European EMC Requirements

ESDM

European EMC Requirements

- Directive 89/336/EEC
- Differs from FCC by including immunity requirements along with emission requirements
- Also the directive covers all electrical/electronic equipments without exceptions
  - Although it does exclude those equipments that are covered by separate EMC guidelines, such as automotive and medical.

Emission Requirements

- Conducted emissions same as FCC
- Radiated emissions similar but not exactly same

TABLE 1-8. CISPR Radiated Emission Limits at 10 m.

Frequency (MHz)	Class A Limit (dB μV/m)	Class B Limit (dB μV/m)
30–230	40	30
230–1000	47	37

- CISPR (Comité International Spécial des Perturbations Radioélectriques) guidelines are more more restrictive than those of FCC between 88MHz-230MHz
- EU has no radiation limit defined above 1GHz
  - FCC has upto 40GHz

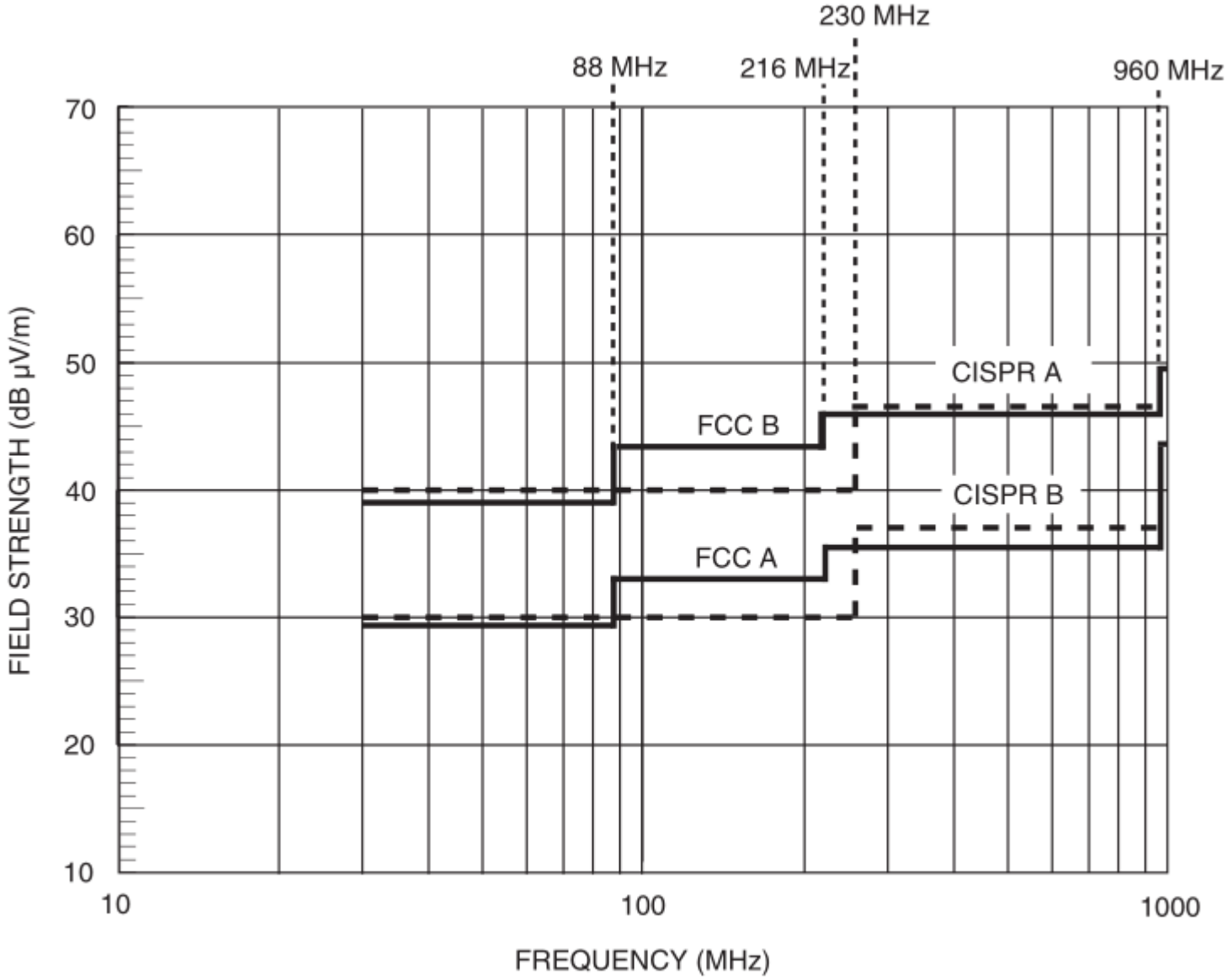

FIGURE 1-5. Comparison of FCC and CISPR radiated emission limits, measured at a distance of 10 m.

