Training Course on EMI/EMC Design and Troubleshooting

Professional Development Training Course Outline

Category	Engineering	**Duration**	10 Days
Base Fee	$3,000 USD	**Delivery Mode**	Online / On-site Hybrid

Course Introduction

Introduction

The Electromagnetic Interference (EMI) and Electromagnetic Compatibility (EMC) landscape is rapidly evolving with the miniaturization of electronics, higher switching speeds, and integration of wireless systems. This specialized training course in EMI/EMC Design and Troubleshooting equips engineers, designers, and quality assurance teams with the tools and techniques required to create robust systems that meet global compliance standards. Training Course on EMI/EMC Design and Troubleshooting integrates practical design strategies, regulatory insights, and troubleshooting techniques to minimize EMI and ensure seamless operation in complex electronic environments.

Participants will gain hands-on experience with filtering, shielding, PCB layout best practices, and pre-compliance testing techniques using real-world case studies. With the rising complexity in automotive electronics, IoT devices, aerospace systems, and industrial automation, the course emphasizes EMC standards (FCC, CISPR, MIL-STD, ISO), root cause analysis, and debugging using spectrum analyzers and near-field probes to enhance product reliability, safety, and compliance.

Programme Curriculum

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Course Objectives

1. Understand EMI and EMC fundamentals and key terminology
2. Interpret global EMI/EMC compliance standards (FCC, CISPR, MIL-STD)
3. Design for low EMI through effective PCB layout techniques
4. Analyze and minimize radiated and conducted emissions
5. Implement filtering and shielding techniques to improve EMC performance
6. Utilize diagnostic tools like spectrum analyzers and LISNs
7. Apply root cause analysis and real-time EMI troubleshooting
8. Design EMI-compliant power supplies and switching regulators
9. Mitigate common-mode and differential-mode noise
10. Understand coupling mechanisms and noise propagation paths
11. Integrate pre-compliance testing in product development cycles
12. Develop EMI-aware designs for automotive, medical, and industrial systems
13. Explore EMI mitigation in high-speed and RF circuit designs

Organizational Benefits

1. Reduce costly product recalls and certification delays
2. Accelerate time-to-market with EMC-compliant designs
3. Improve product reliability in noisy environments
4. Equip engineers with in-demand EMC design and test skills
5. Minimize rework through early-stage EMI diagnosis
6. Ensure regulatory compliance across global markets
7. Enhance cross-functional collaboration between design and QA teams
8. Reduce warranty costs related to EMI-induced failures
9. Support sustainable design through electromagnetic optimization
10. Strengthen customer trust with robust, interference-free products

Target Participants

- Hardware Design Engineers
- EMC Test Engineers
- Quality Assurance & Compliance Teams
- Embedded Systems Developers

- Automotive and Aerospace Engineers
- R&D Teams in Electronics Manufacturing
- Regulatory Affairs Professionals
- Graduate Students in Electronics & Telecommunications

Course Outline

Module 1: EMI/EMC Fundamentals

- What is EMI and EMC?
- Types of EMI: Radiated, Conducted, Crosstalk
- EMC standards overview (CISPR, FCC, MIL-STD)
- Key parameters: Emissions, Immunity, Susceptibility
- **Case Study**: EMI failure in consumer IoT device

Module 2: EMC Regulations and Certifications

- FCC Part 15, CISPR 11/22/32 overview
- Automotive EMC: ISO 7637, ISO 11452
- CE marking and global certification pathways
- Military & aerospace standards: MIL-STD-461
- **Case Study**: Global certification of industrial controller

Module 3: Coupling Mechanisms

- Radiative and conductive coupling
- Capacitive and inductive coupling
- Common-mode vs differential-mode noise
- Near-field vs far-field coupling
- **Case Study**: EMI path analysis in a switching PSU

Module 4: PCB Layout for EMC Compliance

- Layer stack-up strategies
- Grounding and return current paths
- Differential pair routing
- Power integrity vs signal integrity conflicts
- **Case Study**: PCB redesign for CISPR compliance

Module 5: Shielding Techniques

- Material selection: Copper, aluminum, Mu-metal
- Enclosure shielding and gasket design
- Shielding effectiveness testing
- Shielded cables and connectors
- **Case Study**: EMI mitigation in drone electronics

