMI)

IEEE Electromagnetic Compatibility Society

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Clean manufacturing  
is too seldom used  
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**A BOLD PLAN  
FOR 5G WIRELESS**  
Samsung rides the  
millimeter waves  
**P. 34**

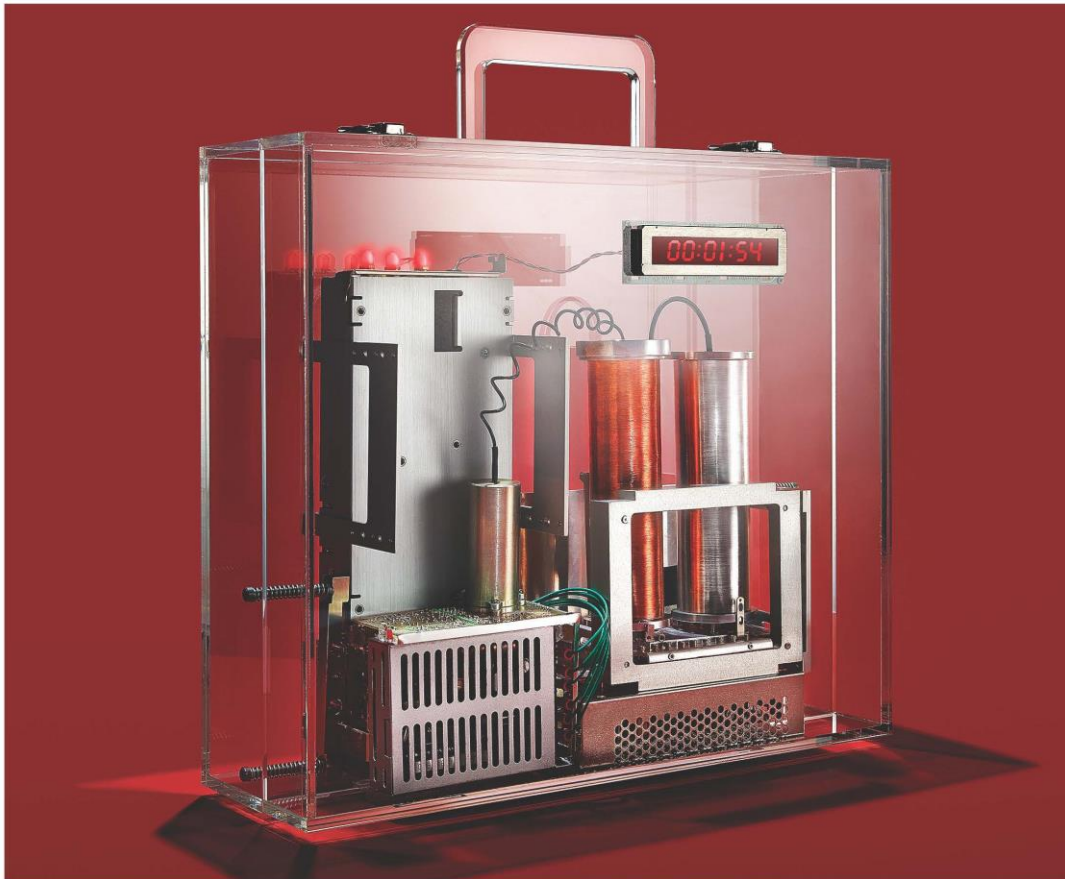
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Data networks are increasingly vulnerable to electromagnetic attacks that can be staged from a distance using machines the size of a suitcase. Here are some ways to defend your system.

BY WILLIAM A. RADASKY

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**Solar's Green Dilemma**

Solar panels are recognizable emblems of the green energy movement, but their manufacture faces environmental challenges.

By **Dustin Mulvaney**

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**Mobile's Millimeter-Wave Makeover**

Millimeter waves could be the future of 5G.

By **Theodore S. Rappaport, Wonil Roh & Kyungwhoon Cheun**

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**Catching Brain Waves in a Net**

What's the best way to send brain commands to a prosthetic limb?

By **Nitish V. Thakor**

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