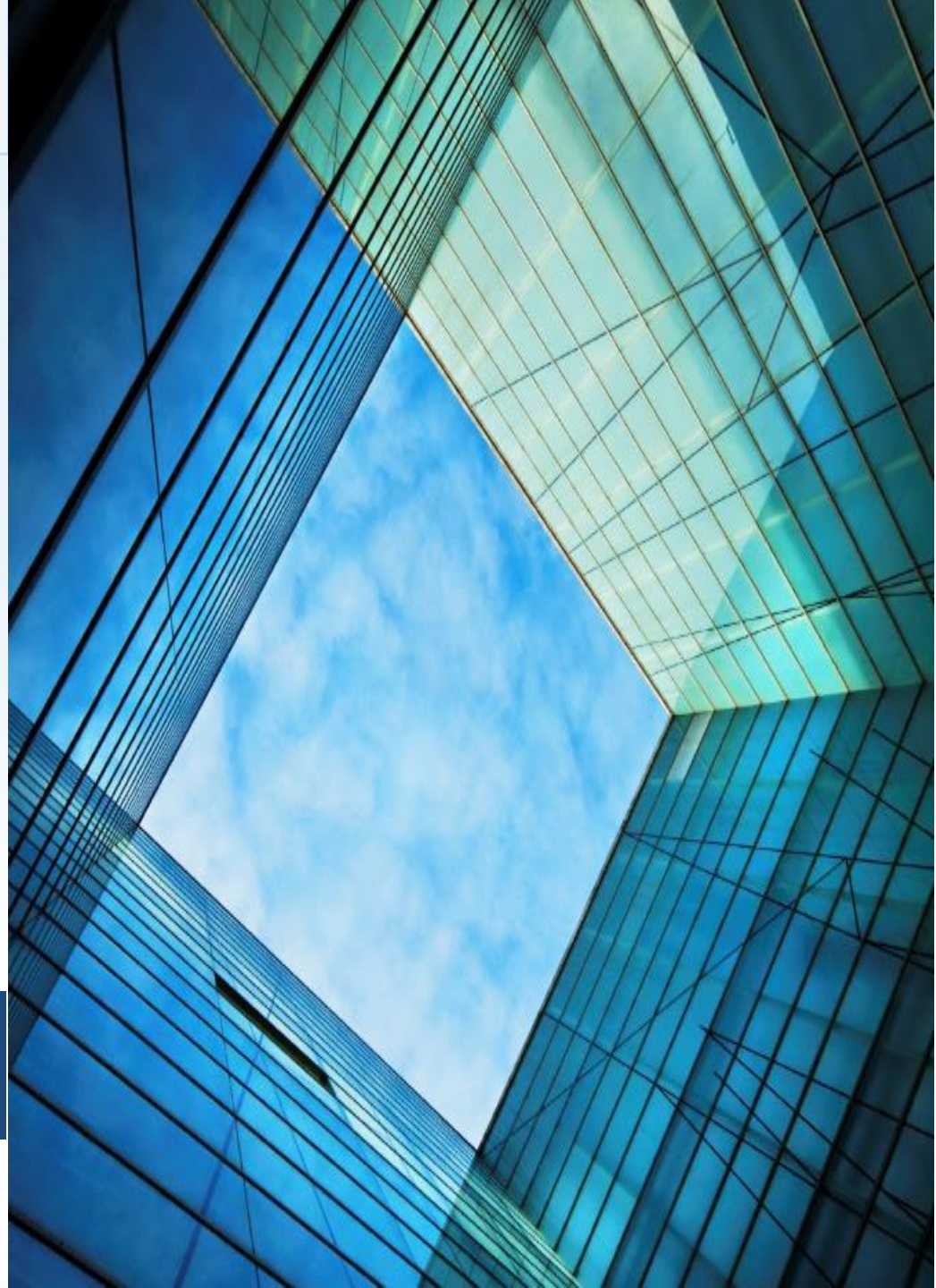


**Conformance testing for
Radio/EMC/Low voltage**

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Conformity assessment



- In this presentation we give some basic informations on topics related to compliance
- Questions:
 - What is Compliance?
 - What does it mean to comply?
 - Different types of compliance regimes?

Definitions

- Conformity assessment is the name given to processes that are used to demonstrate that a product or a service or a management system or a person meets specified requirements.
- The specified requirements may be contained in a technical standard, a regulation or a contract
- “conformity marking” means a marking by which the manufacturer indicates that the radio equipment is in conformity with the applicable requirements providing for its affixing.
- Market surveillance: “Measures by public authorities to ensure that a product made available on the market comply with existing requirements”

Definitions

A vertical column of four circular icons on the left side of the slide: a right-pointing arrow, a right-pointing arrow with a blue dot, a right-pointing arrow with a blue dot, and a right-pointing arrow.

CONFORMANCE TESTING – a way to determine directly or indirectly that relevant requirements are fulfilled.

- Serves as a communication between buyer and sellers
 - Buyers increased confidence
 - Sellers substantiate claims
- Necessary, but not sufficient, for interoperability



Terms & Definitions

- European Directive
 - ✓ Legal Document adopted by EC Council of Ministers
 - ✓ Must be adopted into National Law by each EC member state
- European standards (EN)
 - ✓ Harmonized Standards: Common Standards used for determining conformity
 - Committee process
 - ENs based on existing standards (CISPR, IEC, ETSI)
 - **Application of standards is not mandatory**
 - ✓ Must be adopted into National Standards by each EC Member state



Terms & Definitions

- **Notified Body**

- ✓ “Notified” means that the organization has been “officially announced” to the EC and other states by National Authority

- **IEC**

- ✓ International Electrotechnical Commission

- **CENELEC**

- ✓ European Committee for Electrotechnical Standardization

- **ETSI**

- ✓ European Telecommunications Standards Institute

CERTIFICATION

- **CERTIFICATION** - acknowledgement that a validation was completed and the criteria established for issuing certificates (brands) was met.





Accreditation

- The accreditation process determines, in the public interest, the **technical competence** and **integrity** of organisations offering testing, examination, inspection, calibration, verification and certification services.

