

**IEEE TC-5: High Power Electromagnetics (HPEM)
Seminar Room 2, International Congress Center Dresden, Germany
Wednesday, 19 August 2015 (Noon – 1:30 pm in Conference Center)
Draft Minutes**

1. Opening of the meeting and approval of the agenda – W. Radasky, Chairman

Chairman Dr. William (Bill) Radasky brought the meeting to order at 12:00 Noon. Chairman Radasky welcomed the attendees, reviewed the agenda and asked for suggested changes; Dr. Leferink asked that we consider a small change to the scope of TC-5, and this was agreed to be discussed under New Business. No other additions or changes were mentioned. Dr. Radasky made a motion to approve the agenda. MSC.

22 persons attended the meeting. (See attachment.)

2. Review and approval of the minutes of the last TC-5 – W. Radasky for W. Price, Secretary

Dr. Radasky reviewed the minutes of the 2015 meeting in Santa Clara, California. A motion was made to approve the minutes. MSC.

3. Update TC-5 membership list – All

The Chairman circulated a roster, a summary of which is attached to these minutes. 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 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.

4a. Report on the paper review process for Santa Clara and Dresden – W. Radasky

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). Of the 36 papers reviewed by TC-5, 28 were accepted and 8 were rejected. Of the accepted papers, 24 were presented in the oral session and 4 were presented as poster papers. It should be noted that 4 papers underwent a second mandatory review and were accepted after changes were made.

4b. Review the tutorials/workshops presented in Dresden– W. Radasky

In Dresden TC-5 sponsored 1 tutorial and 2 special sessions. These are reviewed in order of the days they are to be (or were) presented. In addition another workshop was held on Friday

afternoon dealing with IEMI, which is of interest to TC-5.

- Special Session on EM Information Security and Countermeasures (Hayashi); held Tuesday (~55 attendees)
- Special Session on IEMI Protection of Critical Infrastructures (Sabath); to be presented on Thursday morning
- Tutorial on IEC HPEM Standardization Update (Radasky/Hoad); will be held on Friday morning
- Workshop on The IEMI STRUCTURES Program (Righero); will be held on Friday afternoon

5. Report from the Lightning Subcommittee – M. Rubinstein

Prof. Rubinstein began his presentation by reviewing events that had occurred and were planned for 2015 and 2016 in the field of lightning. They are listed below:

2015

- AMS Annual Meeting, Phoenix, Jan 4-8 (Meteorological Applications of Lightning Data, 86 articles)
- APEMC, Taipei, Taiwan, May 26-29 (special session on advanced issues in lightning protection, 8 articles)
- International Conference on Environment and Electrical Engineering (EEEIC) in Rome, June 10-13 (Lightning session, 7 articles)
- APL, Nagoya, Japan, June 23-26 (Lightning Conference, with unknown number of submissions)
- IEEE PES GM, Denver, Jul 26-30 (PES Lightning Performance of Overhead Lines Working Group)
- ASIAEM, Jeju Island, South Korea, Aug 3-8 (8 articles divided into two sessions).
- Joint IEEE EMC/EMC Europe, Dresden, Germany, Aug 16-22 (4 articles, and one demonstration)
- ICOLSE, Toulouse France, Sep 9-11 2015
- SIPDA, Camboriú, Brazil, Sep-Oct 2015

2016

- ILDC/ILMC (San Diego, Apr 18-21)
- GROUND & LPE conference, Brazil (venue and date not yet announced)
- EUROEM, Imperial College, London, July 11-15.
- IEEE Symposium, Ottawa, Canada, July 25-29.
- ICLP, Estoril, Portugal, Sep 25-30.

Also in 2015 there were two working groups dealing with the topic of lightning:

- IEEE PES Lightning Performance of Overhead Lines Working Group (Annual meeting was held in Denver in conjunction with IEEE PES GM a few weeks ago)
- International project on EM radiation from Lightning to Tall Structures (Next meeting in conjunction with ICLP in Portugal Sep 2016)

Cigré is also very active in studying lightning and its effects. There are six working groups within Study Committee C4 that are dealing with this subject (start year of work is listed):

- Working Group C4.410 “Lightning Striking Characteristics for Very High Structures” (2010, Chair: Takatoshi Shindo). Finished its work (TB).
- 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 C4.36 “Winter Lightning – Parameters and Engineering Consequences for Wind Turbines” (2014, Chair: Masaru Ishii)
- Working Group C4.37 “Electromagnetic Computation Methods for Lightning Surge Studies with Emphasis on the FDTD Method” (2014, Chair: Yoshihiro Baba)

Status of Workshops, Tutorials and Sessions

2015

- A workshop was held at the IEEE EMC&SI in Santa Clara on lightning protection of wind turbines.
- Papers were solicited and two sessions (total of 8 articles) were held at ASIAEM in Jeju two weeks ago.