Module 6: Filtering and Decoupling

- Low-pass, common-mode, and differential-mode filters
- Ferrite beads and feedthrough capacitors
- Bypass and decoupling capacitor selection
- Filter placement and impedance matching

- **Case Study**: AC input filter redesign for industrial PSU

Module 7: Grounding and Bonding

- System grounding schemes: Single-point vs multipoint
- Chassis vs signal ground separation
- ESD/EMI control via bonding
- Ground loops and mitigation techniques
- **Case Study**: Grounding fixes in medical device electronics

Module 8: Radiated Emissions and Immunity

- Measurement techniques in anechoic chambers
- Transverse electromagnetic (TEM) cell testing
- Use of antennas, probes, and LISNs
- Radiated immunity testing using GTEM cells
- **Case Study**: Radiated emissions in RF sensor node

Module 9: Conducted Emissions and Immunity

- LISN configuration and measurement
- Line impedance and conducted path analysis
- Surge, EFT, and voltage dips testing
- Common commercial EMI filters
- **Case Study**: Conducted noise from a DC-DC converter

Module 10: Diagnostic Tools and Techniques

- Spectrum analyzers and EMI receivers
- Near-field magnetic and electric field probes
- Oscilloscopes for EMI debugging
- Use of current probes and clamp meters
- **Case Study**: Live EMI debugging on automotive ECU

Module 11: EMI in Power Electronics

- High dV/dt and dI/dt transitions
- Snubbers and soft-switching techniques
- EMI in GaN and SiC-based converters
- EMI-aware SMPS and inverters
- **Case Study**: EMI optimization in EV charger design

Module 12: EMC Design for High-Speed Systems

- Crosstalk and reflection in high-speed buses
- Signal integrity vs EMC trade-offs
- SerDes, DDR, USB, and HDMI EMC design
- Timing skew and EMI emissions
- **Case Study**: EMC in gigabit Ethernet switch board

Module 13: Automotive EMC Design

- Load dump, BCI, and transient immunity
- EMC test setups for vehicle subsystems

- ISO 7637 & ISO 11452 application
- Design for robustness under ESD
- **Case Study**: Automotive infotainment system compliance

Module 14: Pre-Compliance Testing

- Pre-compliance test setups and strategies
- Identifying early EMI hotspots
- Shielding effectiveness verification
- Cost-effective pre-scan environments
- **Case Study**: Startup product saving costs via pre-testing

Module 15: Troubleshooting Methodology

- EMI failure root cause analysis
- Step-by-step troubleshooting framework
- Hotspot identification with probes
- Design modifications and revalidation
- **Case Study**: Stepwise debugging of EMI failure in PCB

Training Methodology

This course employs a participatory and hands-on approach to ensure practical learning, including:

- Interactive lectures and presentations.
- Group discussions and brainstorming sessions.
- Hands-on exercises using real-world datasets.
- Role-playing and scenario-based simulations.
- Analysis of case studies to bridge theory and practice.
- Peer-to-peer learning and networking.
- Expert-led Q&A sessions.
- Continuous feedback and personalized guidance.

Register as a group from 3 participants for a Discount

Send us an email: info@fineskilltrainingcenter.org or call *+254769199797*

Certification

Upon successful completion of this training, participants will be issued with a globally- recognized certificate.

Tailor-Made Course

We also offer tailor-made courses based on your needs.

Key Notes

a. The participant must be conversant with English.

b. Upon completion of training the participant will be issued with an Authorized Training Certificate

c. Course duration is flexible and the contents can be modified to fit any number of days.

d. The course fee includes facilitation training materials, 2 coffee breaks, buffet lunch and A Certificate upon successful completion of Training.

e. One-year post-training support Consultation and Coaching provided after the course.

f. Payment should be done at least a week before commence of the training, to Fineskill Training Center account, as indicated in the invoice so as to enable us prepare better for you.

Upcoming Scheduled Sessions

Start Date	End Date	Location	Price
23 Nov 2026	04 Dec 2026	Online	$2,000
23 Nov 2026	04 Dec 2026	Physical	$3,000
23 Nov 2026	04 Dec 2026	Physical	$6,000
23 Nov 2026	04 Dec 2026	Physical	$6,000
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$9,000
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$12,000

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