The assessment – documentary and on site - includes

- quality systems
- administrative procedures
- working methods
- technical competence

ILAC

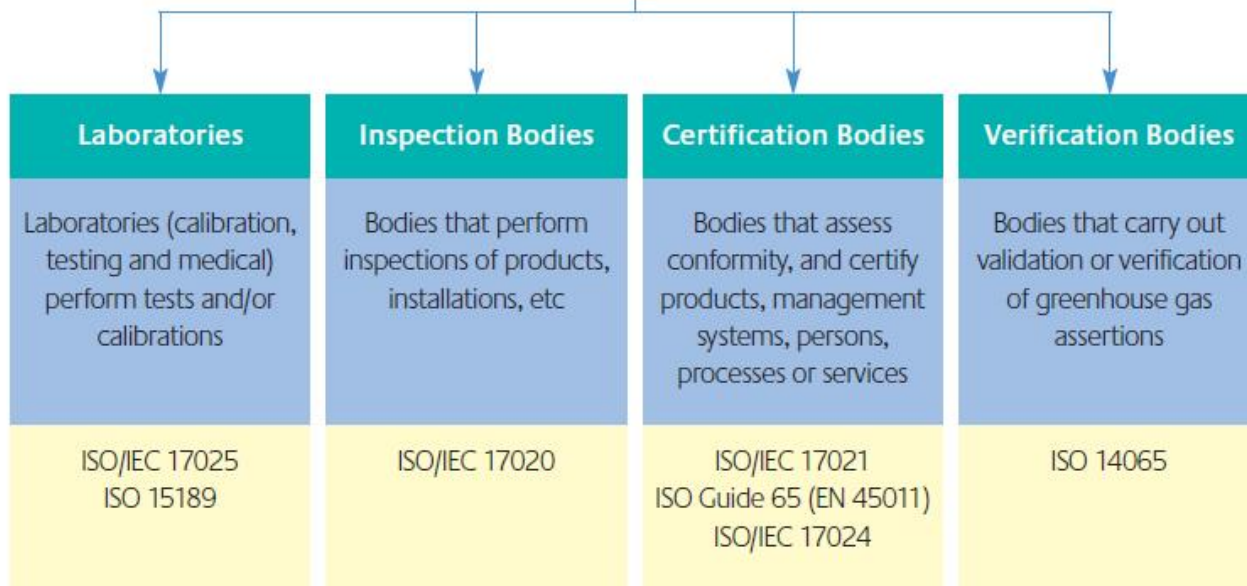


European
co-operation for
Accreditation

- Peer evaluation (ISO/IEC 17011)
- Regulation (EC) No 765/2008

National
Accreditation
Bodies (NABs)

NABs assess and confirm the technical competence and integrity of organisations offering testing, examination, inspection, calibration, verification and certification services.



NABs assess compliance with the requirements in international standards, as well as criteria included in Regulations.



Compliance scheme



- New product to be certified
- Technical procedure & standards
- Testing in lab (test report)
- Issuing a certificate of conformity (in case of certification scheme or autodeclaration)
- Product homologation
- Suspension or withdrawal of homologation certificate
- Monitoring, enforcement, sanction and post market surveillance



Testing Ingredients



Certification

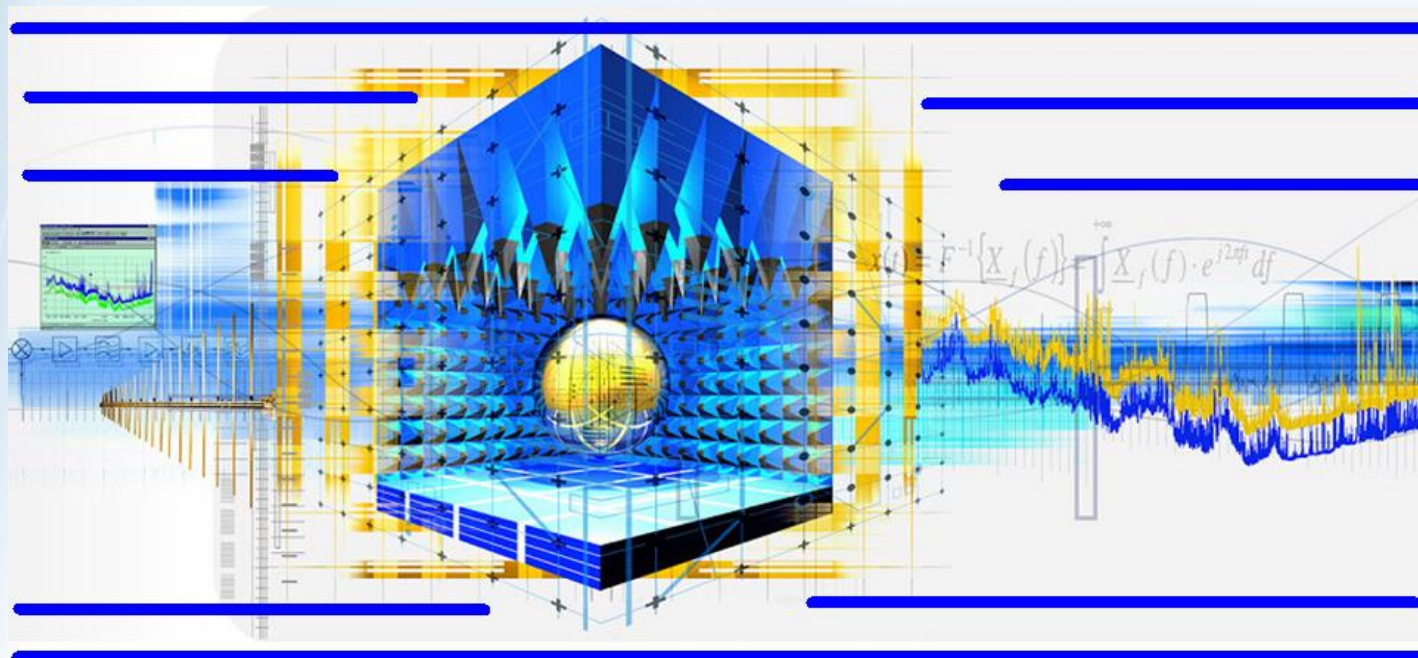
qualified bodies to do the testing and certification
control board

Conformance Testing
Test suite

Standard
Conformance clause



Conformance & Qualification tests





Example of Worldwide Wireless Standards



Digital Cellular Phones / Data

International	Japan	America		International			China
GSM <ul style="list-style-type: none"> • GSM 850 • GSM 900 • E-GSM • R-GSM • GSM 1800 • GSM 1900 	PDC	TDMA [IS-136]	D-AMPS [IS-54]	cdmaOne [IS-95]	1xEV-DV	WCDMA-3GPP/FDD [UTRA TDD HCR]	TD-SCDMA [UTRA TDD LCR]
				cdma2000	1xEV-DO	WCDMA-3GPP/TDD	