2016

- It is planned to organize a lightning session either for EUROEM in London in 2016 or at the IEEE Symposium in Ottawa. (Note: A session is now planned for EUROEM, and a session or tutorial will instead be organized for the IEEE EMC Symposium in 2017.)

6. Report from the EM Information Leakage Subcommittee – Y. Hayashi

Dr. Hayashi first provided a review of the special session on “EM Information Security and Countermeasures,” presented in Dresden on Tuesday. The organizer was Dr. Hayashi and the papers included:

- Comparison of Electromagnetic Side-Channel Energy Available to the Attacker from Different Computer Systems
- Security Simulation against Side-Channel Attack on Advanced Encryption Standard Circuit Based on Equivalent Circuit Model
- Advanced Fault Analysis Techniques on AES
- Method for Estimating Fault Injection Time on Cryptographic Devices from EM Leakage
- Detection Method for Overclocking by Intentional Electromagnetic Interference
- Electromagnetic Circuit Fingerprints for Hardware Trojan Detection
- Proactive and Reactive Protection Circuit Techniques Against EM Leakage and Injection

The next topic mentioned was to present recent research trends in EM Information Leakage

especially with regard to smart devices connected to the Internet of Things (IoT). It turns out that experiments have indicated that there is a significant concern that it is possible to easily view tablet display information from the EM field emissions in real time.

With regard to future plans, the research community is concentrating on several topics including:

- Recent research trends of information leakage
- Typical measurement and analysis method methods for information communication devices
- Countermeasures

The plan is to organize special sessions at EUROEM 2016, URSI AP-RASC 2016 and a tutorial at the IEEE EMC Symposium 2016.

7. Report from the IEMI Subcommittee – F. Sabath

Dr. Sabath began his report by mentioning the Tutorial on IEMI presented in Santa Clara on Monday afternoon, with six presentations. The tutorial was well attended.

Next he indicated that on Thursday morning of this week in Dresden, there is a special session on IEMI Protection of the Critical Infrastructures with 8 papers to be presented. This special session is intended to provide a review of the European Project STRUCTURES.

There is also a regular session on IEMI Pulsers and Effects Evaluations scheduled for Thursday afternoon, with 5 papers to be presented. It is interesting to note that within this session one paper is a finalist for the Best Symposium Paper and another as the Best Student Paper.

He mentioned that in 2015 that since the Santa Clara IEEE EMC Symposium and not including this conference in Dresden, there are three other conferences that have IEMI interests including:

- APEMC 2015 in Taipei, Taiwan
- ASIAEM 2015 in Jeju Island, Korea
- ICEAA 2015 in Turin, Italy

In 2016 there are also 4 conferences of interest to IEMI including:

- APEMC 2016 in Shenzhen, China
- EUROEM 2016 in London, UK
- IEEE EMC 2016 in Ottawa, Canada
- EMC Europe 2016 in Wroclaw, Poland

Dr. Sabath concluded his presentation with a summary of the 3 European Projects dealing with IEMI that have ended or are nearly complete:

- HIPOW - Protection of Critical Infrastructures against High Power Microwave Threats (End date: 2015-05-31)
- SECRET - SEcURITY of Railways against Electromagnetic aTtacks (End date: 2015-07-31)

- STRUCTURES - Strategies for the Improvement of Critical infrastructure Resilience to Electromagnetic Attacks (End date: 2015-10-31)

8. Coordination with SC-1, Smart Grid – W. Radasky

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 IEEE EMC technical committees working on the smart grid. There were no actions for TC-5 resulting from this meeting.

9. Publication of the IEMI standard practice 1642 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.

10. Status of the TC-5 web page – W. Radasky for M. McInerney, Vice Chair

It is not clear whether we are required to keep up our web page, but in 2015 we were able to submit minutes and agendas through the TAC point of contact.

11. Review of HPEM activities since last TC-5 meeting – W. Radasky

Dr. Radasky reviewed the progress of work in the entire field of high power electromagnetics (HPEM) since the Raleigh IEEE EMC Symposium in 2014. This longer period was considered as not all TC-5 members attended the U.S. IEEE EMC Symposium in Santa Clara in March 2015.