Harmonics and Flicker

- Additional emission requirements than FCC
- Apply to products that draw 16A or less and are to be connected to public AC power distribution system

Harmonics

- Harmonic requirement – EN 61000-3-2
- Limits the harmonic content of the current drawn from AC line
- Harmonics are result of non linear behaviour of loads such as SMPS, Variable speed motor drives, electronic ballasts etc.
- A major source is full wave rectifier connected to AC followed by filter cap
  - Current is drawn only when input > cap voltage
  - Therefore current is drawn only from peaks of AC
  - Resultant current waveshape is rich in odd harmonics

Harmonics

- A major source is full wave rectifier connected to AC followed by filter cap
  - THD between 70-150%
  - No of harmonics decided by the rise and fall times of current pulse and their magnitude
  - THD of <25% is required to be compliant

Flicker

- Flicker requirements – EN 61000-3-3
- Limit the transient Ac power line current drawn by the product
- Purpose is to prevent lights from flickering
- Based on not noticeable changes in the output of a 60W incandescent bulb
- Cause
  - Finite impedance of power source line
  - Changing load current requirements, induce voltage changes on line
  - If load changes are of sufficient magnitude and repetition rate, flicker is introduced

Flicker

- Measurements are of statistical nature
  - Require many readings
- Flicker requirements mostly applicable to products that draw sudden large currents
- e.g. products are Air conditioner, owen, copy machine

Immunity Requirements

- Cover radiated and conducted immunity, as well as transient immunity that includes ESD, electrical fast transient (EFT) and surge
- EFT requirements simulates noise generated by inductively switched loads on AC line
- Surge requirement simulated nearby lightening pulse
- In addition there are susceptibility requirements that cover voltage dips, sags and interruptions

Directives and standards

- EU regulations consists of directives and standards
- Directives are general and are legal requirements
- Standards provide one of the ways to meet the directive
  - Product specific
  - Generic
    - Used if no product specific standard exists

Directives and standards

- EMC Directive 2004/108/EC – Essential requirements to sell product in EU

  1) The equipment must be constructed to ensure that any electromagnetic disturbance it generates allows radio and telecommunication equipment and other apparatus to function as intended.

  2) The equipment must be constructed with an inherent level of immunity to externally generated electromagnetic disturbances.

Compliance demonstration

- 2 ways
  - Declaration of Conformity
  - Technical construction file

Declaration of Conformity

- Self Certification
- Manufacturer or importer
  - determines the applicable standards
  - Tests the product to the standards
  - Issues a declaration declaring conformity
- The DoC can be 1 page but must contain
  - Application of which council directives (all applicable directives)
  - Standards used (including date of standard) to determine conformity
  - Product name and model number, also serial numbers if applicable
  - Manufacturer's name and address
  - A dated declaration that the product conforms to the directives
  - A signature by a person empowered to legally bind the manufacturer

Technical construction file

- Used when no harmonized standard exists and manufacturer thinks the generic standards are not appropriate
- Manufacturer produces a technical file to describe the procedures and tests used to ensure compliance with the EMC directive
- The manufacturer can develop its own EMC specifications and test procedures.
- The manufacturer can decide how, where, when, or if, the product is tested for EMC.
- An independent competent body, however, must approve the technical construction file

TABLE 1-10. European Union's EMC Test Standards.

Equipment Type	Emission	Immunity
Product Specific Standards		
Information Technology Equipment (ITE)	EN 55022	EN 55024
Industrial, Scientific & Medical Equipment (ISM)	EN 55011	–
Radio & Television Receivers	EN 55013	EN 55020
Household Appliances/Electric Tools	EN 55014-1	EN 55014-2
Lamps & Luminaries	EN 55015	EN 61547
Adjustable Speed Motor Drives	EN 61800-3	EN 61800-3
Medical Equipment[a]	EN 60601-1-2	EN 60601-1-2
Generic Standards		
Residential, Commercial, Light Industrial Environment	EN 61000-6-3	EN 61000-6-1
Heavy Industrial Environment	EN 61000-6-4	EN 61000-6-2

[a]Covered by the Medical Directive (93/42/EEC), not the EMC Directive

Comité Européen de Normalisation Électrotechnique

- CENELEC (the European Committee for Electro-Technical Standardization) draws up the technical specifications meeting the essential requirements of the EMC directive
- Most CENELEC standards are derived from International Electro-Technical Committee (ITC) or CISPR standards
  - ITC for immunity standards
  - CISPR (International Special Committee on Radio Interference) for emission standards