Digital Cordless Phones

International	Europe	Canada	Japan
DECT	CT2	CT2+	PHS

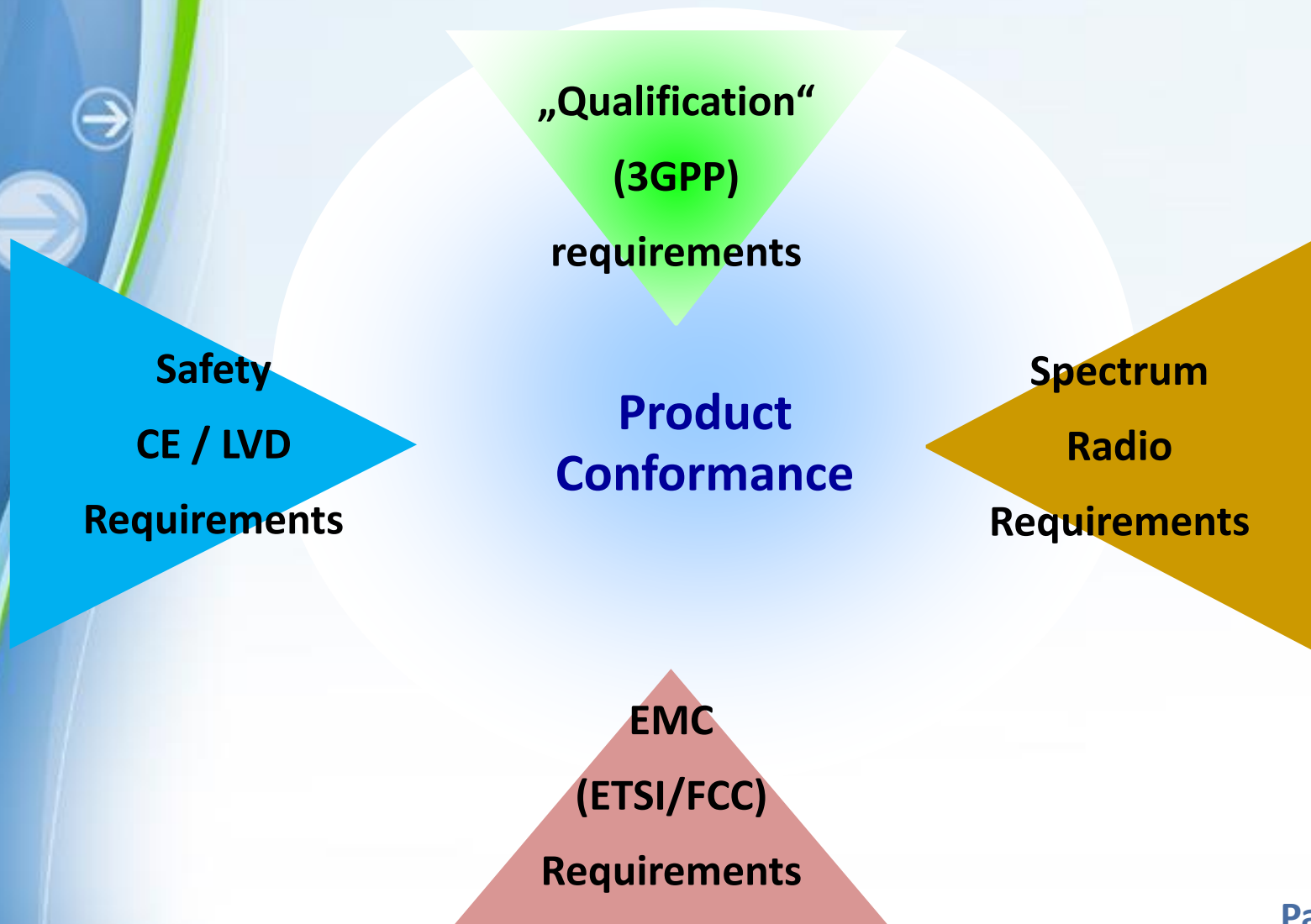
Wireless LAN & Broadband Wireless Access

International

Bluetooth	IEEE 802.11a/e/h/i	IEEE 802.11b/e/i	IEEE 802.11g	IEEE 802.15.3a [UWB]	IEEE 802.15.4 [ZIGBEE]	IEEE 802.16 [Wireless MAN]	IEEE 802.16a [WIMAX]



Wireless Product Test Requirements





◆ Technical Specifications
„Qualification“ (3GPP)

Conformance/Spectrum/EMC

- ◆ TS 25 series (Base Stations - BS)
- ◆ TS 34 series (User Equipment - UE)
- ◆ TR 34.926 (EMC User Equipment)

Safety

- ◆ TR 34.907 (3GPP)
- ◆ TR 34.925 (Safety - radiation hazard)



◆ **EMC (Radio ETSI)**

- ◆ **EN 301 489-1** „radio multipart standard“
- ◆ EN 301 489-23 BS
- ◆ EN 301 489-24 UE



◆ **Spectrum (R&TTE ETSI)**

- ◆ **EN 301 908-1** („spectrum standard“)
- ◆ EN 301 908-3 UTRA FDD BS
- ◆ EN 301 908-7 UTRA TDD BS
- ◆ **ITU-R SM329-8** (spurious emissions)



◆ **Safety**

- ◆ **IEC 60950** (electrical safety)
- ◆ **EN 60950** (LVD)
- ◆ **EN 50360** (human exposure EM fields, MS)



Laboratory Testing

Radio Laboratory



Some Radio measurements



- Maximum output power
- Transmitter Spurious
- Receiver Spurious
- Occupied bandwidth
- Out-of-Band Spurious Emissions
-

Transmitter

- Effective radiated power
 - conducted and radiated, normal and extreme test conditions
- Peak power density
 - conducted or radiated, normal test conditions
- Frequency range
 - conducted or radiated, normal and extreme test conditions
- Spurious emissions
 - conducted and radiated, normal test conditions
 -

Receiver

- ◆ Spurious emissions
 - ◆ conducted and radiated, normal test conditions
 - ◆

Open air test sites (OATS)/SAC

- Ground plane
- measurement distance: 3m (up to 1GHz), any suitable distance (> 1GHz)
- equipment size < 20% of measuring distance
- EUT / substitution antenna 1,5 m height
- test antenna height vary between 1 and 4 m

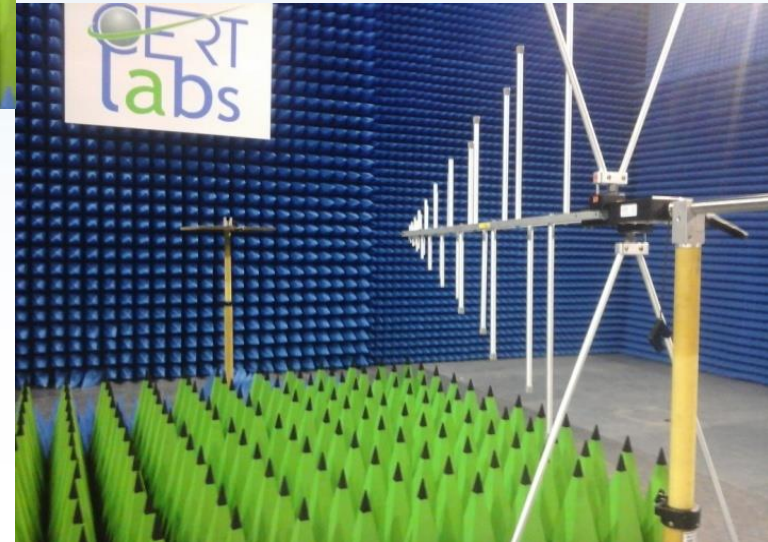
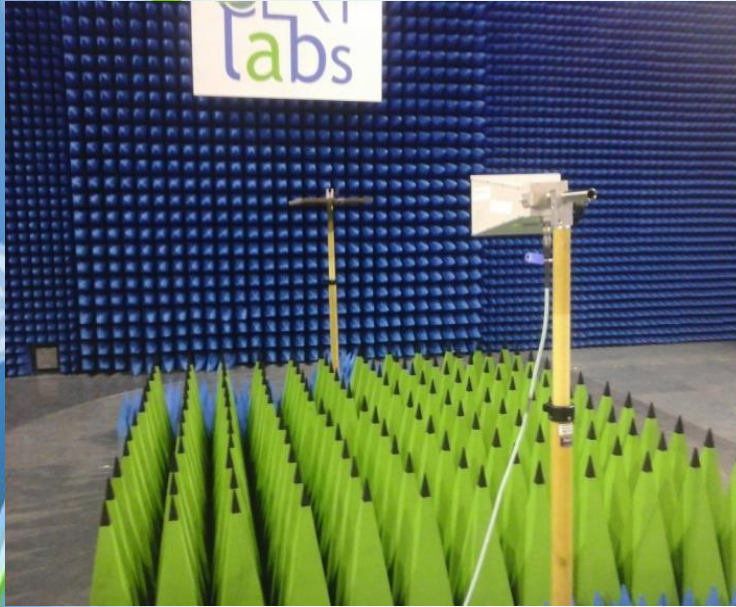
Fully Anechoic Chamber (FAC)

