

Reading instructions EMC. Based on Williams “EMC for product designers”, ed 5.

Generally, the lecture copies and lab exercises contain what is considered most important!

In Appendix D there are a lot of useful formulas that may be used for solving the longer exam tasks.

Chapter 1 Introduction

- Quick read through to get the overall picture.
- “The EMC gap”

Chapter 2-6 The EMC Directive, Standards, Legislation (Intro)

- Principles for the legislations
- Product standards – Generic standards, principles
- Generic emission and Immunity standards – overview to get the picture of what is needed to address and test.

Chapter 7-10 EMC testing (EMC Measurements)

- Properties to test
- Frequency range for testing
- Conducted and Immunity limits (p. 99)
- Measurement equipment, overview, not too detailed except for what you have used in the labs.
 - Measuring receiver
 - Spectrum analyzer
 - Filter bandwidths according to standards
 - Detectors – Peak, Quasi-peak, Average – Properties of those
 - Tracking generator
 - Measuring antennas, Antenna factor
 - Measuring site
 - Shielded, attenuated chamber why?
 - Near field probes
 - LISN – Properties, why
 - Radiated and conducted immunity
 - ESD testing, equipment
 - Transient testing

Chapter 11-12 Coupling mechanisms, Layout and grounding

- Ch 11 Coupling mechanisms
- Coupling paths, conducted, field-based.
- Inductive, capacitive – how modelled in victim circuit.
- Radiated coupling, Wave impedance
- Coupling modes, Differential, Common, Antenna modes
- Radiated emissions
 - Differential mode emission from PCB
 - Common mode from cables
- Immunity

- Cable resonance
- ESD (A separate lecture – see lecture notes also)
- Mains harmonic

- Ch 12 Layout and grounding
- System partitioning
- Grounding, types of ground
- Transfer impedance
- Single point - Multipoint ground, hybrid ground
- Ground impedance
- Gridded ground – ground plane
- Breaks in ground, how to improve
- Multilayer PCB boards
- I/O grounds, cable screen grounding

Chapter 13 Digital and analog circuit design

- The fourier spectrum of digital signals, Bode diagram break points, envelop
- Differential and common mode radiation from digital circuits
 - Estimate total emission
 - Measures to reduce the emission
- I/O filtering
- Decoupling, component selection
- Analogue instability
- Switching mode power supply, basic principles behind noise generation
- Design for immunity, transients, ESD
- Microprocessor immunity, watch dog
- Analog immunity, bandwidth, isolation

Chapter 14-15, Interface and shielding

- Ch 14 Interfaces and filtering
- Differential mode and common mode on cables
- Cable return currents
- Grounding of cable screens and cable screens at low and high frequencies
- Types of cabel screens
- Surface transfer impedance
- Pigtail – no go
- Twisted pair cables
- Ribbon cables – ground configurations
- Filtering and suppression, p 357-
- Source and load impedance
- Parasitic resonance
- Component layout
- Ferrites
- Three terminal capacitors
- Mains filter, basic principles
- I/O filtering and transient protection components

- Ch 15 Shielding
- Shielding theory, $SE = R + A + B$, refer to Appendix D
- Effect of apertures, seams, other hardware to use for screening.

Passive components

- Covered by the lecture and lab 3
- Frequency behavior is important.

ESD

- Covered by the lecture
 - Basic principles for origin
 - Effects of discharge on electronics and systems
 - Construction details to consider, shielding, filtering, transient protection
 - Testing