Another EMC resource from EMC Standards

PCB Design and Layout Techniques for EMC (1-day course)
PCB Design and Layout Techniques for EMC

The EMC techniques now generally required for all PCBs

A One-day Training Course

by

EurIng Keith Armstrong
Cherry Clough Consultants Ltd, U.K.

Synopsis

Provides training for engineers and their managers in the use of EMC design, layout, manufacturing and assembly practices for printed circuit boards (PCBs – also known as printed wiring boards, PWBs) made necessary by modern silicon transistors and ICs.

Every two years, on average, every type of semiconductor that is available on the market goes through a die-shrink, which makes their emissions and immunity worse. This applies to older device types, like 74-series TTL and HCMOS, as well as to the latest microprocessors, so designing with the same old parts does not protect us from this problem.

So PCB technology must continually advance, to design PCBs that don’t have EMC problems.

This course is kept up-to-date as technology advances, so is never the same from one 6 months to the next. It is much more up-to-date than any textbook can ever be.

A companion course on Advanced PCB design and layout techniques for EMC is also available.

Objective

The most cost-effective EMC techniques are those applied at PCB/PWB level.

This course provides a practical grounding in PCB/PWB EMC design and layout techniques that have been proven in real life over many years to help companies quickly improve their commercial and financial performance by:

- Bringing advanced products to market more quickly
- Reducing unit manufacturing costs
- Reducing warranty costs and costs of ownership by improving reliability
- Easily complying with legal EMC requirements
- Reducing financial risks and improving Return On Investment
Who Should Attend

All electronic and PCB/PWB designers, and their managers, in all industry areas, including:

- Automotive
- Consumer
- Information Technology (IT)
- Railway
- Aerospace
- Telecommunications
- Medical and healthcare
- Household (domestic) appliances
- Industrial instrumentation or control
- Marine
- Military
- Radiocommunications

Prerequisites

Familiarity with circuit (hardware) design and/or the layout of PCBs/PWBs.

Plain English is used, with a small amount of very easy mathematics

Course Methodology

This course is presented classroom style using a PowerPoint slideshow containing practical illustrations of the techniques to aid understanding.

Case studies that are relevant to the trainees will be included verbally.

Each attendee will be presented with a bound copy of the PowerPoint slides used during the training, printed at 6 slides per page. The spaces around the slides usually suffice for taking extra notes.

Copies of the textbook “EMC for Printed Circuit Boards, basic and advanced design and layout techniques”, Armstrong/Nutwood January 2007, ISBN: 978-0-95555118-0-6 (spiral bound to lie flat when open) or 978-0-9555118-1-3 (perfect bound), can be provided at extra cost.

Course Duration

One (1) day: For example: 9:00am – 5:00pm (for example)

This is an intensive course with a very large amount of practical detail.

If presented as an in-house course it can be very usefully combined with individual consultancy for each engineer or manager, to help him or her apply the material to his or her current projects.

Venue and Date

To be decided. The course could be provided as a public course, or as an in-house course. As an in-house course, it has the added value of allowing confidential discussions on how best to apply the material to particular projects or products.

Reviews of this course

Delegates world-wide have always awarded this course an overall score of at least 80%.
COURSE OUTLINE

The EMC techniques now generally required for all PCBs

- Saving time and money
- Segregation
- Interface analysis, filtering and suppression
- 0V and power planes
- PCB-chassis bonding
- Power supply decoupling
- Transmission line techniques
- Layer stacking
- Some useful references and sources
Course Instructor

**Academic Qualifications**
BSc (Elec.Eng), Upper 2nd Class with Honours, Imperial College of Science & Technology, London, UK, 1972

**Professional Qualifications**
Fellow IET (Institution of Engineering and Technology, formerly the Institution of Electrical Engineers, IEE), London, UK (Member since 1977) 2010
Senior Member IEEE (Institute of Electrical and Electronic Engineers Inc.) USA, member of its EMC, Product Safety Engineering Societies since 1998 2010
Associate of the City and Guilds Institute, London, UK 1972
UK Chartered Engineer, Engineering Council, London, UK 1978
Group 1 European Engineer (EurIng), FEANI, Paris, France 1988

**Professional Activities**
Chair of IET’s Working Group on EMC and Functional Safety 1997-date
Chair of IEEE EMC Soc. Special Committee on Risk Management of EMC 2012-date
UK expert appointed (by invitation) to IEC maintenance team MT23 for IEC 60601-1-2 (Medical Equipment/Systems EMC) 2006-date
UK expert appointed (by invitation) to IEC maintenance team MT15 for IEC 61000-1-2 (EMC & Functional Safety) 2003-date
UK expert appointed to IEC 61000-6-7 (EMC & Functional Safety, Generic) 2010-date
Member EMC Industries Association (EMCIA) 2003-date
Member EMC Test Labs Association (EMCTLA) and its Working Group B 2001-date
Technical Panel, IET Functional Safety Professional Network 2003-date
Technical Panel, IET EMC Professional Network 2001-date
Editor, Inside Functional Safety magazine 2010-date
Editorial Advisory board member, Interference Technology magazine 2007-date
Editorial Advisory board member, Compliance Engineering magazine 1998-date
EMCIA representative to BSI GEL 210/12 EMC committee 2009-date
President of the EMC Industries Association (EMCIA) 2008-2010
Vice-President of the EMC Industries Association (EMCIA) 2010-2012
Chair of IEE’s EMC Professional Group (E2) 1997-1999