- ◆ test setup similar to open air test site
- ◆ fully anechoic chamber with floor absorbers allowed
- ◆ no height variation -> simplifies method of measurement

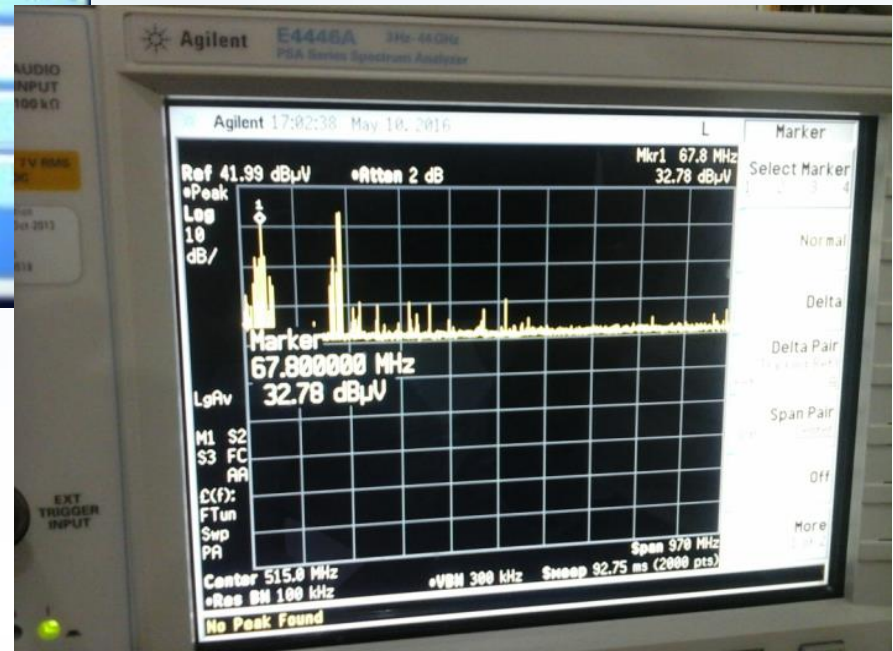
Antenna Requirements

- ◆ Test antenna: size shall not exceed 20% of measurement Distance
- ◆ substitution antenna: dipole (tuned, or shortened) and horn radiator

