



EMC EXPERIMENTS & DEMONSTRATIONS: FOLLOWING THE CLUES, SOLVING EMI MYSTERIES

by Andy Drozd (right) and Pat André as shown during the EMC 2006 Awards Luncheon in Portland, Oregon

They're back! The EMC Crime Scene Investigators (EM-CSI) that is. Their latest rounds of EMC crime solving took place this past August as part of the EMC Experiment Demonstrations at the annual EMC Symposium in Portland. By the way, we are now going into our 15th year of holding the "demos."

Both hardware experiments and computer-based demonstrations were conducted in parallel over a two-day period, where each emphasized some fundamental aspect of EMI phenomenology and effects, along with practical methods of EMI troubleshooting. Recall that the demos are designed to be an interactive educational tool for learning about novel methods of hands-on EMI problem solving, but at a somewhat basic level and through the use of fairly inexpensive devices. Over the past few years, the focus has shifted slightly from the 'basics' to more complex and problem-specific EMC issues encountered by industry, such as the EMI associated with printed circuit boards, electronic assemblies, and shielded enclosures for automotive and wireless communications applications. Nonetheless, the goal of the demonstrations remains the same to demystify EMC using examples and problems that are often encountered in our day-to-day work. Whereas the live hardware experiments spotlight methods for troubleshooting actual devices on the spot, the computer demos are an exercise in virtual troubleshooting. Both provide excellent opportunities for closely examining

the electromagnetic phenomena, physics, and mechanisms underlying EMI coupling including methods for mitigating interference.

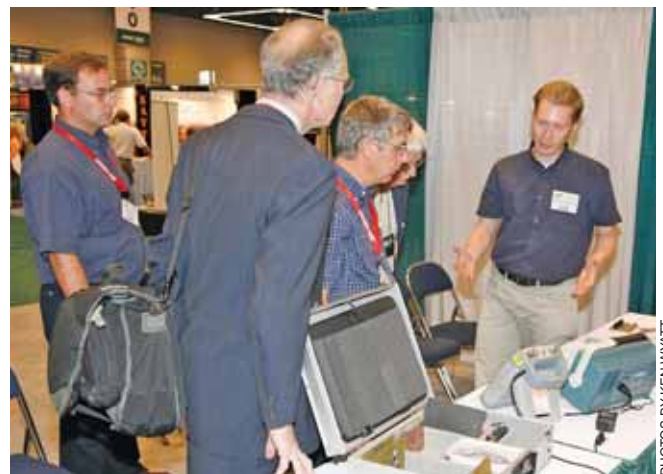
Last year, we coined the term EM-CSI. If EMI is the crime, then EMC is our scene and the EMC expert is the investigator. I liken our expert presenters to EM-CSIs, who will stop at nothing to follow the clues and fix those pesky EMI problems along the way. So let us do a quick review of this year's demos and the EM-CSIs who made it happen.

This year's hardware Experiments were very well attended and enjoyed by all (co-chaired by Pat André in cooperation with Gary Town). Fifteen presenters offered their knowledge, experience, and talents to a receptive crowd. The presenters were both local, as well as international, including Juan J. Jerez, Luis Nuño, and Juan V. Balbastre from Universidad Politécnica de Valencia, Valencia, Spain, Dr. Frank Leferink from the University of Twente, Thales, Netherlands, Michael Eckert and Simon Vilela from Wurth Electronics in Germany, and Mohamed Ramdani from Enseignant-Chercheur in France.

A very wide variety of experiments was provided once again, from measuring the effects of clocks and clock frequencies by Patrick Webb of National Instruments, to "How Parasitic Effects in Inductors and Capacitors Affect Electrical Equipment" by James J. Whalen of State University of New York at Buffalo. Dr. Michael D. Foegelle of ETS-Lindgren spoke on "Demonstration of Antenna Pattern Measurements"



Clayton Paul of Mercer University in Macon, Georgia conducts a demonstration on "The Effect of Pulse Rise/Fall Time on Signal Spectra" at the Portland EMC Symposium.



"EMI Effects of PCB Design" was the title of the demonstration conducted by Jasper van der Graaff (far right) from the University of Twente, Thales, The Netherlands.

