Another EMC resource
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Electronic Design for cost-effective EMC (2-day course)

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Practical Electronic Design Techniques for Cost-Effective EMC

A Two-day Training Course

by

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Cherry Clough Consultants, U.K.

Synopsis

Training for electronic and mechanical design engineers, and their managers, in the use of good EMC design and manufacturing practices suitable for modern products and equipment.

Objective

The aim of the course is 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

This course is highly recommended for those involved in any aspect of the design or testing of electrical/electronic products.

It is based upon the course that Keith teaches to post-graduate students on the Electronic Instrumentation Systems M.Sc. course at the University of Manchester (formerly UMIST, University of Manchester Institute of Science and Technology), UK.

Who Should Attend

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

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

Mechanical designers will also find much of the course material very valuable, and the order of delivery of the material can be arranged to make it easy for them to attend part-time. Alternatively, we can offer a version of this course aimed solely at mechanical designers.

Prerequisites

Familiarity with circuit (hardware) design, PCBs/PWBs and electronic and mechanical assembly and interconnection techniques.

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. Space is provided for taking 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

Two (2) full days, for example: 9:00am – 5:00pm each day

This is a very 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.

In countries where English is not the first language, a longer duration may be preferred.

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 have always awarded this course an overall score of at least 80%.

COURSE OUTLINE

DAY 1

EMC approaches for regulatory compliance; high reliability or functional safety
What interference can occur, and how it affects hardware and software
Saving time and money with good EMC techniques
EMC specification and standards
Digital circuit design for EMC
Analogue circuit design for EMC
Switch-mode power conversion circuit design for EMC
Communications circuit design for EMC
Choice of PCB components for EMC
Cables and connectors
EMC filtering

DAY 2

EMC shielding
Printed-Circuit Board (PCB) design and layout for EMC
Suppressing surges
Suppressing electrostatic discharge (ESD)
Suppressing electromechanical devices
Suppressing emissions of harmonics, voltage fluctuations and flicker
Techniques for dealing with poor mains power quality
Some very useful references

A more detailed course contents list is available upon request

Course Instructor

EurIng Keith Armstrong C.Eng, FIET, ACGI, MIEEE, BSc(Hons)

Partner and Principal Consultant for Cherry Clough Consultants

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EDUCATION/CERTIFICATION

Bachelor of Science (BSc) with Honours, Upper Second Class, Electrical Engineering, Imperial College of Science and Technology, London, U.K. 1972.

Associate of the City and Guilds Institute (ACGI), London, U.K., 1972

Member of the Institution of Electrical Engineers (MIEE) London, U.K. recently renamed as The Institution of Engineering and Technology (IET), since 1977. Appointed Fellow (FIET) in 2010.

Appointed as Chartered Engineer (C.Eng) by the Council of Engineering Institutions, London, U.K., 1977

European Engineer (EurIng) Group 1 awarded by the European Federation of National Engineering Institutions (FEANI), 1988

Member of IEEE (USA) and IEEE EMC Society, MIEEE, 1998

Member of IEEE Product Safety Engineering Society (USA), 2004

PROFESSIONAL ACTIVITIES

President of the EMC Industry Association (www.emcia.org) 2008-date

Chair of IEE's Electromagnetic Compatibility (EMC) Professional Group (E2) 1997-1999

Chair of IET's Working Group on EMC and Functional Safety 1998-date

Member EMC Test Labs Association (EMCTLA) and its Working Group B 2001-date

Member of Technical Panel for IET's EMC Professional Network (PN)	2001-date
Member of Technical Panel for IET's Functional Safety PN	2003-date
UK Expert appointed to the maintenance team (MT15) for IEC 61000-1-2 (EMC & Functional safety)	2003-date
UK Expert appointed to the maintenance team (MT23) for IEC 60601-1-2 (Medical EMC)	2007-date

RECENT RELEVANT EXPERIENCE (1990-PRESENT)

Started Cherry Clough Consultants in 1990, currently one of the two Partners.

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 (so far) – please note this is not a complete listing:

Systems and installations:

Machinery and manufacturing/process plant of all sizes
Robotics
Air traffic control towers
Computer and telecommunication rooms
Administration centres
Financial dealer rooms
Professional audio systems and installations (e.g. theatres, opera houses, recording studios)
Steel rolling mills
Hospitals
Hotels
Chemical and pharmaceutical processing plant
Nuclear processing plant
Bottling and canning lines
Road tunnel lighting schemes
Broadband-Over-Power-Line (BPL) systems
Synchrotrons (e.g. the Diamond Light Source, Harwell, Oxfordshire)
Railway systems
Mobile X-ray systems for shipping containers

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
Computers
Photocopiers
Digital Signal Processing
Datacommunications devices
Professional audio consoles and other equipment
Professional video projectors
Lighting
Telephones and telecommunications
Consumer electronics (TV, Hi-Fi, etc.)
Radiocommunications, cellphones and pagers
Lifts (elevators)
Domestic (household) appliances
Gambling machines
Gas boilers
Electricity meters
Electrical power generators (small scale)
Building electrical services equipment
Subsea oil and gas production equipment
Robots
Solar power converters
Military avionics
Medical equipment (various)
Microscope manipulators
Coin mechanisms
Security equipment
Mains-borne communications
Induction heating
Laser welding
Digital microwave radio
Variable-speed winch for a military submarine

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 management in the UK, South Africa and France, after finishing graduate apprenticeship with Thorn Automation in 1973.

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 for Systems and Installations, Tim Williams and Keith Armstrong, Newnes, 2000, ISBN: 0-7506-4167-3, www.bh.com/newnes, RS Components P/No. 377-6463.

EMC for Printed Circuit Boards – Basic and Advanced Design and Layout Techniques,
Keith Armstrong, February 2007. Cost £47 plus p&p.
Perfect bound (with titled spine): ISBN 978-0-9555118-1-3
Spiral bound (lays flat for easy use): ISBN 978-0-9555118-0-6
Full colour graphics throughout. Written in a clear concise no-nonsense style full of practical detail. Order via http://www.emcacademy.org/books.asp

The First 500 'Banana Skins',
Nutwood UK, 2007, 500 reports and anecdotes concerning EMI. Edited by Keith Armstrong.

Very useful for have a laugh at other's mistakes, or frightening yourself with what could go wrong. A useful present for a boss that doesn't believe EMC can cause very real engineering and financial problems. Read it at www.theemcjournal.com, or buy from pam@nutwood.eu.com (approximately £10) or via http://www.emcacademy.org/books.asp.

The IET's new (2008) Guide on EMC for Functional Safety
ISBN 978-0-9555118-2-0, colour graphics throughout, cost £27 plus p&p from www.emcacademy.org/books.asp, or free download from www.theiet.org/factfil;es/emc/index.cfm. Written by an IET Working Group chaired by Keith Armstrong, this book comprehensively describes a practical and cost-effective procedure to help to save lives and reduce injuries where electronics technologies are used in all safety-implicated products, 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.

Member of the editorial advisory board for Compliance Engineering Magazine, 1998 - date.

Member of the editorial board for Interference Technology Magazine, 2007 - date.

Please visit www.cherryclough.com for more information.