Some Radio setup testing



Some Radio Measurements





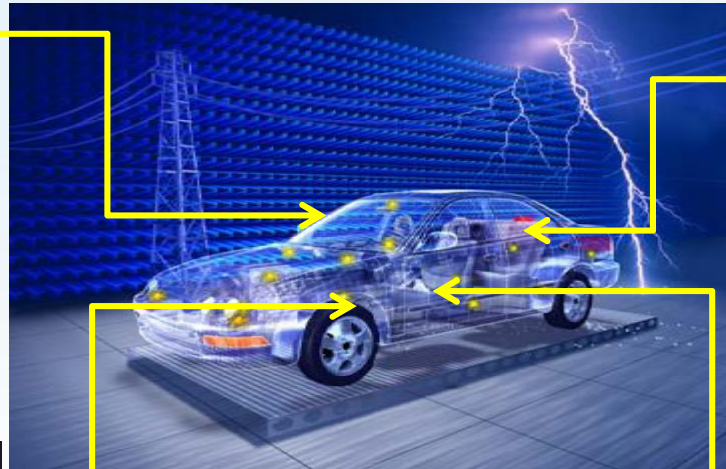
Laboratory Testing

EMC Laboratory

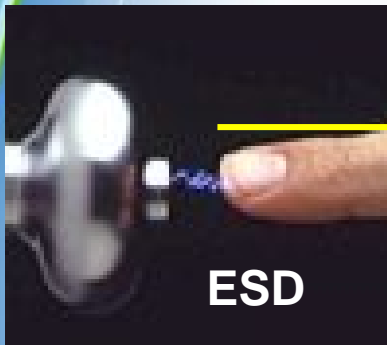
Sources of perturbation



RF transmitters



Mobile phones



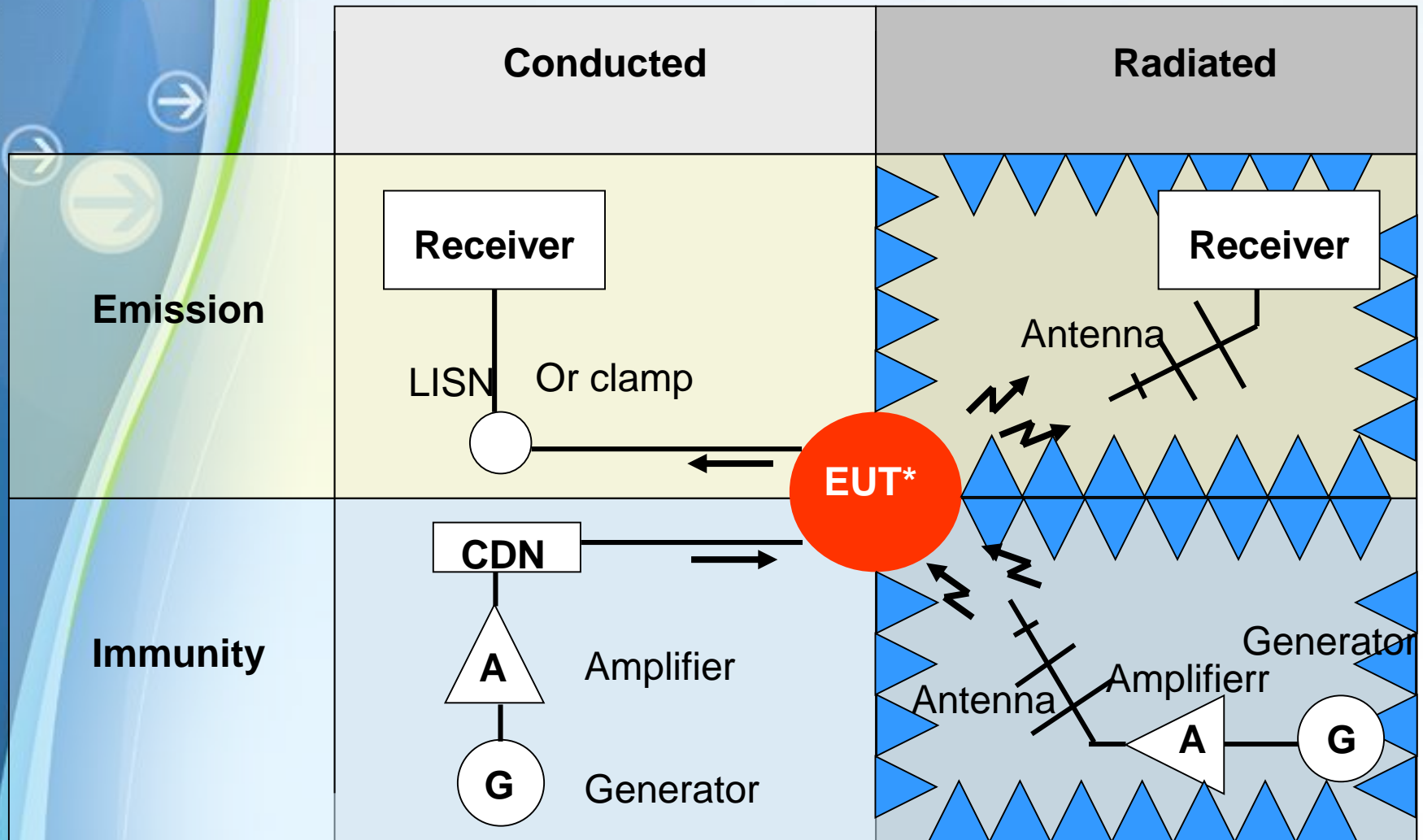
ESD



Oragons

- External Impacts
- Internal Impacts
- Human Impacts

EMC (measurements)



*EUT = Equipement Under Test

EMC (setups)

Semi anechoic chamber SAC (1)



