Training Course on Conformity and Interoperability,
Tunis-Tunisia, 22-26 May 2017

Basics of EMC

Presented by: Karim Loukil & Kaïs Siala

Karim.wakil@cert.mincom.tn

Kais.siala@cert.mincom.tn

Basics of electromagnetics

Electromagnetic waves (3)

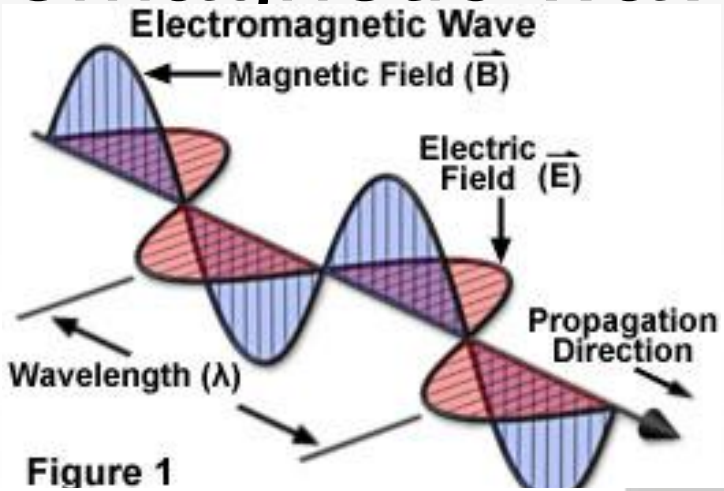
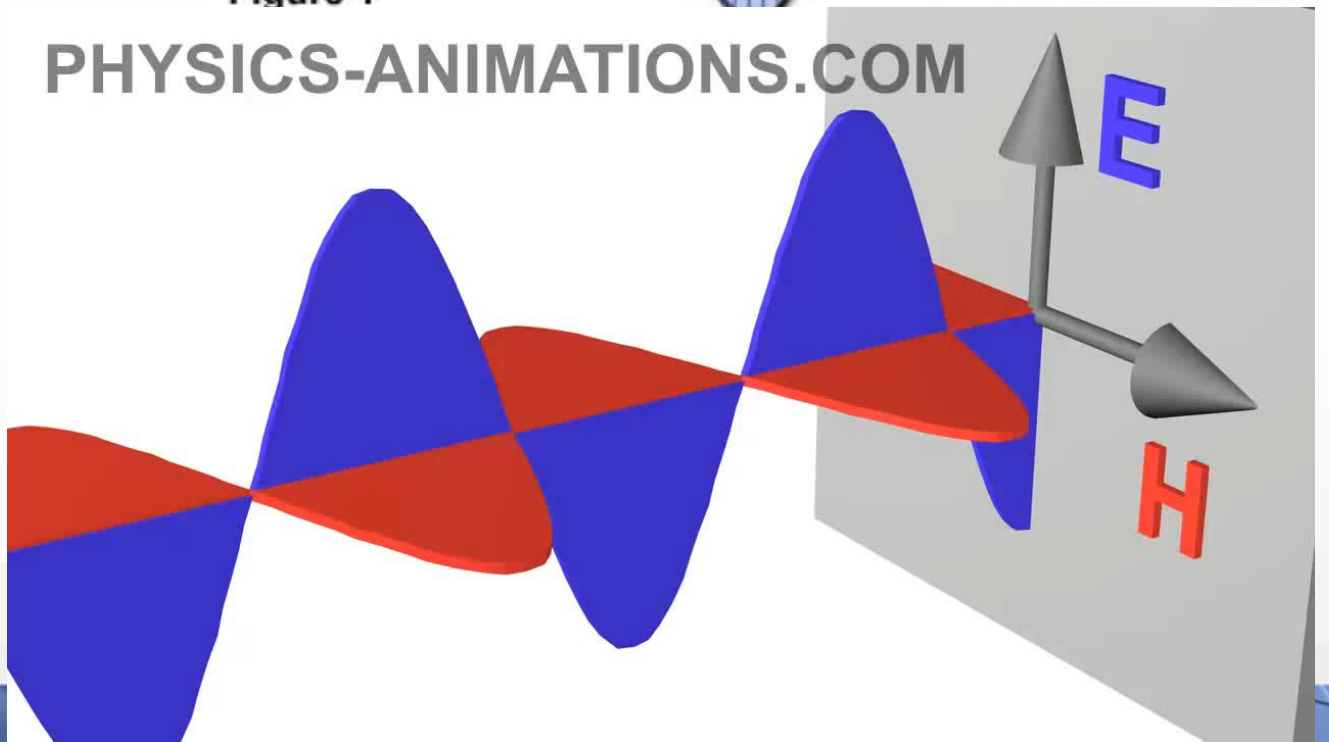
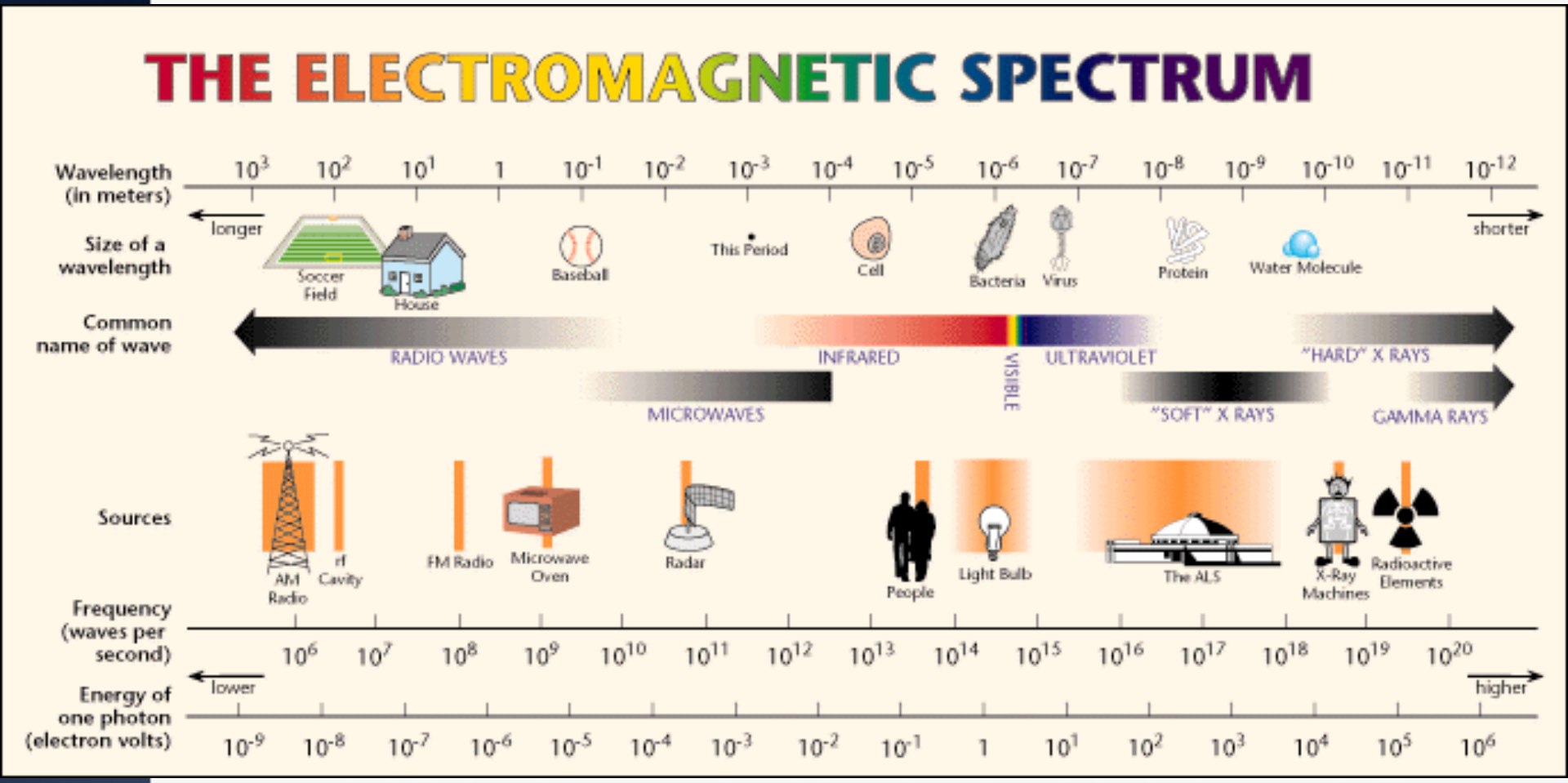


