2020
DRESDEN
OCTOBER 27 - 29

WORLD-CLASS EMC/EMI TRAINING COMES TO DRESDEN, GERMANY

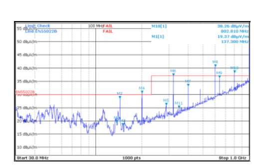
- ***Applying Practical EMI Design & Troubleshooting Techniques***
- ***Advanced Printed Circuit Board Design for EMC + SI***

Taught by Lee Hill, MSEE, SILENT Solutions LLC & GmbH
Member of Adjunct Faculty, Worcester Polytechnic Institute
EMC course instructor, University of Oxford (England)

Each seminar provides 2 full days of interactive and intensive classroom instruction and hardware demonstrations

After attending these classes, you will be able to:

- Systematically analyze and solve noise problems by using the noise model
- Minimize EMI by designing low inductance signal interconnects
- Understand ground loops, how to model them, 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 and measure common-mode current in emissions and immunity problems
- Improve the quality of sensor and instrumentation signals in the presence of noise



SILENT
Solutions for your noisy world.

Course content is identical to that which is presented annually at the University of Oxford, England. Download course syllabus.

ABOUT THE 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 University of Missouri-Rolla EMC Laboratory, (now MS&T) emclab.mst.edu. He is a member of the adjunct faculty at Worcester Polytechnic Institute (WPI), and an EMC course instructor for the University of Oxford (England) and the IEEE EMC Society's Global University. He is a past EMC instructor for UC Berkeley, Agilent, and Hewlett Packard.

With over 25 years of EMC design and troubleshooting experience, Lee consults and teaches worldwide, and has presented classes in Poland, China, Singapore, Taiwan, Mexico, Norway, South Korea Canada, France, Germany & United Kingdom. Lee is a past member of the IEEE EMC Society's Board of Directors (2004-2007).

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Dresden
October 27 - 29

SILENT provides
EMC Education Worldwide
through **Worcester Polytechnic Institute (WPI),**
and University of Oxford

To Register

ONLINE
http://silentde2020.eventbee.com

EMAIL
courses@silent-solutions.com

PHONE +1 (603) 578-1842

Are you frustrated with high frequency noise problems? Tired of failing radiated emissions requirements at EMI test labs? Looking for a logical, systematic way of analyzing and solving electrical noise problems that is based on the latest academic research? Sign up now for North America's premier EMC design & troubleshooting educational event!

This class presents a unique blend of applications, hardware demonstrations, and supporting theory to help design engineers and EMC engineers master key electrical noise reduction techniques. The underlying theory and techniques are equally applicable during design or troubleshooting of regulatory compliance, electrostatic discharge (ESD), RF/wireless, and self-interference problems.

Discounts & Duration

Fee: 995 € per person / per seminar

Note: Each seminar individually is 2 days
Both seminars taken together is 3 days
Day #1 is common to both seminars
Lunch included each day
This course is taught in English

Discounts: Register for both seminars and receive a 400 € discount

Testimonials

"Lee effectively penetrates those impenetrable greek equations with simple insights, and de-funking many common EMC myths – converting magic to practice."

"Good teacher, good tech chops, good passion, loved it!"

"Hardware Demos were very, very helpful"

"Everything you didn't learn about EMC in college but wish you had! Never heard such a complex subject spoken about in such a clear way"

"Give him longer. Would have stayed 2 more hours. Wonderful summary to Global University. Very Clear. Clearly in control of his material"

"If your company designs electrical products, you need your engineers to take this course. For all those EMC topics and solutions never covered in school, this course hits them all"

SILENT Partner Companies

ROHDE&SCHWARZ

LANGER
EMV-Technik

SILENT Solutions LLC
10 Northern Blvd, Suite 1
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Class Location:

Langer EMV-Technik
Rosentitzer Str 73
01728 Bannewitz,
Germany

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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

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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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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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Applying Practical EMI Design & Troubleshooting Techniques

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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Advanced Printed Circuit Board Design for EMC + SI

This course provides a unique blend of theory, applications, and numerous hardware demonstrations to describe effective PCB design strategies to eliminate EMC problems such as radiated emissions & immunity, and ESD, and to improve low and high frequency signal integrity of analog and digital sensors.

The real-time hardware demonstrations use a spectrum analyzer, oscilloscope and signal generators to illustrate inductance, common-impedance coupling, and ground loops in PCBs, cables, and systems. Specific examples of single-point, multi-point, "good", and "bad" grounds will be discussed. We will also apply the course learning by discussing and examining actual SILENT client case histories as well as examples of integrated circuit application notes that give bad EMC design advice.

Course Instructor

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After Attending This Course, You Will Be Able To:

- Place decoupling capacitors to obtain best performance for a given layer stackup, based on the latest university research
- Explain the pros and cons of different PCB stackups, and know where to route and not to route high frequency noise sources
- Control trace inductance for signal integrity and low noise design
- Correctly identify the possible noise paths that can disrupt PCB operation and choose appropriate solutions
- Explain the problems that split ground planes cause and how to use them correctly
- Choose & place connectors and assign signals for lowest crosstalk, best signal integrity, and lowest EMI
- How to identify mutual inductance and improve the effectiveness of filter capacitors
- Identify good and bad design practices when viewing actual PCB layout screenshots

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Advanced Printed Circuit Board Design for EMC + SI

Section 1: PCB Noise Models

1. Review of the noise coupling model
2. Review of the four noise coupling paths
3. Emissions and immunity

Section 2: Capacitance, Inductance and Current Paths in PC Boards

1. Good and bad capacitance
2. Good and bad inductance
3. Current loops
4. Low versus high frequency current paths
5. Inductance and low versus high frequency current paths + DEMONSTRATION
6. “Ground plane” splits - appropriate and inappropriate uses
7. Connectors, cables, and I/O wires connected to the PCB

Section 3: Signals on PC Boards

1. Which signals are important?
2. What do they look like? + DEMONSTRATION
3. Transmission lines, characteristic impedance, terminations + SIMULATIONS
4. Harmonic content versus duty cycle + DEMONSTRATION

Section 4: Power Distribution

1. Functions of PCB “grounds”
2. Vcc noise
3. Decoupling and filtering
4. Board layer stack-ups
5. Funny design ideas, current research, new design applications

Section 5: Design Techniques and Examples

1. Component placement
2. Signal routing + stackup
3. Examining vendor applications notes that give bad EMC advice for PCB design
4. Examining past SILENT PCB design review findings

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