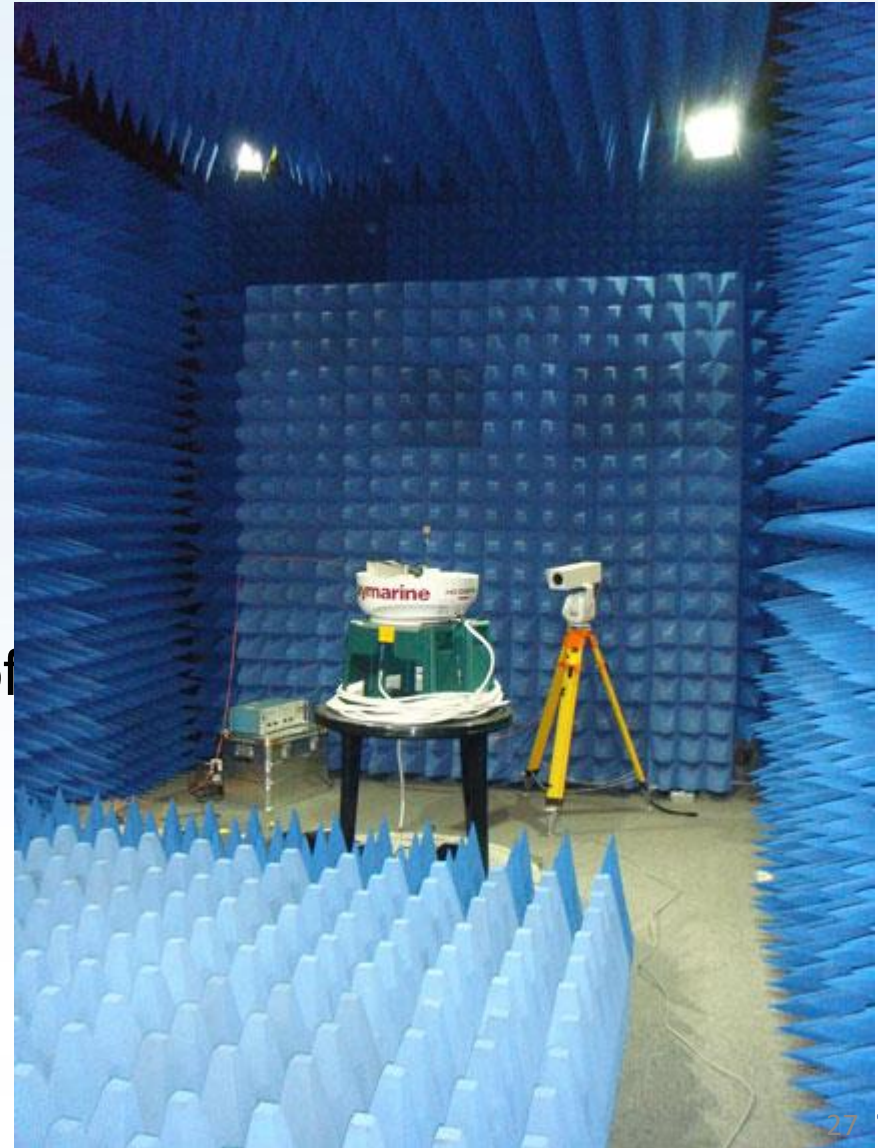


Semi anechoic chamber SAC



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

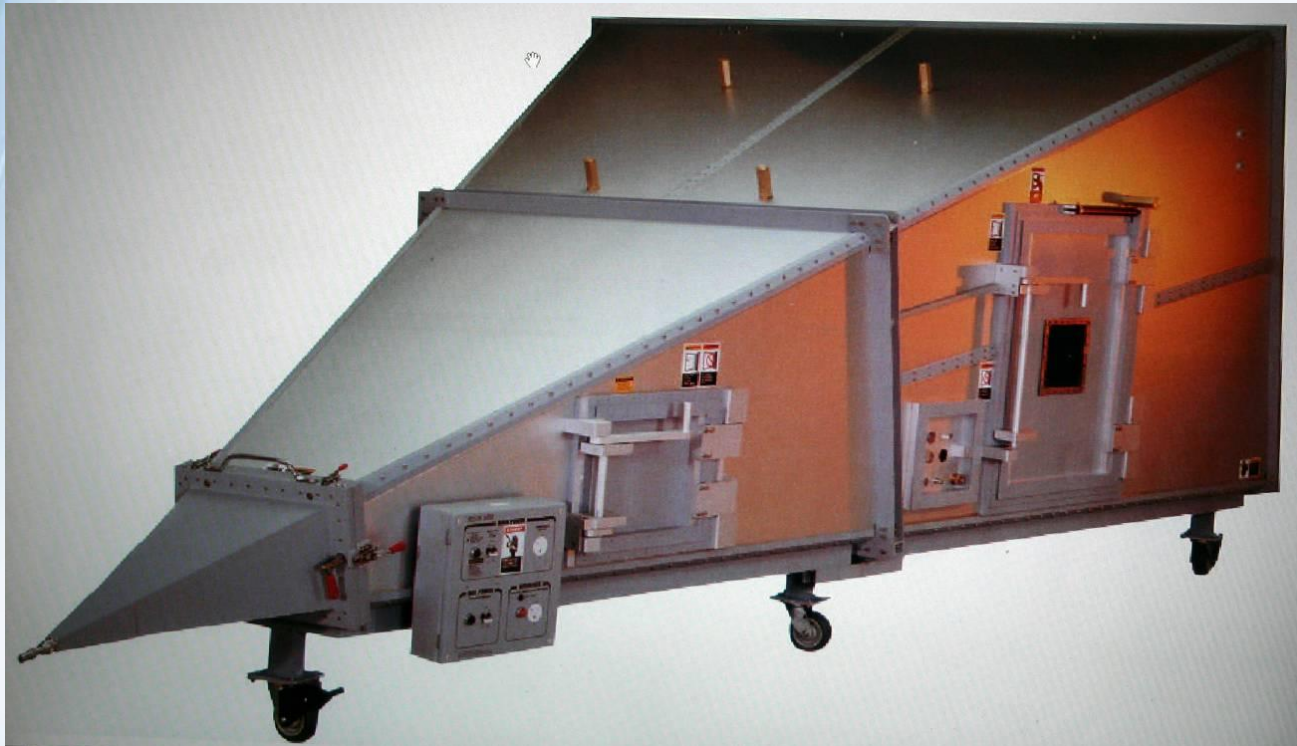


-
-
-
- Shielded enclosure, single or double wall, with metal stirrer
- Measures of radiated immunity and emission
- EN 61000-4-21.



TEM Cells

- Closed cell loaded onto a characteristic impedance
- Measures radiated emission and immunity.
- EN61000-4-20



Open Area test sites

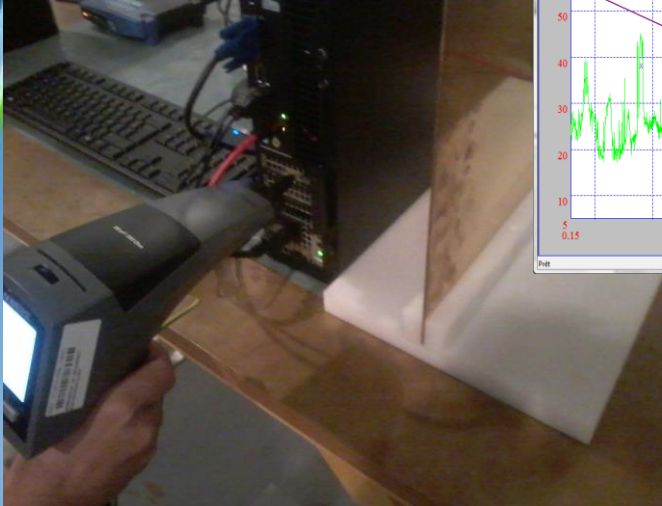
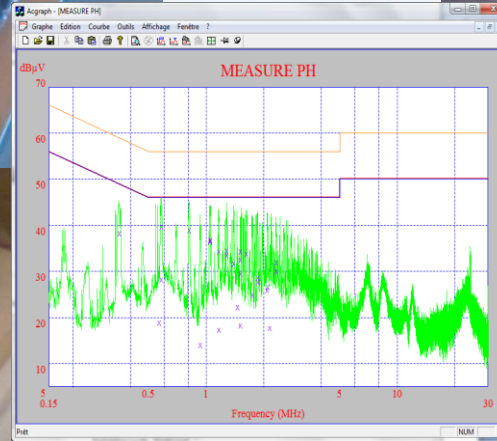
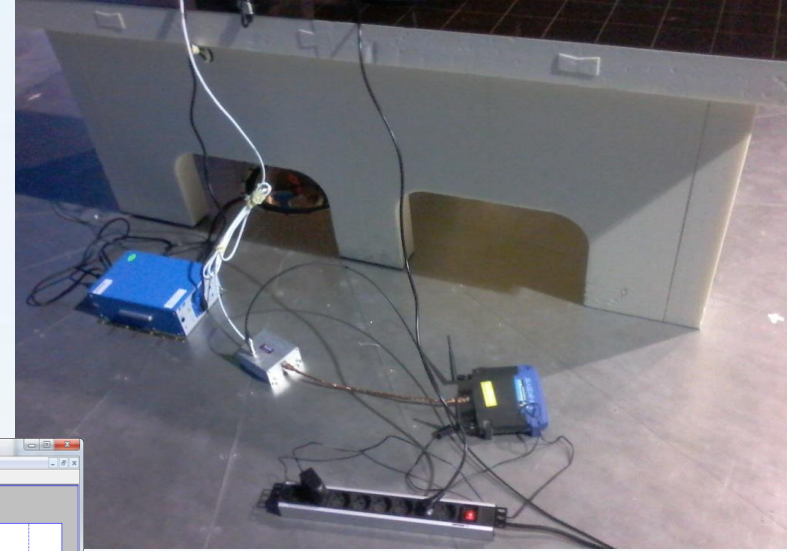
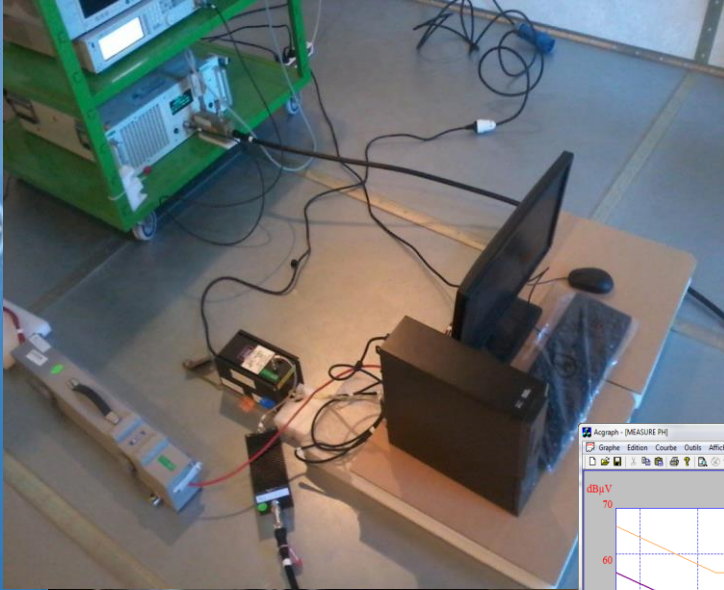
- The reference CISPR test site
- Radiated fields measures
- Great distance measures (10m – 30m).



Open Area test sites



EMC setups





Summary of EMC Measurements for wireless devices



- EMC Measurements of wireless devices are done in Europe according to ETSI EN 301489 **Multipart standard**.
- ◆ ETSI standards are **product family standards**, if not they refer to **generic standards** (e.g. EN 61000-6-X) , **basic standards** (e.g. CISPR 32, CISPR 16) and **fundamental standards** EN61000-4-x)
- ◆ Conformance tests - which are not typically EMC tests are required e.g. **radiated / conducted Spurious Emission**, **Power density**, **Adjacent Channels** and those under normal and extreme conditions.