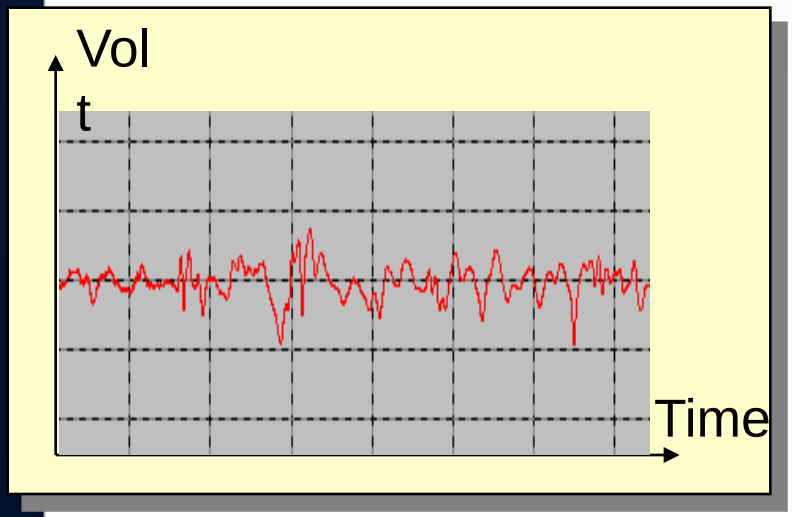
Figure 1

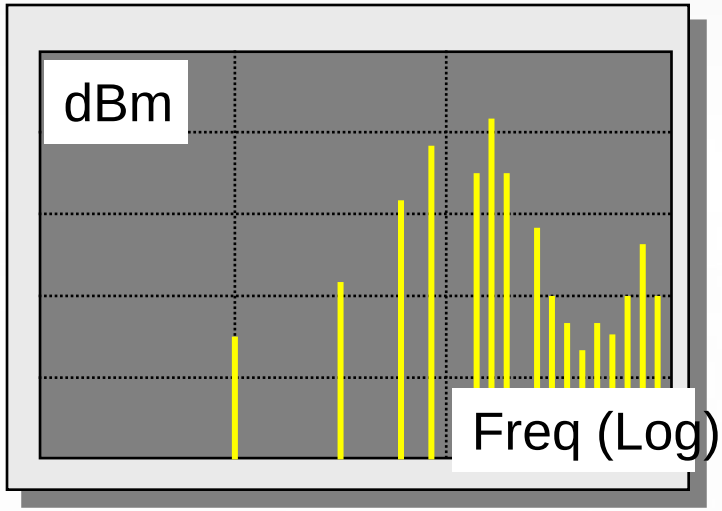


Electromagnetic spectrum



Specific units



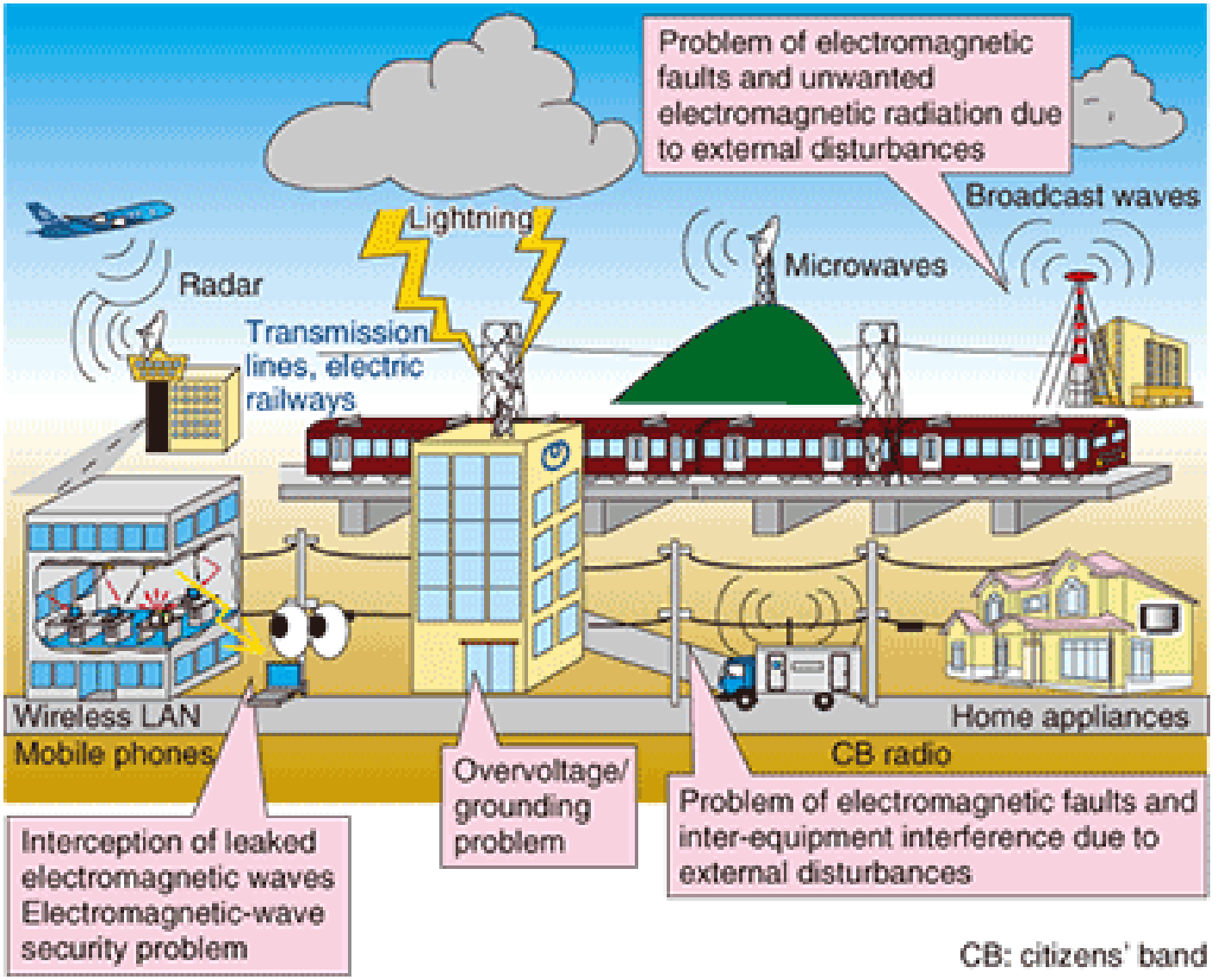


Oscilloscope

Spectrum analyser

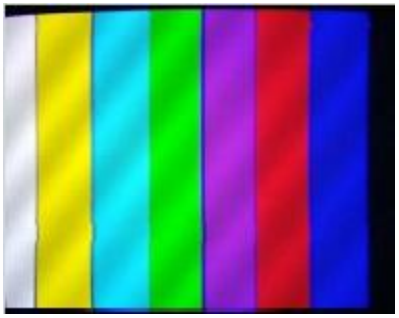
Electromagnetic compatibility

What is EMC?



Example of perturbation

Analogue video signal



- ✓Moire
- ✓loss of luminance, contrast
- ✓loss of color
- ✓loss of synchronization

Digital video signal

- ✓block effect
- ✓cessation of movement
- ✓black screen

EMC (1)