International Requirements

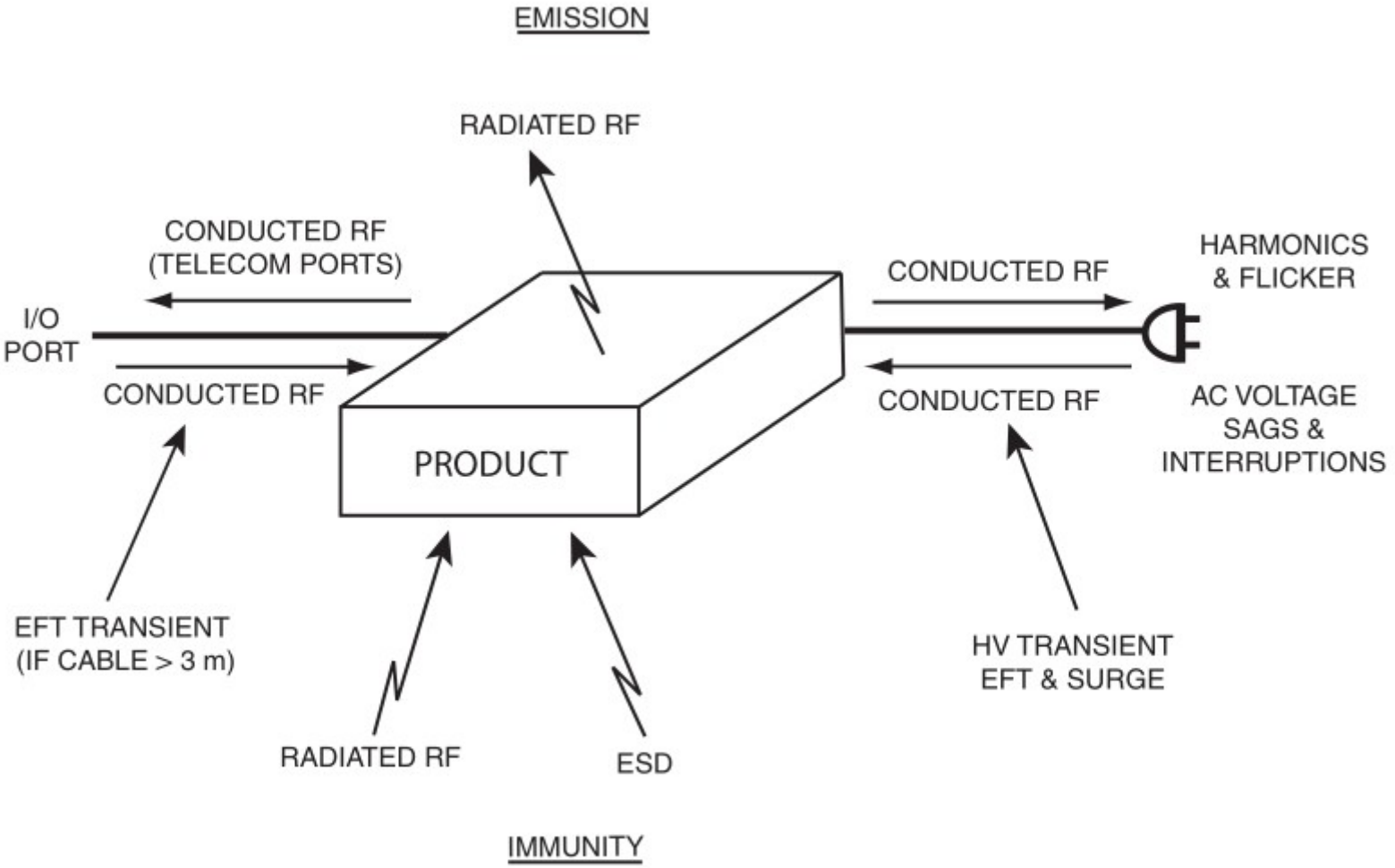

FIGURE 1-6. Typical composite worldwide commercial EMC requirements.

Military Standards

- MIL-STD-461 specified the limits
- MIL-STD-462 specified the test methods and procedures
- issued by the U.S. Department of Defence
- more stringent than the FCC regulations
- cover immunity as well as emissions in the frequency range of 30 Hz to 40 GHz

Military Standards

- Test procedures are often different
- For radiated emissions the military standard specifies enclosed chamber (shielded room) testing,
  - FCC and EU rules require open-area testing
- For conducted emission testing, the military standards originally measured current, whereas the commercial standards measure voltage
  - Now measure voltage