Standard for Tests of Wireless Products



Content of EN 301 489

- ◆ Part 1: Common technical requirements
- ◆ Part 2: Radio Paging Equipment
- ◆ Part 3: Short Range Devices
- ◆ Part 4: Fixed Radio Links
- ◆ Part 5: Private land Mobile Radio
- ◆ Part 6: DECT
- ◆ Part 7: GSM and DCS
- ◆ Part 8: GSM base stations
- ◆ Part 9: Wireless Microphones
- ◆ Part 10: CT1, CT1+, CT2
- ◆ Part 11: FM BC Transmitter
- ◆ Part 12: Earth Stationary 4 GHz to 30 GHz, Fixed Satellite Service
- ◆ Part 13: CB radio
- ◆ Part 15: Amateur Radio Equipment
- ◆ Part 16: Analogue Cellular Radio
- ◆ Part 17: Wideband data and HIPERLAN
- ◆ Part 18: TETRA
- ◆ Part 19: ROMES
- ◆ Part 20: MES and MSS
- ◆ Part 22: VHF aeronautical radios
- ◆ Part 23: UMTS (BS)
- ◆ Part 24: UMTS (MS)
- ◆ Part 25: CDMA MC (MS)
- ◆ Part 26: CDMA MC (BS)



Laboratory Testing

Electrical Safety Laboratory



Introduction

- The "Low Voltage" tests are used to check whether the electrical and electronic devices comply with the essential requirements set out in European Directives.
- These tests are based on national and European standards and are essential for:
 - Ensure the safety of users and consumers of these products,
 - Ensure the free movement of products within the market,
 - Limit the environmental impact of products on the market.

Introduction

- ❑ All products placed on the market must be safe ! →
- ❑ The product must comply with the design and test requirements of the proper safety standard →
- ❑ General Product Safety Directive 2006/95/CE for Electrical equipment designed for use with a voltage rating [50 – 1000] Volt AC or [75 – 1500] Volt DC →



Standardisation

- ◆ Large system of European electro technical standards based on international standards (> 600)
- ◆ Example : EN 60950-1 “Information technology equipment – Safety – Part 1 : General requirements”
- ◆ Reduction of risk of injury or damage due to
 - ❑ Electric shock
 - ❑ Energy related hazards
 - ❑ Fire
 - ❑ Heat related hazards
 - ❑ Mechanical hazards
 - ❑ Radiation
 - ❑ Chemical hazards





Tests and requirements



- Measure of ground resistance,
- Verification of resistance to moisture,
- Testing of electrical insulation and dielectric strength,
- Measure of leakage/ touch currents,
- Checking screw connections
- Measurement of creepage distances and isolation,
- Endurance tests,
- Measuring the temperature rise of the apparatus,
- Abnormal operating and fault conditions analysis,
- Test of the resistance to heat, fire and tracking currents,
- Connection to telecommunication networks
-



- So these tests called "electrical safety" is not only limited to electrical testing, but also cover thermal and mechanical aspects.
- Some of the "low voltage" tests are destructive, at the end of testing the device under test "DUT" may no longer be operational.

Access to energized parts: Used Equipments



Rigid Test finger (2A)



Jointed Test finger (2A)



2C – Test probe



2B – Test pin

Resistance of earthing conductors

Used Equipments

- DC power supply,
- Multimeter,
- Milliohmmeter.



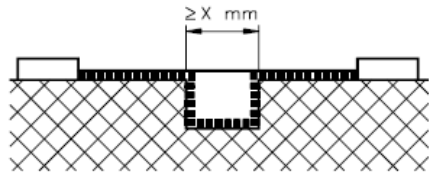
Humidity conditioning

Used test equipments

- Climatic chamber



Clearances, creepage distances and distances through insulation



Condition: Path under consideration includes a parallel-sided groove of any depth, and equal to or more than X mm wide.

Rule: CLEARANCE is the "line of sight" distance. CREEPAGE DISTANCE path follows the contour of the groove.

— Clearance
 - - - - - Creepage distance

- ◆ calipers
- ◆ Micrometer
- ◆ optical comparator
- ◆ gages chocks
- ◆ test finger



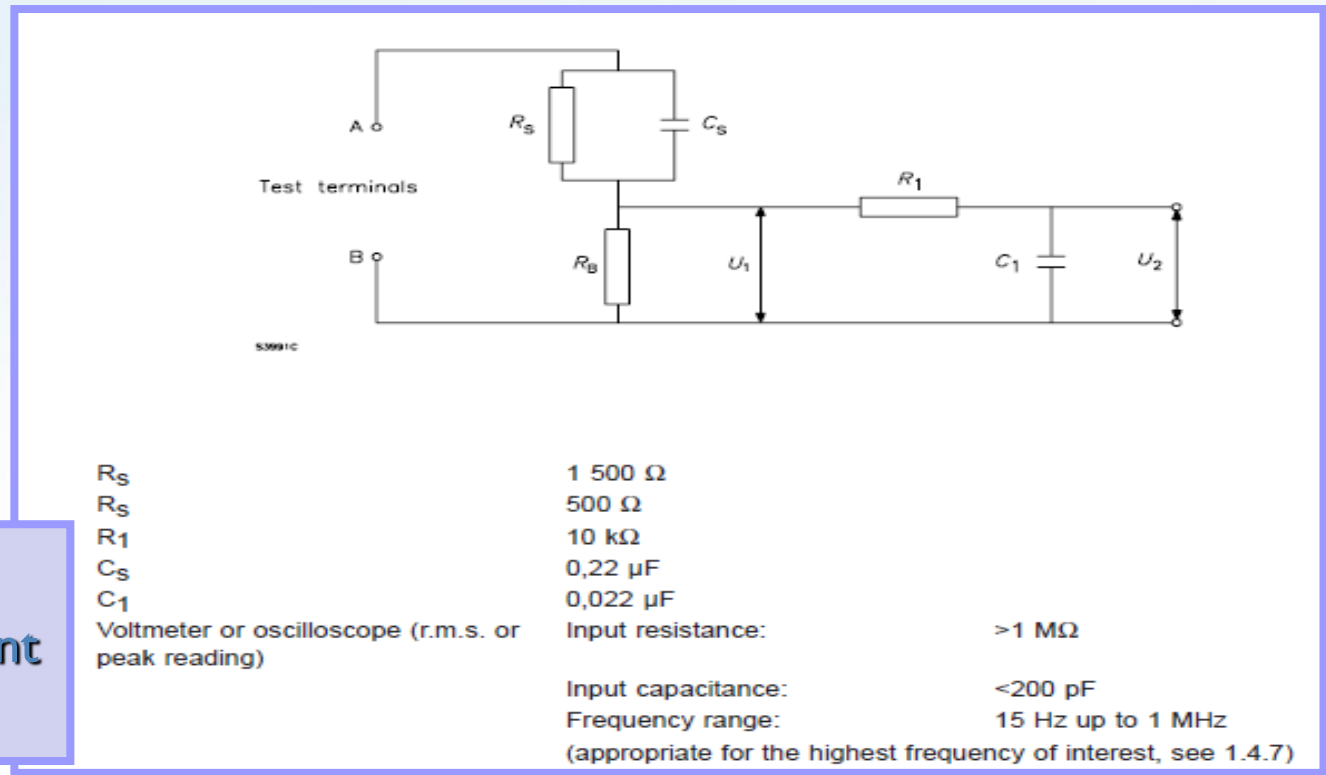
Electric strength Used Equipements

- dielectric strength tester
- With accessories:



