



EMC Experiments & Demonstrations: Demystifying EMC

By Andy Drozd

Once again, we had an outstanding array of EMC experiments and demonstrations at the 2008 EMC Symposium in Detroit this past August, with a total of eleven hardware experiments and nine computer software demonstrations conducted in Cobo Center. We saw many first-time presenters as well as several popular veteran presenters demonstrate some very important EMC concepts, phenomena and effects, including EMI measurement and troubleshooting procedures all meant to demystify EMC and illustrate its practical side. Overall, this forum, now going into its 17th consecutive year, proved again to be highly successful and educational.

This forum has been traditionally sponsored by the Education & Student Activities Committee (ESAC) of the EMC Society with the goal of providing a live, interactive educational tool to help others understand EMC via examples and problems that are often encountered in our day-to-day work. Since we first started these experiments and demonstrations, the problems have become more complex, as have their solutions. Yet, these demonstrations still provide excellent opportunities for intimately examining the various electromagnetic phenomena, physics, and mechanisms underlying EMI coupling including methods for mitigating interference.

This year's hardware experiment demonstrations were ably organized by Edward Wheeler. Arranging for the hardware experiments over 2-days was no small feat. In addition to our dedicated volunteers and symposium committee staff, we are again indebted to the equipment suppliers which included Tektronix, Rohde & Schwarz, Advantest, Agilent/Hewlett-Packard, KeyTek, and Schaffner EMC for providing the oscilloscopes, spectrum and network analyzers, EMI receivers, signal and function generators, meters and probes, and other hardware for the hardware demonstrations. Their ongoing support on behalf of the demos continues to be very much appreciated and we look forward to their assistance next year in Austin at EMC 2009.

The hardware presentations included the following, which drew significant crowds and much interest:

Test issues inherent in EN61000-4-3 radiated immunity testing – addressing the new harmonic requirements and capital equipment upgrade options by David Seabury of ETS-Lindgren.

Measuring structural resonances of cables and assemblies by Doug Smith of D.C. Smith Consultants.

Noise figure demonstration by Tom Holmes of Agilent Technologies and Candace Suriano of Suriano Solutions.

Improving EMC test productivity with automated EMC test software by Joe Tannehill of ETS-Lindgren and David Guzman of RFTEK.

Chokes in DC-DC converters, bypass capacitors and FM wireless microphones by Keith Hoover of Rose-Hulman Institute of Technology.

Low cost method for comparison of radiated emissions using a toolbox by James Muccioli of Jastech EMC Consultants.

PCB-based EMC issues and their solutions by Bogdan Adamczyk of Grand Valley State University and Jim Teune of Gentex Corporation.

Skin effect, impedance, and resonance of ground planes by Orin Laney of Atwood Research.

Magnetic crosstalk and enclosure resonances by Lee Hill and Randal Vaughn of Silent Solutions.

Insertion loss by Vino Pathmanathan of TRW and Tom Holmes of Agilent Technologies.

In addition to these, the 2008 Student Design Contest Award winners Friedrich Kirk, Wilfred Ghonsalves and Tian He of California State University, Chico presented results from the Student EMC Design Competition as part of the hardware experiment demonstrations.

Additionally, this year's agenda of computer modeling and simulation demonstrations, read again like a Who's Who of EMC. These were co-chaired by Bruce Archambeault, William Goodwin, and yours truly. These were run in parallel with the hardware experiments and included:

Utilization of circuit simulation and electromagnetic FEA models to predict conducted emissions by Zed Tang of Ansoft Corporation.



Bogdan Adamczyk (with microphone) of Grand Valley State University and Jim Teune (seated near laptop) of Gentex Corporation presented an experiment on PCB-based EMC issues and their solutions.



Haixin Ke of Clemson University presented a software demonstration involving modeling printed circuit board geometries.

PHOTOS BY KEN WYATT

Modeling arbitrarily-shaped power/ground planes using cavity model and segmentation technique by Jun Fan of the Missouri University of Science and Technology.

Transmission line transient analysis by Alex Packard and Edward Wheeler of Rose-Hulman Institute of Technology, and James Drewniak of Missouri University of Science and Technology.

Time domain analysis of PCB problems with the discontinuous Galerkin finite element time domain method by J. Alan Roden of The Aerospace Corporation.

Finite element method applied to reverberation chamber analysis by Charles F. Bunting of Oklahoma State University.

Benchmark study on resources for computational electromagnetics by C. J. Reddy of EM Software & Systems (USA), Inc.

Modeling printed circuit board geometries with full-wave EM modeling software by Haixin Ke and Todd Hubing of Clemson University.

Use of computation EM tools in training and career development by Colin E. Brench of Southwest Research Institute.

Utilization of the finite element method in radiated emissions and susceptibility studies by Matt Commens of Ansoft Corporation.

Various modeling techniques were applied to simple canonical models as well as more sophisticated models in order to show how specific EMC problems can be resolved. The computer demonstrations further showed how modeling and analysis can be an effective means of identifying and mitigating EMI problems, as a complement to EMC design and measurement.

For the first time ever, several of the computer demonstrations focused on applying the finite element method (FEM) for problem solving and fostering education in the use of computational electromagnetics (CEM) tools for professional and career development.

I would like to acknowledge and thank all the presenters for a job well done!

We continue to seek new topics and ideas for novel experiments/demonstrations for next year. We have begun the process of planning next year's demonstrations in Austin. If you have ideas for a demonstration and want to have it considered, please contact Colin Brench (colin.brench@ieee.org), the Chair of the Demonstrations Committee for EMC Austin 2009. Also, go to the 2009 EMC Symposium web site (<http://www.emc2009.org>) for more information. We are particularly interested in hardware experiments that have a computer modeling and/or technical paper counterpart. We encourage you to submit your proposal and look forward to your feedback. EMC



Tom Holmes (far right) of Agilent Technologies provided an in depth explanation following his experiment on insertion loss.



Orin Laney of Atwood Research presented a quite detailed experiment on skin effect, impedance, and resonance of ground.



C. J. Reddy (left) of EM Software & Systems presented a demo on computational electromagnetics to the rapt attention of Harry Gaul of General Dynamics.



Doug Smith (right) of D.C. Smith Consultants draws a crowd for his experiment on measuring structural resonances of cables and assemblies.



Dave Seabury (far left) of ETS-Lindgren discussed his presentation on test issues inherent in EN 61000-4-3 radiated immunity testing with Dave Case (center) of Cisco Systems and Mike Slocum of the Naval Surface Warfare Center.