

Basic Aspects of EMC

Choose yourself and new technologies

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Introduction

May I introduce myself. My name is Andrzej Sowa, doctor Andrzej Sowa.
My email address is in a standard form : andrzej.sowa@pwr.edu.pl.
I will read the second part of the lecture entitled Analog Peripherals of Digital Systems which is devoted to some basic electromagnetic compatibility issues.
We have at our disposal 7 lecture hours – 6 hours devoted to the lecture and 1 to the final test.
The test will be kept together with doctor Witkowski's part of the lecture.

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References

1. Ott H. W., *Electromagnetic Compatibility Engineering*, Wiley, Hoboken, NJ, 2009
2. Williams T., *EMC for Product Designers*, Elsevier-Newnes, 4-th ed., Oxford, 2007

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Electro-magnetic compatibility means the ability of an electrical device (component, system), to work properly in its electro-magnetic environment, without introducing intolerable electro-magnetic disturbances to anything in that environment.

Line bound Field bound

Emission disturbance disturbance effect

disturbance effect (immunity) emission of radiation

wire with the effect of an antenna

Electrical Device

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EMC subjects

Physical aspects Biological+ medical aspects

Emission Immunity

Disturbances in supply systems Corona

Radar hazard Secondary radiation

Detection Amagnetic

Lack of stray field Temporary Emanation and Spurious Transmission

Electrical corrosion Echo sounding device

Nuclear electromagnetic pulse Touch proof

Lightning protection

EMC

Economic aspects Legal aspects

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Directive 2014/30/EU
of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to ElectroMagnetic Compatibility

Applicable from 20 April 2016.

[Summary of references of harmonised standards published in the Official Journal – Directive 2014/30/EU](#)

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- ▷ This Directive applies to apparatus liable to cause electromagnetic disturbance or the performance of which is liable to be affected by such disturbance.
- ▷ It defines the protection requirements and inspection procedures relating thereto.
- ▷ Electromagnetic emissions of most electrical and electronic products are controlled and it is ensured that these products are not themselves unduly affected by electromagnetic interference

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Apparatus Affected

- ▷ Domestic audio and video receivers
- ▷ industrial equipment
- ▷ mobile radio and commercial radiotelephone equipment
- ▷ medical and scientific apparatuses and devices
- ▷ information technological appliances (e.g. computer)
- ▷ domestic appliances and household electronic equipment
- ▷ radio equipment ("walkie-talkie")
- ▷ electronic teaching devices
- ▷ telecommunication equipment and networks
- ▷ radio and television broadcast transmitters
- ▷ lights and fluorescent lamps

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Noise vs. Interference

Noise – electric signal other than desired:

- intrinsic noise sources as thermal noise or shot noise,
- man – made noise coupled from EM environment,
- natural disturbances as lightning or sunspots, but
- **not** distortion produced in a circuit due to nonlinearities unless coupled to other part of circuits

Interference – undesired effect of noise

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Noise vs. Interference

- interference can be eliminated – for example by eliminating nonlinearities
- noise cannot be eliminated – can be reduced in magnitude, until it no longer causes interference

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ElectroMagnetic Sources in EM Environment

Fig. from: H.W.Ott Noise Reduction Techniques in Electronic Systems

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Electronic System as a Noise Source

Fig. from: H.W.Ott Noise Reduction Techniques in Electronic Systems

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EXCLUSIONS

- Certain installations (combinations of items put together at a given place to fulfil a specific function but not designed for supply as a single functional unit)
- Spare parts
- Second hand apparatus
- Apparatus for use in a sealed electromagnetic environment
- Some military equipment
- Certain radio equipment for radio amateurs which is not available commercially
- Apparatus which - irrespective of their design - can neither emit nor be affected by electromagnetic disturbance

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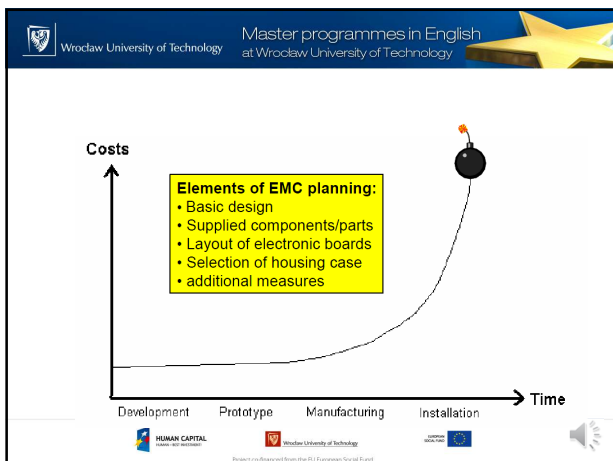
$CE + CE = \text{no CE}$

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**EMC - ElectroMagnetic
Compatibility**

- is the ability of an electronic system to:

- function properly in its intended EM environment,
- not be a source of noise to EM environment

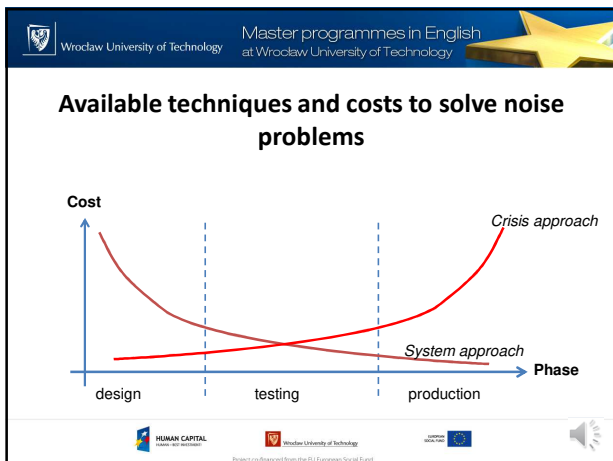


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Two approaches to EMC engineering:

- **Crisis approach** – designer proceed with a total disregard of EMC – EMC problems are solved by „add on” („Band Aid”)
 - *very expensive and nervous*
- **System approach** – designer proceed with EMC rules at the beginning
 - *90 % of problems are eliminated during designing process*

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Test questions example:

1. Describe briefly **two approaches to EMC engineering**.
2. Noise vs. Interference.
3. How to understand graphics: $\text{CE} + \text{CE} = \text{CE}$

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