The first subject was to review conferences where papers were published dealing with HPEM from August 2014 until this conference in Dresden:

- 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)
- 1st URSI Atlantic Radio Science Conference (URSI AT- RASC), Gran Canaria (May 2015)
- APEMC, Taipei (May 2015)
- ASIAEM, Jeju, Korea (August 2015)

Next, new articles, reports and standard updates were mentioned:

- “Fear of Frying: Electromagnetic weapons threaten our data networks. Here’s how to stop them,” IEEE Spectrum, September 2014
- “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

A third topic of interest was upcoming publications of interest to HPEM:

- Publication of results of European IEMI projects at Dresden (Special Session)
- Publication of Edition 2 of IEC 61000-4-24 to standardize the testing of HEMP power filters
- Publication of Edition 2 of IEC 61000-4-23 to develop inside-out CW testing and to harmonize with IEEE 299
- Work has begun to develop a guide to IEC HPEM standards (IEC 61000-5-10)

Dr. Radasky closed his presentation with a review of U.S. activities in the field of HEMP/IEMI:

- Hardening of new and existing U.S. power control facilities is continuing
 - EMC hardware companies are developing hardening components designed for HPEM
- Hardening of power substations is being considered by private power companies
 - FERC is concerned about all aspects of substation security
- Congress is getting close to requiring the critical infrastructures to consider the IEMI, HEMP and Geomagnetic Storm threats as part of security upgrades (through DHS)
 - Hearings have been held in both houses of Congress and there is strong support

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

At the end of the meeting the three subcommittees discussed their plans for Ottawa in 2016, and there was an agreement to propose a tutorial on lightning, and possibly a tutorial and special session of EM information leakage. The IEMI subcommittee indicated that due to the high level of activity in Santa Clara and Dresden that a pause was needed in this topic area. (Note: It was decided later that the lightning tutorial would be postponed until 2017, and the EM Information Leakage topic would be dealt with in a tutorial only. Also in late 2015, it was recommended that an ESD special session be held in Ottawa, and this is now scheduled).

13. Any other business – All

At this point in the meeting, Dr. Leferink noted that the scope of TC-5 deals only with the subject of high power EM threats, which are defined as above 100 V/m. However it is well known that “EM Jamming” at low levels can interfere with commercial equipment. It was decided that while we probably did not want to mention the term jamming explicitly in our scope, a proposed minor change was made to our scope during the discussion (with changes indicated in red):

“This committee is concerned with the effects and protection methods for electronic

equipment and systems for all types of high power **and other** electromagnetic **threat** environments. These environments include electromagnetic pulse (EMP), intentional EMI environments (i.e., narrowband and wideband), lightning electromagnetic currents and fields, electrostatic discharge and geomagnetic storms. In addition this committee deals with the commercial data security issue through electromagnetic information leakage activities. Interactions with subsystems, systems and platforms are included."

After this change was discussed, a motion to approve the new scope was made, a vote of the members was taken, and the vote was unanimous. This proposal will be submitted by the Chairman of TC-5 to the TAC on Friday.

14. Adjournment – All

The committee meeting adjourned at 1:30 PM.

2015 Dresden TC-5 Attendees

NAME	AFFILIATION
Dr. Per Ängskog	KTH Royal Institute of Technology, Sweden
Dr. Mats Bäckström	Saab Aeronautics, Sweden
Dr. Larry Cohen	Self
Mr. Sven Fisahn	Leibniz University Hannover, Germany
Dr. Yu-ichi Hayashi	Tohoku Gakuin University, Japan
Mr. Elya Joffe	Elya Joffe Electromagnetic Solutions, Israel
Mr. Matthias Kreitlow	Bundeswehr Research Institute (WIS), Germany
Prof. Frank Leferink	Thales, The Netherlands
Dr. Nicolas Mora	EPFL, Switzerland
Mr. John Ockerse	Airbus Defence and Space
Prof. Nicolae Petre-Marian	University of Craiova, Romania
Dr. William Radasky	Metatech Corporation, USA
Dr. Ronald Rambousky	Bundeswehr Research Institute (WIS), Germany
Dr. Marcos Rubinstein	Univ. of Applied Science, Switzerland
Dr. Frank Sabath	Bundeswehr Research Institute (WIS), Germany
Mr. Hans Schipper	Thales
Mr. Eike Scholz	Technical University of Munich, Germany
Mr. Kim Williams	IEEE, USA
Dr. Perry Wilson	NIST, USA
Mr. Pooi Yi Wong	Google, Inc., USA
Jong-Gwan Yook	Yonsei University, Korea
Ms. Alenka Zajic	Georgia Tech, USA