**RECENT RELEVANT EXPERIENCE (1990-PRESENT)**
Started Cherry Clough Consultants in 1990, Director of the Limited Company since 2010.
External lecturer for the Sensors and Electronic Instrumentation MSc course at the University of Manchester, teaching an IET-accredited module on practical EMC design techniques.
The services that Keith provides for Cherry Clough Consultants include:
- Product, system, and installation EMC and safety good practices for reliability and cost-effective regulatory compliance
- Assessment of electromagnetic environments
- Control plans, test plans, etc., for effective management of EMC and safety in projects of all sizes
• Company procedures for EMC and safety, for financial benefits and/or regulatory compliance
• Production / QA procedures for maintaining regulatory compliance in volume manufacture and custom engineering
• Testing and remedial work to meet EMC and safety standards
• Creation of EMC Directive Technical Construction Files and other compliance documentation
• Assessment of EMC Directive Technical Construction Files for a number of EMC Competent Bodies
• Education and training for designers and managers on cost-effective EMC and Safety techniques; and on “EMC for Functional Safety, high-reliability and legal metrology”
• Education and training for executives in EU compliance; liability; financial benefits of using good EMC techniques; and related marketing issues

The above services have been applied in the following areas – this is not a complete listing:

**Systems and installations:**
Machinery and manufacturing/process plant of all sizes
Robotics
Air traffic control towers
Administration centres
Professional audio systems and installations (e.g. theatres, opera houses, recording studios)
Steel rolling mills
Hotels
Nuclear processing plant
Road tunnel lighting schemes
Synchrotrons (e.g. the Diamond Light Source, Harwell, Oxfordshire)
Railway systems

**Products and items of equipment:**
Industrial instrumentation, control, and machinery of all sizes
Variable speed AC and DC motor drives from very small to 10MW
Automotive engine control units (ECUs) and other electronic subassemblies (ESAs)
Information technology equipment (ITE) e.g. computers, servers, RAID arrays
Personal Digital Assistants (PDAs) and other hand-held wireless-enabled computing devices
Marine equipment
Photocopiers
Datacommunications devices
Professional video projectors
Telephones and telecommunications
Radiocommunications, cellphones and pagers
Lifts (elevators)
Gambling machines
Electricity meters
Building electrical services equipment
Robots
Military avionics
Microscope manipulators
Security equipment
Induction heating
Digital microwave radio

**PREVIOUS PROFESSIONAL EXPERIENCE (1982-1990)**
Keith was mostly involved with the design and development of state-of-the-art capital equipment during the period 1968 to 1990. He has wide experience in electronic product design and project

Technically, he started in analogue design in 1968; adding digital control of analogue circuits in 1978, and A/D and D/A conversion in 1980. Project and departmental management experience was gained from 1983 onwards, including teams of more than 20 engineers and scientists (this was for the Microwave division of Marconi Instruments Ltd, Stevenage, UK, 1983-1988).

BOOKS, PUBLICATIONS and PAPERS

**EMC Design Techniques for electronic engineers**

(Chapter 2 of this book is the complete text of "The Physical Basis of EMC" (below), so don't purchase both!)

**The Physical Basis of EMC**

(Chapter 2 of my book "EMC Design Techniques for electronic engineers" (above) is the complete text of this book, so don't purchase both of them!)

**EMC for Printed Circuit Boards – Basic and Advanced Design and Layout Techniques**

**The First 500 ‘Banana Skins’**

**EMC for Systems and Installations**

Keith has written and presented a great many papers for a wide range of symposia, conferences, colloquia, and seminars worldwide, including ERA, IEE, IET, IEEE EMC Society and IEEE Product Safety Engineering Society events. Too many to list here, please ask for further details.

He has also published a great many articles on EMC for publication in professional journals and trade magazines worldwide, including the following five annual series for the EMC Compliance Journal (visit http://www.compliance-club.com/keith_armstrong.asp):

- “Designing for EMC”  (6 parts 2006-8, updating the 1999 series)
- “EMC for Systems and Installations”  (6 parts, 2000)
- “EMC Testing”  (7 parts, 2001-2)
- “Advanced PCB Design for EMC”  (8 parts, 2004-5)

Keith has written 17 informative booklets on electromagnetic phenomena, what they are, what causes them, how they cause interference, and how to test for them using IEC and EN standard methods, plus 5 booklets (so far) on EMC issues in Installations, for example: Power Quality, Good EMC Engineering Practices, Variable-Speed Drives, etc. They can all be downloaded for free from www.reo.co.uk/knowledgebase.

Please visit www.cherryclough.com for more information.