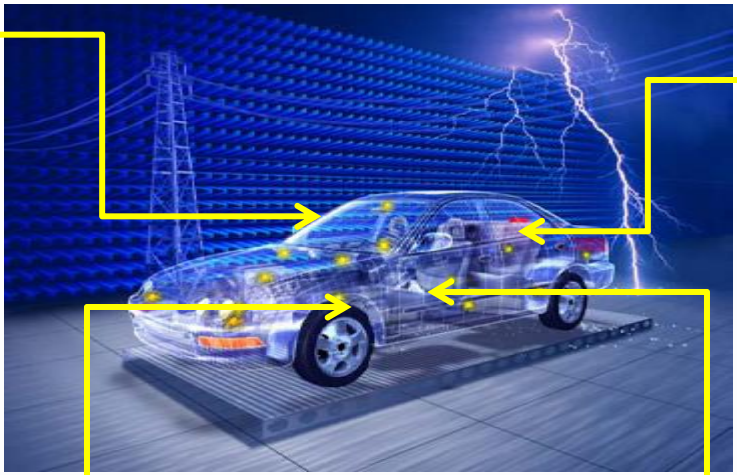
Electric equipment:

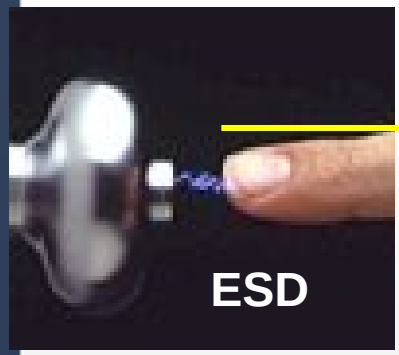
1. Victim of its environment:
   - ✓Malfunction
   - ✓Temporary malfunction or permanent

2. Source of disturbance in its environment

Sources of perturbation

RF transmitters





- External Impacts
- Internal Impacts
- Human Impacts

Les questions essentielles qui se posent au stade conception

Quelle réglementation applicable ?

Existence de limitations ou restrictions

Nouvelle norme en préparation ?

Plan de qualification défini ?