PHOTOS BY KEN WYATT

Advanced Test Equipment

Rentals • Leases • Sales



1-800-404-2832



One Source for All Your Test Equipment Needs!!

Advanced Test Equipment offers custom **Rental, Lease and Sale Solutions** for all of your Test & Measurement requirements.

By offering off-the-shelf solutions, we have immediate availability for all of your testing needs.

- Compliance Test Systems
- Turn-Key Systems
- Immediate Availability from Stock
- Full Line of Specialty and General Purpose Test Equipment



George Kunkel of Spira Manufacturing Corporation presented the computer demonstration titled “Generation and Propagation of Electromagnetic Waves and Subsequent Suppression Using EMI Gasketed Joints.”



Tom Holmes of Agilent Technologies and Candace Suriano of Suriano Solutions jointly conducted a “Noise Figure Demonstration” during the Portland EMC Symposium.

and Mark DeBattista of Harley-Davidson spoke on “The Repeatability and Reproducibility Techniques for ESD, Susceptibility, and Emissions Tests.” Our own Ken Wyatt, IEEE EMC Photographer, with Agilent Technologies, gave a wonderful presentation on “ESD Waveform Analysis - Unusual ESD Sources.”

A very interesting demonstration was given by Shaofeng (Tony) Laun, Jin Zhao, and Raymond Chen, of Sigriety, on “Evaluation and Elimination of Package or Printed Circuit Board Resonance by Decoupling Capacitors Placement Optimization.” Tom Holmes and Candace Suriano gave a demonstration on “Noise Figures.” Fair-Rite Products Corporation provided an experiment on “Impedance Testing of Suppression Components.” Of course, other presenters included Dr. Daryl Beetner of the University of Missouri Rolla, Dr. Clayton Paul of Mercer University, and Dr. Lothar (Bud) Hoeft, consultant. They are always a big draw and are most entertaining!



Daryl Beetner of the University of Missouri in Rolla showed an “Evaluation of TEM Cell Measurements” as one of the several hardware demonstrations in Portland.

Hidden from most were the many volunteers behind the scenes who would rush in before the floor was open with a list of demonstrations to be given. They would open the cage where the test equipment was being stored and set up the equipment for the presenter. Power had to be routed, coaxial cables found, connectors and adapters located, and projectors set up. Then the presenter, if he/she was unfamiliar with the test equipment, was given instructions on how to operate the machine so they could look like experts when the observers arrived. By the end of their talks, the volunteers would have to pry the test equipment away from the presenters, lock it back up, and wait until the afternoon group was ready to arrive, when they would repeat the whole process again. For most of us, our days were filled with moving computers to location, unpacking projectors, and then at day’s end return them to storage and repack them, assuring the equipment was safe overnight. And the next day, we would be there to set everything back up for when the next round of people arrived. If it weren’t for a vast workgroup of volunteers from the University of Portland headed up by Mitchell Phillipi, this whole process would not have run so smoothly. Thank you Mitchell and all your crew!

Additionally, this year’s agenda of computer modeling and simulation demonstrations, read again like a Who’s Who of EMC (co-chaired by Andy Drozd, Bruce Archambeault and Pat André). These were run in parallel with the hardware experiments and included:

- “Time-Domain Simulation for Enclosure EMC Design” by Xin Wu of the ICE Electronic Products Division of Fluent, Inc. in Austin, TX, USA.
- “Using FDTD for Real-World EMC Simulation” by Bruce Archambeault of IBM, Research Triangle Park, NC, USA.
- “Combination of MoM/MLFMM/PO/FEM with Transmission Line Theory for the Analysis of External Field Coupling into Shielded Cables” by Robert Kellerman and C. J. Reddy of EM Software & Systems in Hampton VA, USA.

