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Electromagnetic Compatibility (EMC) for Mechanical and Packaging Engineers

Background

"EMC MUST BE DESIGNED INTO THE SYSTEM"

The discipline of Electromagnetic Compatibility (EMC) is concerned with the design of Electronic Systems, while minimizing electromagnetic coupling and interference from within the system and between systems to their environment.

It therefore covers and requires involvement in a wide range of other fields of engineering, mechanical and packaging engineering, electronic engineering, etc.

Meeting the strict EMC standards, as well as ensuring the satisfactory performance of the equipment in its intended electromagnetic environment requires the implementation of technical measures into the system's design.

Often, the solution of EMI problems (or the avoidance of potential EMI problems) falls upon the packaging and mechanical engineers, who have little electronic engineering background, and yet – must interact with the electronic design engineers in order to achieve consistent and overall system electromagnetic compatibility (EMC).

Proper implementation of the necessary design measures in the early stages of the packaging and mechanical installation design of electronic equipment is a cost-effective approach for the control of EMI in modern electrical and electronic equipment.

Course Objectives

This two-day comprehensive Course provides the trainees with the necessary tools for identification, analysis and understanding of the electromagnetic phenomena related to enclosure and installation design of electrical and electronic equipment.

The Course will emphasize the basic principles and practical applications of packaging and mechanical design, with mathematical derivations and calculations kept to the minimum necessary.

The Course will cover most topics related to the discipline of mechanical and packaging design for EMC and ESD control, which the mechanical/packaging engineer may encounter along his daily work. This includes enclosure shield design and maintaining shield integrity, aperture control, grounding and bonding, installation of filtering and suppression devices and the necessary interface between the enclosure and circuits for achieving EMC, e.g., cable and PCB installation in the enclosure, grounding of circuits within the enclosure, etc.

Practical solutions to practical problems, as well as "real life case studies" are used as examples, and case studies are extensively used along the Course.

Bring your interference problems and return with practical and useful solutions.

Target Trainees

The Course is intended for packaging and mechanical engineers and technicians, who are involved in the design and development, qualification or engineering management of electronic and electrical enclosures and installations.

Benefit to the Participants

Participants in the Course will:-

- obtain a systematic approach to equipment enclosure and packaging for achieving EMC
- acquire a fundamental knowledge of the problem and interference sources in electrical and electronic systems
- acquire the proper design considerations and know-how for the design of electrical and electronic equipment enclosures and packaging for EMC compliance
- understand the importance of the mechanical enclosure-electronic circuit interface, and acquire a "common language" with the electronic design engineers for achieving total system compatibility

In addition, participants are encouraged to bring forward actual design problems and questions they encountered, which the instructor will attempt to assist in their solution.

Course Outline

Module 1: Introduction - Why Design for EMC?

- Sources and victims of EMI
- Nature of an EMI problem
- *"EMI - The Silent Threat"*: A video presentation
- Why design for EMC – motivation and motives?
- The electromagnetic environment

Module 2: Principal EMI Coupling Modes

- Spectral contents of signals
- Models of interference coupling modes

Module 4: Enclosure design for EMC

- Definition of shielding figures of merit: shielding effectiveness and transfer impedance
- Shielding effectiveness mechanisms of metallic enclosures
- Absorption and Reflection losses
- Selection of metals for the enclosure

Module 5: Aperture control and shielding components

- Apertures: violation of shielding integrity, slots, seams and windows
- Aperture control techniques
- Shielding components: meshes, screens, gaskets and special shielding components

Module 5: Grounding and Bonding considerations

- Definition of grounding and bonding
- Achieving effective grounding performance
- Dissimilar metals considerations: Corrosion and corrosion control
- Conductive and non-conductive Surface treatments

Module 6: EMC external enclosure design techniques

- Ensuring total enclosure shielding integrity
- Control of cable and conduit entry: Cable to enclosure interface (connectors)
- Installation of filters and transient suppression devices
- Grounding measures and provisions on the enclosure

Module 7: EMC internal enclosure design techniques

- Compartmentization of enclosure
- Interfacing Electronic circuits (PCBs) to the enclosure
- Grounding and bonding provisions in the enclosure
- Feedthrough filtering implementation

Module 8: Complex structures: cabinets and racks

- EMI considerations in the design of cabinets and racks

Module 9: Mechanical considerations in cable design

- EMI interaction with cables
- Cable design, shielding and routing considerations

Module 10: ESD Control in enclosure design

- The accumulation of Electrostatic charge
- Electrostatic discharge (ESD) control in electronic enclosures

Module 11: Summary and wrap-up

- Miscellaneous issues
- Practical EMC protection problems - discussion