Étude et développement d'un équipement

Spécification de besoin

Conception du produit

Prototype, série

Qualification

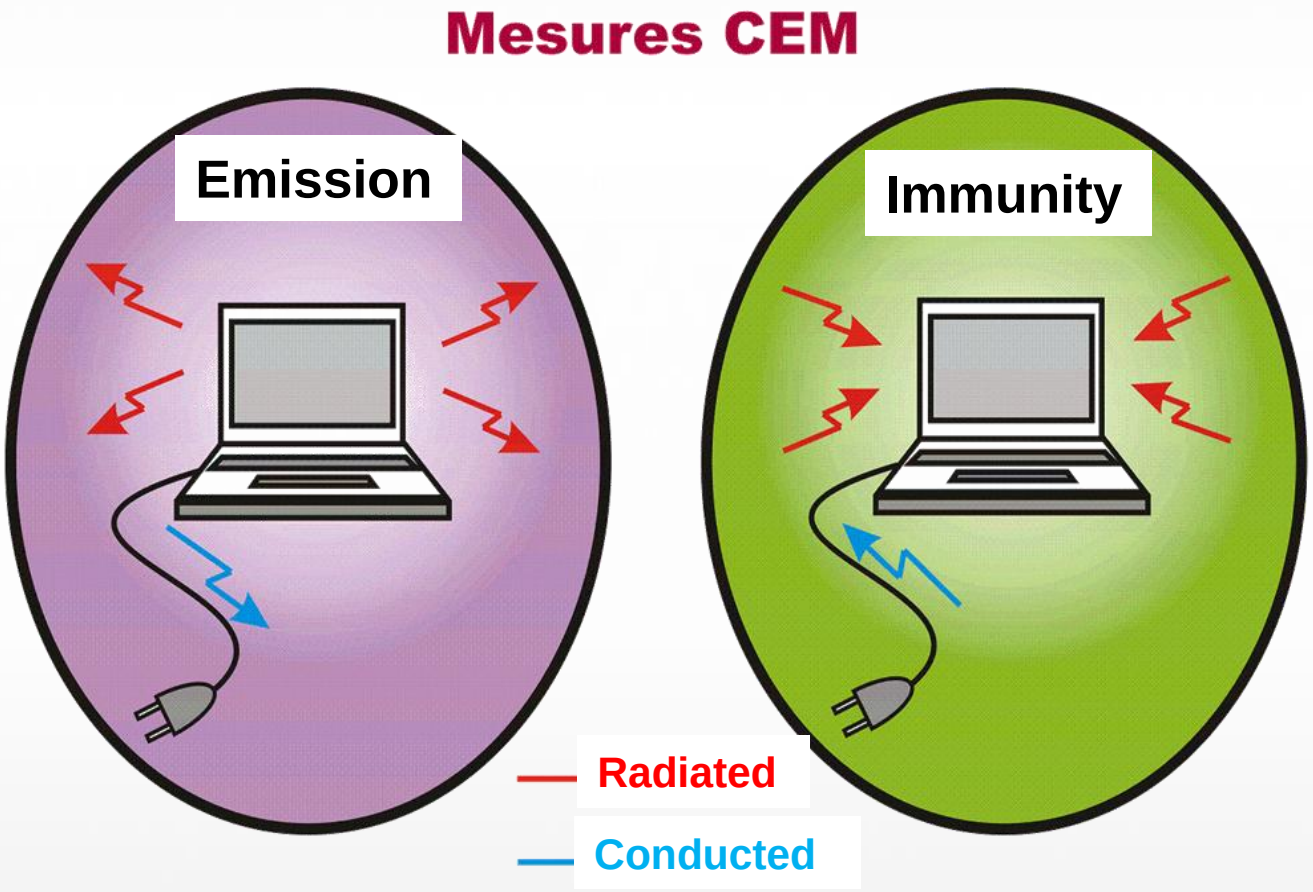
Mise sur le marché

Quel impact de la réglementation sur les choix en matière de conception ?

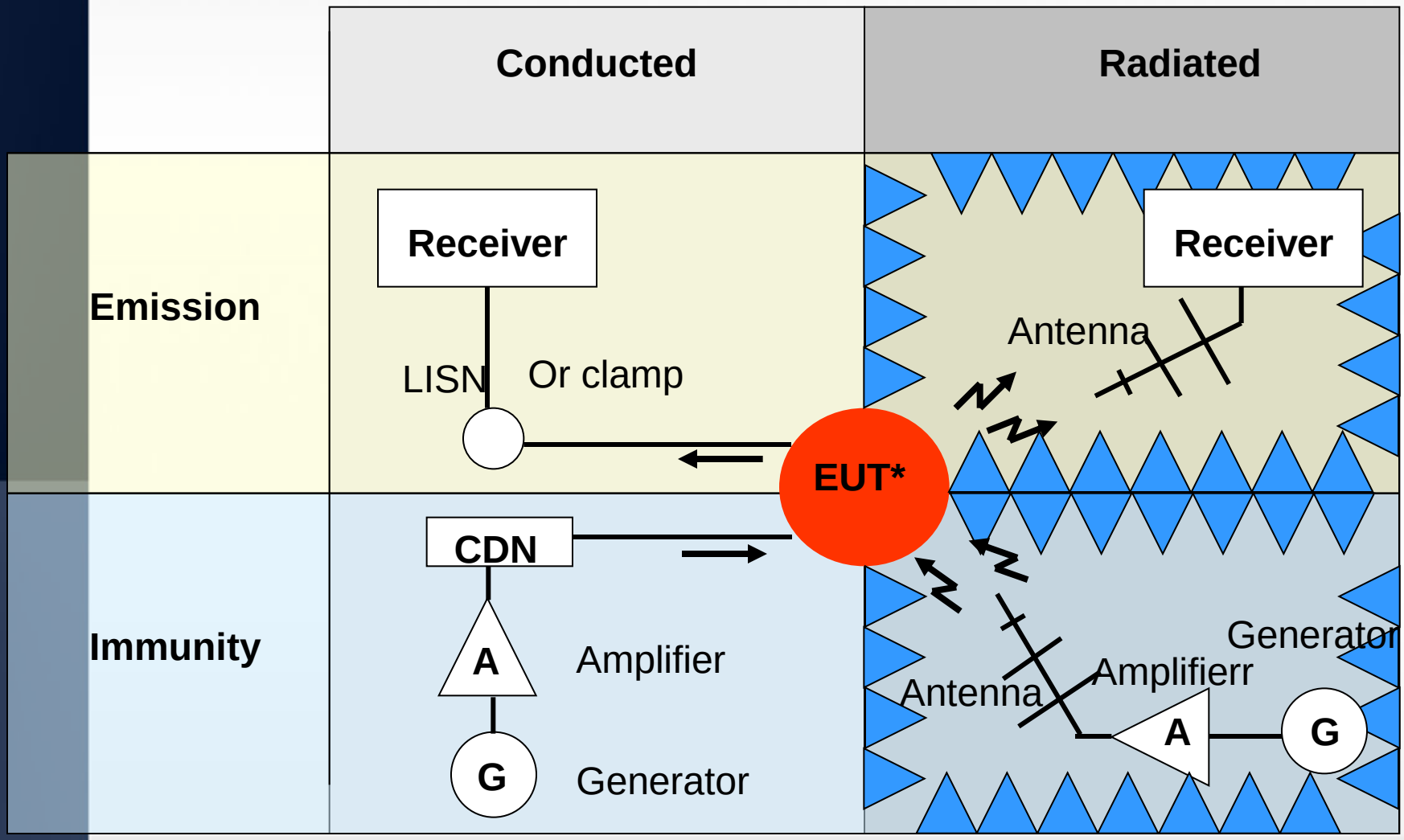
Certification ou qualification différente selon les marchés ciblés ?

Que nécessite le maintien de la certification ou qualification dans le processus de fabrication ?