- “Modeling the Coupling of Radiated High Intensity Fields to Cables Attached to Electrically-Initiated Devices (EIDs) in Aircraft Structures” by Irina P. Kasperovich of ANDRO Computational Solutions, LLC in Rome, NY, USA.
- “Characterization of Components and Circuits Up To 3 GHz” by Juan J. Jerez, Luis Nuño and Juan V. Balbastro of the Universidad Politécnica de Valencia in Valencia, Spain.
- “Differential Via Pairs Modeling and Shorting Vias Placement for PPW Noise Mitigation” by Fabrizio Zanella and Antonio Ciccomancini Scogna of CST of America, Inc. in Wellesley Hills, MA, USA.
- “IR Images of EM Fields” by John Norgard of the US Air Force Research Laboratory in Rome, NY and the Air Force Academy in Colorado Springs, CO.
- “Generation and Propagation of Electromagnetic Waves, and Subsequent Suppression Using EMI Gasketed Joints” by George Kunkel of Spira Manufacturing Corporation in North Hollywood, CA, USA.
- “IC-EMC, a Software for Analyzing EMC of Integrated Circuits” by Mohamed Ramdani of Enseignant-Chercheur, France.

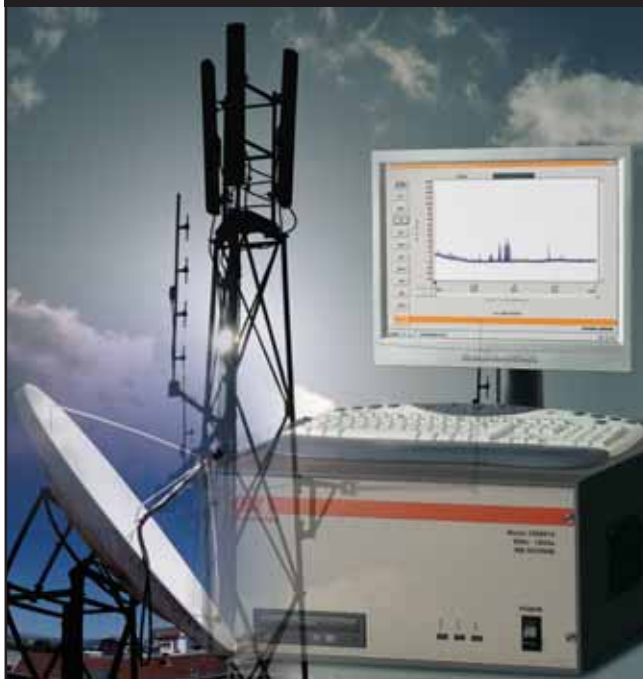
These demos highlighted fundamental EMC modeling approaches and simulation methods applied to EMI trouble shooting and problem solving. Various computational electromagnetic modeling techniques were applied to simple canonical models as well as more sophisticated models in order to show how specific EMC problems can be resolved. The computer demonstrations further showed how modeling and analysis could be an effective means of identifying and mitigating EMI problems, as a complement to EMC design and measurement.

For the first time, all experiments and demonstrations were conducted without the need for encores due to the full agenda of topics and presentations.

Arranging for the many demos over two-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 Hawaii.

We will continue to stress the EM-CSI theme and plan to add new topics as well as a fresh batch of experiments in the future. Speaking of EMC 2007 in Hawaii, we are already in the process of planning next year's demonstrations. **If you have ideas for a demonstration and want to have it considered, please contact Colin Brench (colin.brench@ieee.org), the Co-Chair for next year's demonstrations. Also, go to the 2007 EMC Symposium web site (<http://www.emc2007.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

GET READY FOR THE NEXT WAVE IN EMI RECEIVERS



The CER2018 Compliant Emissions Receiver is here. And in many ways it's unlike any receiver that came before it.

This complete EMI test solution offers continuous coverage from 20 Hz to 18 GHz with expandability to 110 GHz. And to ensure the highest accuracy, it self-calibrates on-demand at every frequency scan.

It includes a built-in computer that operates under Windows XP. Software is also included free along with a 19" flat screen monitor, keyboard and mouse. Programmed-in test formats include CISPR 16-1-1, MIL-STD 461/462, ANSI C63 and FCC. All functions are menu-driven. There is no need to fiddle with switches, buttons or sliders.

Like all AR Worldwide products, the CER2018 is backed by the best and most comprehensive warranty in the business. AR Worldwide is here to help you – today, tomorrow and always.

To learn more, visit us at www.ar-worldwide.com or call an applications engineer at 800-933-8181.

receiver systems **ar**
worldwide

rf/microwave instrumentation • modular rf • receiver systems • ar europe
Copyright© 2006 AR Worldwide. The orange stripe on AR Worldwide products is Reg. U.S. Pat. & Tm. Off.