Touch current and protective conductor current

- None of the values measured shall exceed the relevant limits in table 5A of this standard,



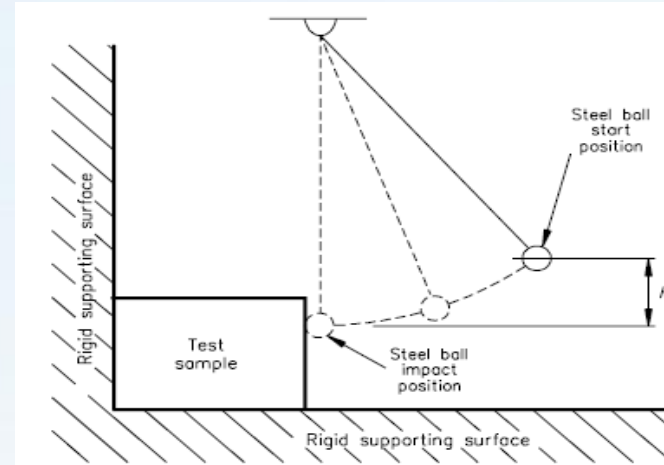
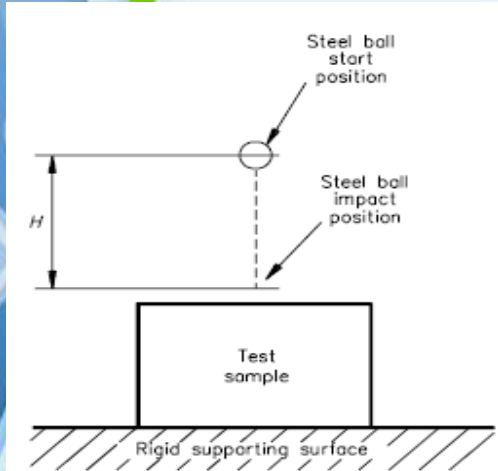
Test Equipement

Steady force tests- Used equipments

- Dynamometer,
- Test finger,
- Circular flat surface of 30mm diameter,



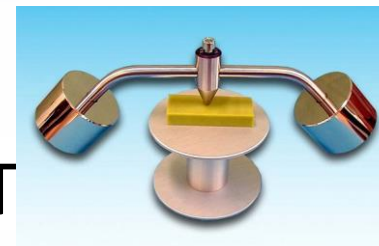
Impact test



Prescriptions thermiques

Matériels utilisés

- Recording thermometer
- Thermocouples,
- Oven or climatic chamber,
- Multimeter,
- BALL PRESSURE TEST APPARAT



Summary

- To declare the conformance of a wireless product, the requirements of R&TTE-, EMC- and Low Voltage-Directive needed to be tested.

- ◆ To follow this requirements an combination of Test-systems are required.

New Approach – necessary infrastructure

- Metrology
- Standardization
- Accreditation
- Authority to designate notified bodies
- Notified bodies
- Conformity assessment
- Sector authorities
- Market surveillance



JAPAN



	Regulator	Mandatory Testing	Accepted Route
EMC Requirement	The Voluntary Control Council for Interference by Information Technology Equipment (VCCI)	VCCI V-3 report required	Product dependent some mandatory certification some via Declaration of Conformity (DoC)
Safety (Electrical) Requirement	Product Safety Electrical Appliance & Material (PSE)	IEC report with Japanese deviations (under CB Scheme)	DoC based on report and Construction File (CF)
Radio Requirement	Ministry of Internal Affairs and Communications (MiC)	Report required proving conformity to Japanese Radio Law and ordinances	MiC Conformity Assessment Body (CAB) review, leading to certification
Telecoms Requirement	MiC	Report required to prove conformity to Japanese Telecoms	MiC CAB review leading to certification

SOUTH KOREA

	Regulator	Mandatory Testing	Accepted Route
EMC Requirement	Radio Research Agency (RRA)	Required	For non-radio or non-telecoms products, the Korean Certification (KC) Mark certification can be obtained using ILAC accredited EU EMC Reports
Safety (Electrical) Requirement	Ministry of Commerce, Industry and Energy (MOCIE)	A CB Scheme report is accepted but only part covers eK requirement so samples will need to be provided	Most AC powered and some DC powered products require eK Mark Certification
Radio Requirement	RRA	Mandatory In Country Testing	KC Certification
Telecoms Requirement	RRA	Mandatory In Country Testing	KC Certification

	Regulator	Mandatory Testing	Accepted Route
EMC Requirement	Agência Nacional de Telecomunicações (ANATEL)	In Country Testing	ANATEL Certification
Safety (Electrical) Requirement	The National Institute of Metrology, Standardization and Industrial Quality (INMETRO)	Product Dependent, CB Reports can be used	INMETRO Certification
Radio Requirement	ANATEL	In Country Testing	ANATEL Certification
Telecoms Requirement	ANATEL	In Country Testing	ANATEL Certification



SAUDIA ARABIA



	Regulator	Mandatory Testing	Accepted Route
Safety (Electrical) Requirement	MB Saudi Standards, Metrology and Quality Organisation (SASO)	CB Scheme	
Radio Requirement	Communications and Information Technology Commission (CITC)	EU Test Reports	CITC Certification
Telecoms Requirement	CITC	EU Test Reports	CITC Certification



Australia



	Regulator	Mandatory Testing	Accepted Route
EMC Requirement	Australian Communications and Media Authority (ACMA)	AS/NZS (or equivalent) Report	Declaration of Conformity (DoC) for Regulatory Compliance Mark (RCM). Supported by Technical Construction File
Safety (Electrical) Requirement	Electrical Regulatory Authorities Council (ERAC)	AS/NZS (or equivalent) Report	For most products DoC, but please check with us
Radio Requirement	ACMA	AS/NZS (or equivalent) Report	Doc for RCM. Supported by Technical Construction File
Telecoms Requirement	ACMA	AS/NZS (or equivalent) Report	Doc for RCM. Supported by Technical Construction File

Please be aware you will need a representative in Australia



New Zealand



	Regulator	Mandatory Testing	Accepted Route
EMC Requirement	Australian Communications and Media Authority (ACMA)	AS/NZS (or equivalent) Report	Declaration of Conformity (DoC) for Regulatory Compliance Mark (RCM). Supported by Technical Construction File
Safety (Electrical) Requirement	Electrical Regulatory Authorities Council (ERAC)	AS/NZS (or equivalent) Report	For most products DOC (please check with our approvals experts)
Radio Requirement	ACMA	AS/NZS (or equivalent) Report	Doc for RCM. Supported by Technical Construction File
Telecoms Requirement	Telecoms NZ	For the majority of products PTC (or equivalent)	Telepermit Certification

Please be aware you will need a representative in New Zealand.

**Conformance testing for
Radio/EMC/Low voltage**

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