Types of EMC measures



EMC (3)

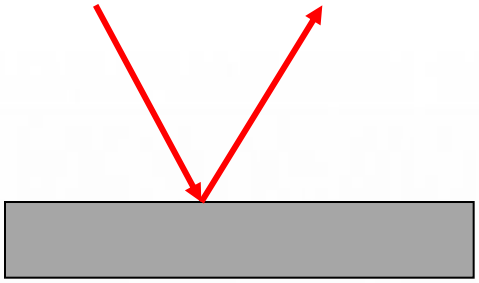


*EUT = Equipement Under Test

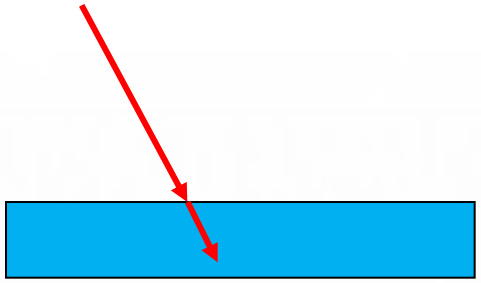
Test sites

Reflectivity

Electromagnetic wave

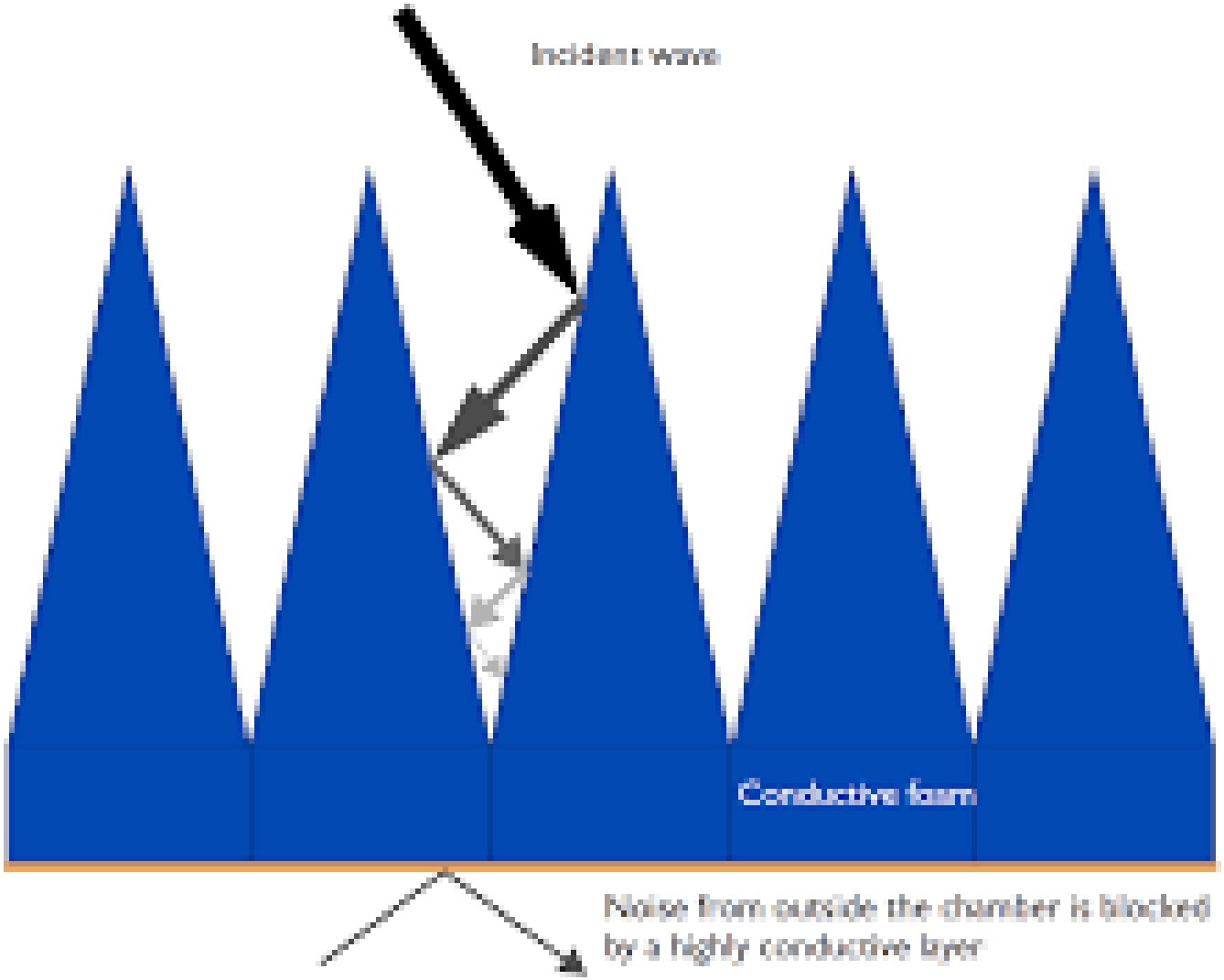


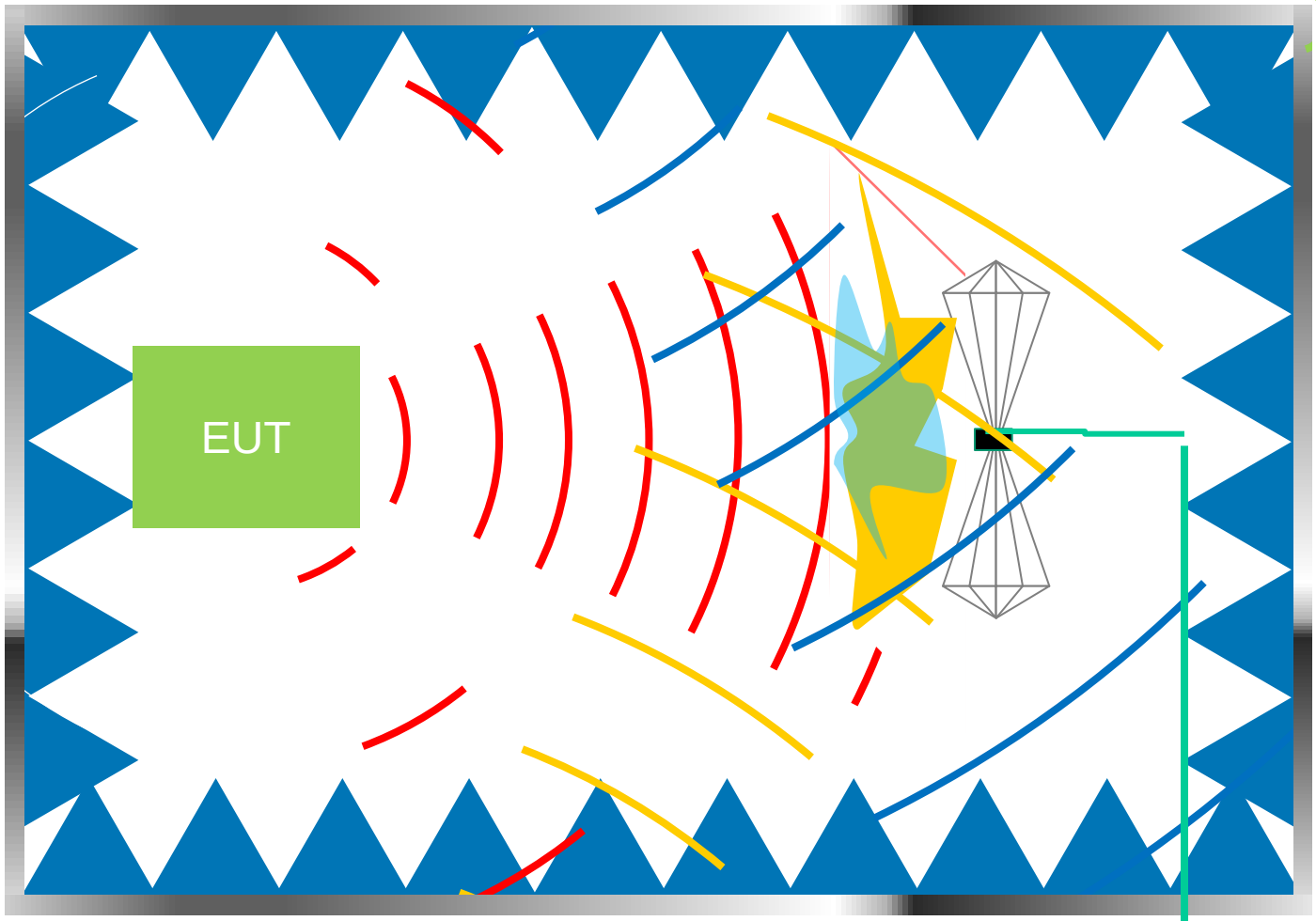
Metal



Absorber

Pyramid absorber



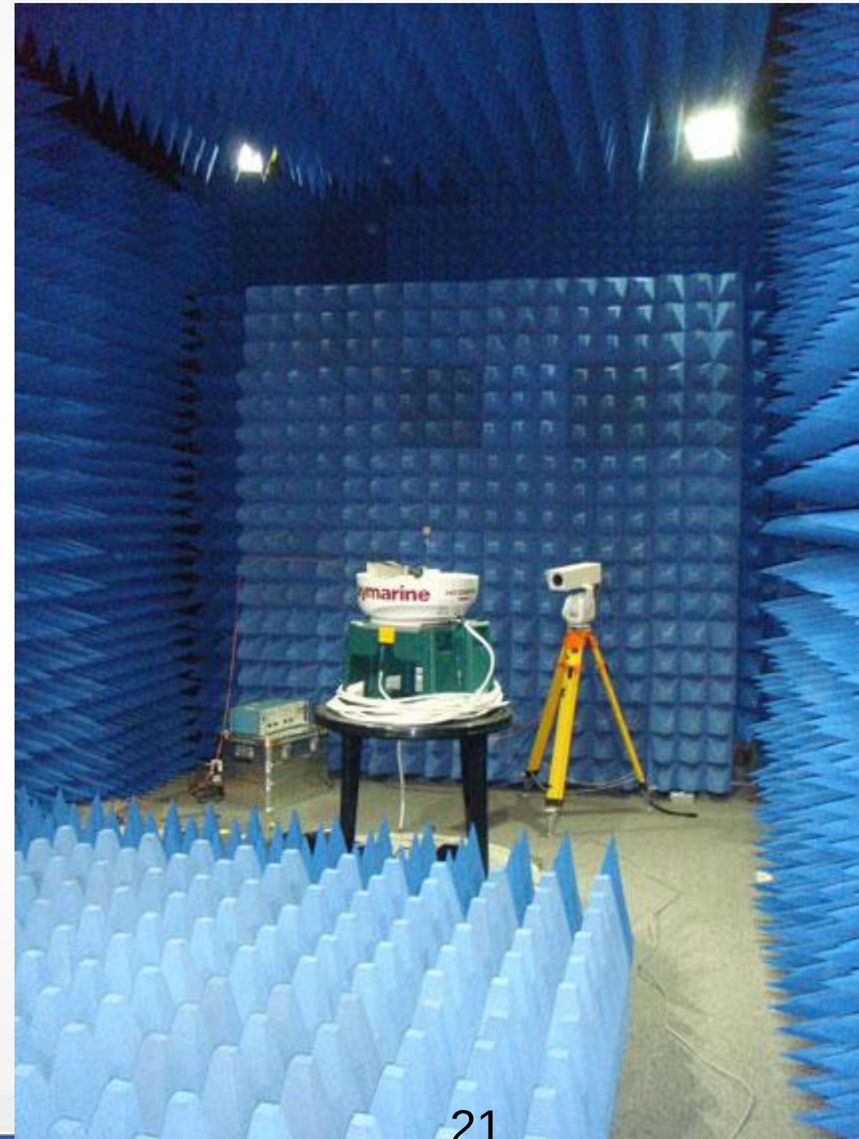

EUT
