



EMC Management – Thursday Session at the Chicago EMC Symposium

By Dan Hooliban – Session Chair and TC-1 (EMC Management) Chair

Introduction

The Technical Committee of the EMC Society specializing in EMC Management (TC-1) sponsored and chaired a session at the 2005 IEEE International Symposium on EMC.

The session was held on Thursday morning and was attended by approximately 75 people. The session consisted of six scheduled papers plus a special invited paper. The session was considered to be a “regular” session where the papers had been submitted and reviewed by the Technical Committee as part of the normal symposium acceptance procedure.

Papers

The first paper was given by Darryl Ray of Apple Computer and was entitled “Remodeling a 10-meter Semi-Anechoic Chamber – A Case History.” This presentation described the aftermath of a 1995 water-accident that destroyed much of the pyramidal polyurethane material and resulted in significant damage to the room. The material was replaced with polystyrene absorber along with additional changes to the room such as a video projector for trouble shooting electronic designs. Antenna masts were relocated and additional earthquake support was considered but found to be unnecessary. It was found that replacement of the older polyurethane RF absorbers with ferrite-based hybrid absorbers greatly improved the chamber’s Volumetric Normalized Site Attenuation characteristics. The 1991 chamber now performs like a new chamber.

“Pattern Approval of Measuring Instruments in China” was the second paper given in the EMC Management Session. The presenter was Grace Lin of Grace Compliance Specialists, LLC. Because of China’s growing importance in world trade, this presentation provided communication channels to help people understand and follow the unique Chinese regulations. China’s regulatory agency for measuring instruments is the

General Administration of Quality Supervision, Inspection and Quarantine of the People’s Republic of China (AQSIQ). China’s compliance approval process for measuring instruments is the Pattern Approval. The Pattern Approval process includes Submitting an Application, Initial Review, Type Testing, Final Review, and Issuance of Certificate. A better understanding of the regulations should lead to an expedited approval of measuring instruments imported into China. There are, of course, legal sanctions if the imported instruments do not meet the laws of China.

The third speaker of the session, Eli Recht, addressed the issue of “System Level EMC – From Theory to Practice.” His presentation addressed the issue of the importance of EMC Engineering being an integral part of the system engineering in a complex, technology-driven military project. The system addressed had multiple, diverse capabilities and was comprised of subunits belonging to such areas as electronic boxes, electro-optical units, inertial sensors, functional displays and computers. The system was comprised of both custom-made units and commercial off-the shelf (COTS) units. The presentation reviewed the methodology that was adopted in order to minimize problem/failures during the system EMC testing, both in the laboratory and after installation in its platform. Adoption of this methodology ensures that the EMC activity in a large project will be incorporated correctly and assures that EMC problems will be detected early enabling local and/or system solutions to be found in a timely manner thus minimizing any schedule delays.

“Effective Use of EMC Analysis Tools in the Automotive Product Development Process” was the title of the fourth presentation. It was given by Scott Mee of Johnson Controls in Holland, Michigan. The purpose of the EMC analysis process is to bring compliant products to the market place in a timely manner. A workflow diagram was introduced in the

presentation to help an engineering team through the development process that is interlaced with EMC requirements. The Predictive Analysis concept allows the team to create ‘virtual’ board iterations, saving time and costs in the development challenge. The Predictive Analysis also allows the creation of product ‘blueprints’ which can be used for later re-use on other designs. The process was used in a 12-18 month design cycle and included 8-layer boards with up to five internal clocks. The proposed workflow diagram was developed for the automotive industry, but it has potential applications in other industries.

The fifth presentation was given by Hirayr M. Kudyayn of Lucent Technologies. It was entitled “Pre-Compliance Testing and Characterization of Equipment Shelf EMC Behavior by Empirical Frequency Response Measurements on the Primary Power Bus.”

This paper demonstrated a frequency-swept measurement technique for predicting both conducted and radiated emissions for both pre-compliance and diagnostic purposes. The technique uses a Vector Network Analyzer and is used to optimize or rank alternate designs of equipment shelves for EMC. It is keyed to the Power Bus designs of the Equipment Shelf since the empirical frequency response of the primary power bus is a strong predictor of the overall performance of the fully-populated Equipment Shelf. The measured conducted and radiated emission spectra for two primary power bus designs agreed very well with the Vector Network Analyzer measurement predictions.

“Examination of Electronic Module Immunity Using Transfer Functions” was the sixth presentation given in the session. The author and presenter was Chingchi Chen of Ford Motor Company. The immunity of electronic modules to external electromagnetic interference was evaluated using transfer functions, which correlate the external field-threats with the energy encountered by the compo-

nents inside the module. Simple lumped-circuit models were used to describe the coupling mechanisms and they were verified through straight-forward test procedures. The models were used to examine an actual electronic module with immunity weaknesses. The module was studied, countermeasures were applied, and their effectiveness measured. The module was then tested in a functional vehicle and the measured effectiveness matched the predicted results.

The final presentation was invited by the chair of the session in conjunction with the TAC Chair (Bill Strauss) and the Symposium Committee. It was entitled “Electromagnetic Environmental Effects (E3) Technical Performance Measures (TPMs)” and was given by Douglas Howard and Beverly Persons of Lockheed Martin Aeronautics. The paper was given originally on Tuesday morning as part of a session on “EM Environment” but, because of its excellent EMC management content, it was decided to ask the authors to give it a second time as part of the “EMC Management” session. They agreed and the paper was well received in the EMC Management session.

The presentation addressed the concept of communicating E3 information to project/program management. The TPMs are used to evaluate performance attributes using consistent judgment criteria. Subsystem attributes may be evaluated and combined to form system-level TPMs. Weighting factors can be used to stress the importance of some subsystem

attributes. Once the attributes are defined, the judgment criteria established, and weighting factors determined; a spreadsheet program can be used to periodically update the TPMs. The E3 TPM tool has successfully been utilized at Lockheed Martin for communicating E3 concerns and status to program management. It uses both a numbering scheme and a color-coded scheme to relay critical information to project management. The E3 TPM approach provides a consistent methodology for assessing, predicting, and tracking E3 performance by allowing for archiving assessments to give a way to track the history of system and subsystem perfor-

mance and the historical performance can be used with trend analysis for predictions for future similar equipment.

For more information, please contact Dan Hoolihan, Session Chair, at d.hoolihan@ieee.org or the paper authors as follows:

Darryl Ray: darryl@apple.com

Grace Lin: gracelin@graspllc.com

Eli Recht: elir@elop.co.il

Scott Mee: scott.mee@jci.com

Hirayr Kudyayn: bmkudyayn@lucent.com

Chingchi Chen: cchen4@ford.com

Unfortunately, contact information was not readily available for all the authors at press time. **EMC**



Eli Recht, Grace Lin, Dan Hoolihan (Session Chair), Hirayr M. Kudyayn, Scott Mee, Darryl Ray, and Chingchi Chen are shown from left following the TC-1 EMC Management Session in Chicago. (Note: Douglas Howard and Beverly Persons were not available for the photo.)