SILENT SOLUTIONS EMC TRAINING

Unique courses on recognizing, solving, and avoiding the toughest EMI problems, from SILENT Solutions LLC

10 Northern Blvd, Suite 1, Amherst, NH 03031-2328 USA

T: +1 (603) 578-1842 www.silent-solutions.com

Applying Practical EMI Design & Troubleshooting Techniques

This course gives engineering professionals the ability to successfully recognize, solve and avoid challenging EMI problems. Demonstrations using working hardware illustrate concepts such as radiated emissions, high frequency antennas, radiated and conducted immunity and crosstalk in connectors, cables and IC packages. Integrating over 30 years of hands-on troubleshooting experience and the latest EMC research, this course is appropriate for experienced circuit and system design engineers, EMC engineers, as well as those who are new to EMI problem solving.

Course Instructor

Lee Hill is Founding Partner of SILENT, an independent EMC and RF design firm established in 1992 that specializes in EMC and RF design, troubleshooting, and training. Lee received his MSEE from the Missouri University of Science & Technology EMC Laboratory, emclab.mst.edu. He teaches a graduate course in EMC as a member of adjunct faculty at Worcester Polytechnic Institute (WPI), and is also an EMC course instructor for Texas Instruments, the University of Oxford (England) and the IEEE EMC Society's Global University, which he currently chairs. He is a past EMC instructor for UC Berkeley, Agilent, and Hewlett Packard.

With over 30 years of EMC design and troubleshooting experience, Lee consults and teaches worldwide, and has presented courses in Taiwan, China, Poland, Singapore, Mexico, Norway, Canada, South Korea, France, Germany and United Kingdom. Lee is a past member of the IEEE EMC Society's Board of Directors (2004-2007).

After Attending This Course, You Will Be Able To:

- Systematically analyze and solve noise problems by using the noise model to create and analyze a noise circuit schematic
- Minimize radiated EMI by designing low inductance signal interconnects
- Understand ground loops, how to represent them in an equivalent circuit, and how to eliminate them
- Clearly identify and manage the different types of "ground" in schematics and physical circuits
- Identify "accidental antennas" in new designs
- Understand, measure, and reduce common-mode current in emissions and immunity, and functional noise problems
- Improve the quality of sensor and instrumentation signals in the presence of noise

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Solutions for your noisy world.

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Applying Practical EMI Design & Troubleshooting Techniques

Day 1

Section 1: Measuring and Inducing Noise

1) The electrical noise model
2) Distinguishing the four noise paths by name, electrical driving function, necessary physical features, and impact of source to victim distance
3) Troubleshooting techniques based on the noise model
4) Far-field versus Near-field coupling + DEMONSTRATION
5) Practical antenna theory for radiated emissions and immunity + DEMONSTRATTION
6) Problems inherent in predicting radiated emissions and radiated immunity test results
7) Conducted emissions—mode separation, LISNs, troubleshooting
8) Practical applications

Section 2: Understanding the Physics and Root Causes of Noise Problems

1) Capacitance—in ESD, PD boards, decoupling networks, filter networks, cables + DEMONSTRATION
2) Electrostatic discharge (ESD). IC and system ESD tests. Problems with test repeatability. Design techniques to improve PCB ESD immunity + DEMONSTRATION
3) Inductance—in PC boards, connectors, ICs, high speed signal paths, decoupling networks,
4) How to use connectors for improved signal quality, reduced emissions, & improved immunity
5) Behavior of current paths at low and high frequencies + DEMONSTRATION

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Day 2

Section 3: Modeling the Four Noise Coupling Paths with Lumped Element Schematics Functions of "Ground" and "Ground" Loops

1) Common impedance - in PCB power planes, ground planes, cables
2) Capacitive - in PCB power filtering, transformers, heatsinks, connectors +DEMONSTRATION
3) Inductive - in PCB ground planes, connectors, and IC packages
4) Radiative - from small electronic products
5) Function and definition of "ground".
   Distinguishing ground from signal return in PCB and system design.
6) Diagnosing the two types of ground loops. How to design to avoid ground loops.

Section 4: Optimum Use of EMI Control Components

1) Control components: capacitors, inductors, ferrite beads, common-mode filters +DEMONSTRATION
2) Coping with and improving non-ideal characteristics such as interconnect inductance, DC bias

Section 5: Measuring and Diagnosing Effects of Common and Differential-Mode Sources and Filters

1) Differential-mode current, voltages
2) Common-mode currents, voltages, +DEMONSTRATION
3) Understanding the common-mode current and antenna path for emissions and immunity
4) Antenna currents and relevance to filter networks and troubleshooting
5) Common and differential-mode filtering. Filter network topology and function
6) Inherent difficulties in EMC filter design. Effects of filters on intended and unintended signals

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