EMI receiver

Semi anechoic chamber SAC (1)

Semi anechoic chamber SAC (2)

Fully anechoic chamber (FAC)

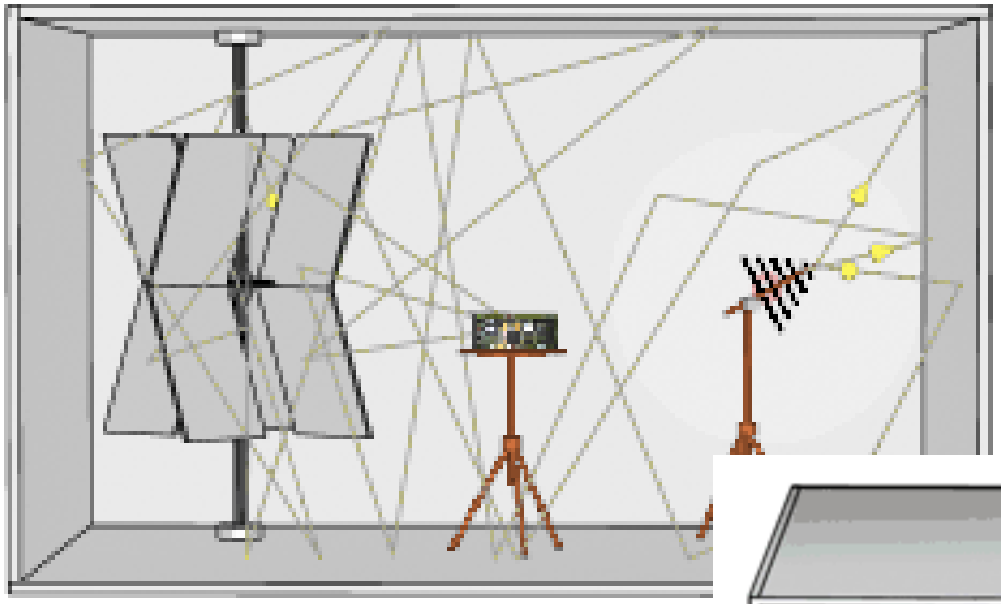
- Fully anechoic shielded enclosure
- Provided with radio frequency absorbent on its entire inner surface
- Emission measurements of direct radiation of radio frequency transmitters.
- Complies with ETSI standards

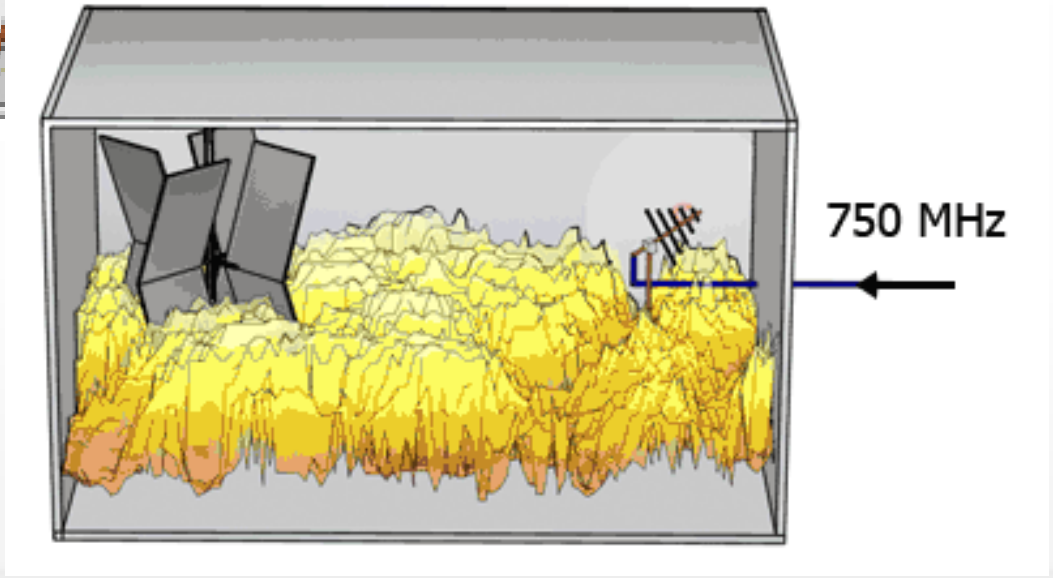


Mode stirred reverberation chambers

- Measures of radiated immunity and emission
- EN 61000-4-21.

Mode stirred reverberation chambers





TEM Cells

- Closed cell loaded onto a characteristic impedance
-
-

Open Area test sites

- The reference CISPR test site
- Radiated fields measures
- Great distance measures (10m – 30m).

Open Area test sites

Performance of measure sites

	Low distance faraday cage	Open area test site	Sami or fully anechoic chamber
Advantages	Isolating EUT from external EM noise	Correct field measurements	Correct field measurements
drawbacks	•Walls reflexions •Near field measure	Electromagnetic noise	•Degradation of absorbers performance •high cost

EMC standards

Fundamental standards

EN 61000.4.2	Electrostatic discharge immunity test
EN 61000.4.3	Radiated, radio-frequency, electromagnetic field immunity test
EN 61000.4.4	Electrical fast transient/burst immunity test
EN 61000.4.5	Surge immunity test
EN 61000.4.6	Immunity to conducted disturbances, induced by radio-frequency fields
EN 61000.4.8	Power frequency magnetic field immunity test
EN 61000.4.9	Pulse magnetic field immunity test
EN 61000.4.11	Voltage dips, short interruptions and voltage variations immunity tests
EN 61000-3-2 et EN 61000-3-3	Limits for harmonic current / flicker emissions (equipment input current ≤ 16 A per phase)

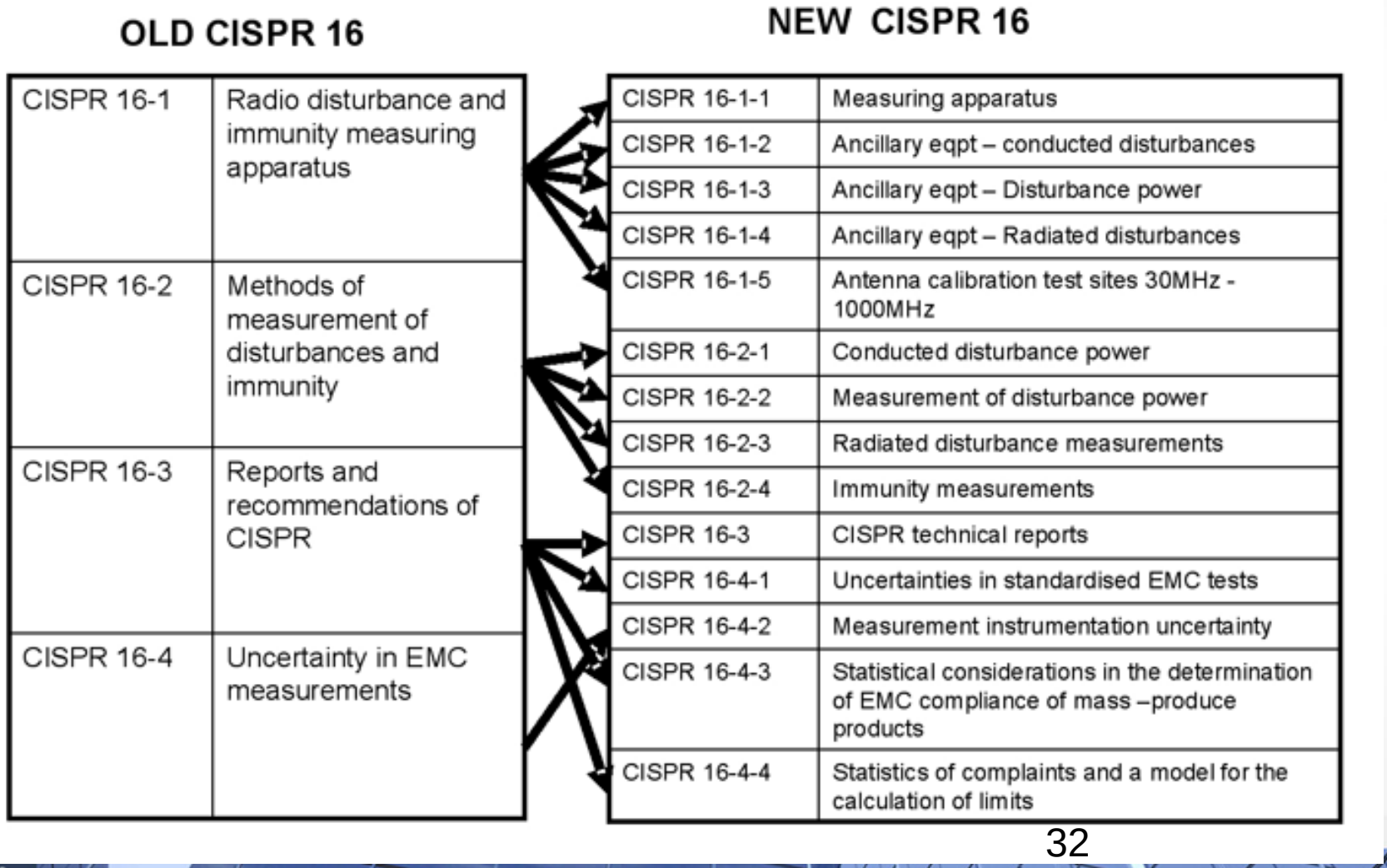
Product standards

EN 55011	Industrial, scientific and medical (ISM) radio-frequency equipment - Electromagnetic disturbance characteristics - Limits and methods of measurement
EN 55014	Requirements for household appliances, electric tools and similar apparatus Part 1: Emission. Part 2: Immunity
EN 55022	Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement
EN 55024	Information technology equipment - Immunity characteristics - Limits and methods of measurement.
ETSI EN 300-330	Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD); Radio equipment in the frequency range 9 kHz to 25 MHz and inductive loop systems in the frequency range 9 kHz to 30 MHz;

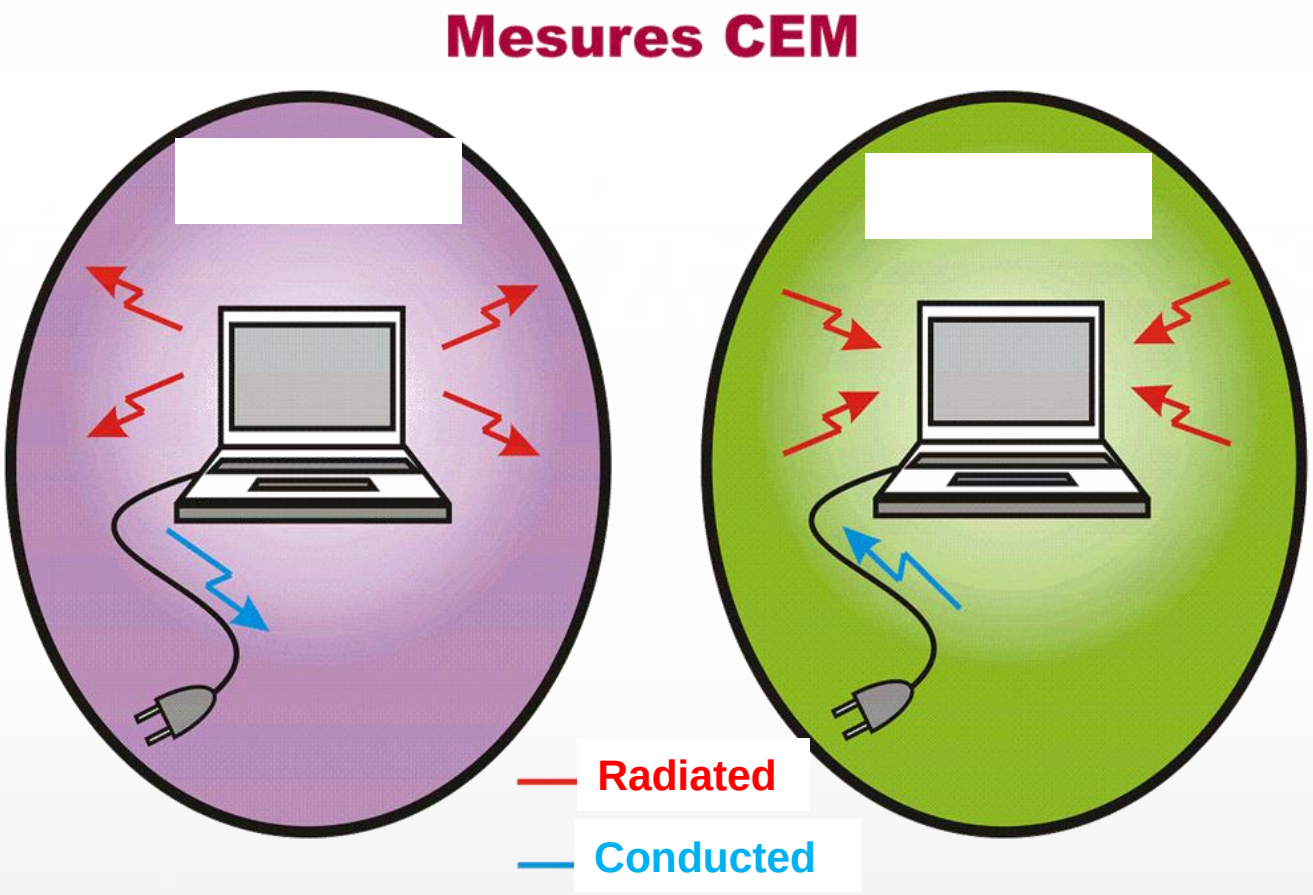
Generic standards

EN 61000-6-1: .	Immunity for residential, commercial and light-industrial environments
EN 61000-6-2	Immunity for industrial environments
EN 61000-6-3:	Emission standard for residential, commercial and light-industrial environments
EN 61000-6-4:	Emission standard for industrial environments

CISPR 16 standards



Types of EMC measures



Training Course on Conformity and Interoperability,
Tunis-Tunisia, 22-26 May 2017

Basics of EMC

Presented by: Karim Loukil & Kaïs Siala

Karim.wakil@cert.mincom.tn

Kais.siala@cert.mincom.tn