

Power Management Basics

6. Power Management Subsystem Regulatory Standards

Regulatory standards must be met because international and domestic standards are required for the power management section of the end-item equipment. These standards vary from one country to another, so the power subsystem manufacturer and the end-item system manufacturer must adhere to these standards where the system will be sold. Design engineers must understand these standards even though they may not perform standards certification. Understanding these regulatory standards usually pose problems for power management subsystem designers.

- Many standards are technically complex, requiring an expert to be able to decipher them.
- Often, standards are written in a form that is difficult for the uninitiated to interpret because there are usually exemptions and exclusions that are not clear.
- Several different agencies may be involved, so some may be specific to one country or group of countries and not others.
- Standard requirements vary and sometimes conflict from one jurisdiction to another.
- Standards are continually evolving, with new ones introduced periodically, so it is difficult to keep pace with them.

What standards agencies are encountered at the product and system level?

1. **ANSI:** American National Standards Institute oversees the creation, promulgation and use of norms and guidelines that directly impact businesses, including energy distribution
2. **EC (European Community) Directives.** Companies responsible for the product intended for use in the European Community must design and manufacture it in accordance with the requirements in the relevant directives.
3. **EN (European Norm):** Standard directives for the European community.
4. **IEC (International Electrotechnical Commission):** Generates standards for electrical and electronic systems.
5. **UL (Underwriter's Laboratory):** Safety approvals for electrical and electronics products within the USA. A UL approval can also be obtained through the CSA.
6. **CSA (Canadian Standards Association):** Safety approval required to use an electrical or electronic product within Canada. A CSA approval can also be obtained through the UL.
7. **Telcordia:** Standards for telecom equipment in the USA.
8. **ETSI (European Telecommunications Standards Institute):** Standards for telecom equipment.

Required safety standards for power supplies include EN60950 and UL60950 "Safety of Information Technology Equipment" based on IEC60950, containing requirements to prevent injury or damage due to hazards such as: electric shock, energy, fire, mechanical, heat, radiation and chemicals. As of January 1997, the EC Low Voltage Directive (LVD) 73/23/EEC and the amending directive 93/68/EEC requires the manufacturer to make a declaration of conformity if the product is intended to be sold in the European Community.

Specific standards power supply acoustics define maximum audible noise levels that may be produced by the product. The main contributor to the acoustic noise is usually the fan in a power supply with an internal fan.

ESD (Electrostatic Discharge) standards include **EN61000-4-2** that tests immunity to the effects of high voltage low energy discharges, such as the static charge built up on operating

personnel.

Power Line Standards For Power Supplies

1. **EN61000-3:** Limits voltage changes the power supply under test can impose on the input power source (flicker test).
2. **EN61000-4:** Tests the effects of transients and determines the ability of the power supply to survive without damage or operate through temporary variations in mains voltage. These transients can be in either direction (under voltage or over voltage).
3. **EN61000-3-2:** Limits the harmonic currents that the power supply generates onto the power line. The standard applies to power supplies rated at 75 W with an input line current up to 16A/phase.
4. **EN61000-4-11:** Checks the effect of input voltage dips on the ac input power supplies.

EMC Standards For Power Supplies

The most commonly used international standard for emissions is C.I.S.P.R. 22 “Limits and Methods for Measurement of Emissions from ITE.” Most of the immunity standards are contained in various sections of EN61000. As of January 1996, EC Directive 89/336/EEC on EMC requires the manufacturer to make a declaration of conformity if the product is sold in the European Community.

Sections of **EN61000** for EMC include:

1. **EN61204-3:** This covers the EMC requirements for power supplies with a dc output up to 200V at power levels up to 30kW, and operating from ac or dc sources up to 600 V.
2. **EN61000-2-12:** Compatibility levels for low-frequency conducted disturbances and signalling in public medium-voltage power supply systems
3. **EN61000-3-12:** Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current >16A and < 75A per phase
4. **EN61000-3-2:** Limits harmonic currents injected into the public supply system. It specifies limits of harmonic components of the input current which may be produced by equipment tested under specified conditions
5. **EN61000-4-1:** Test and measurement techniques for electric and electronic equipment (apparatus and systems) in its electromagnetic environment.
6. **EN61000-4-11:** Measurement techniques for voltage dips, short interruptions and voltage variations immunity tests.
7. **EN61000-4-12:** Testing for non-repetitive damped oscillatory transients (ring waves) occurring in low-voltage power, control and signal lines supplied by public and non-public networks.
8. **EN61000-4-3:** Testing and measurement techniques for immunity requirements of electrical and electronic equipment to radiated electromagnetic energy. It establishes test levels and the required test procedures.
9. **EN61000-4-4:** Testing and measurement techniques for electrical fast transient/burst immunity test.
10. **EN61000-4-5:** Recommended test levels for equipment to unidirectional surges caused by overvoltage from switching and lightning transients. Several test levels are defined that relate to different environment and installation conditions.
11. **EN61000-6-1:** Electromagnetic compatibility (EMC) immunity for residential, commercial and light-industrial environments
12. **EN61000-6-2:** Generic standards for EMC immunity in industrial environments

13. EN61000-6-3: Electromagnetic compatibility (EMC) emission requirements for electrical and electronic apparatus intended for use in residential, commercial and light-industrial environments.
14. **EN61000-6-4**: Generic EMC standards for industrial environments intended for use by test laboratories, industrial/medical product designers, system designers and system installers.

Restriction of Hazardous Substances (RoHS) Affects Power Supplies

RoHS, is a Directive that restricts use of hazardous substances in electrical and electronic equipment. Designated 2002/95/EC, it is commonly referred to as the Restriction of Hazardous Substances Directive. This RoHS directive took effect in July 2006, and includes power supplies. Although often referred to as the lead-free directive, RoHS also restricts the use of:

1. **Lead**
2. Mercury
3. Cadmium
4. Hexavalent chromium (Cr6+)
5. Polybrominated biphenyls (PBB) (flame retardant)
6. Polybrominated diphenyl ether (PBDE) (flame retardant)

Electronic Waste Directives

RoHS is closely linked to the Waste and Electronic Equipment Directive (WEEE). Designated 2002/96/EC, it makes power supply manufacturers responsible for the disposal of their waste electrical and electronic equipment. Companies are compelled to use the collected waste in an ecologically-friendly manner, either by ecological disposal or by reuse/refurbishment of the collected WEEE.

Directives for Disposal Of Batteries

Batteries are not included within the scope of RoHS. However, in Europe, batteries are under the European Commission's 1991 Battery Directive (91/157/EEC), which was recently increased in scope and approved in the form of the new **battery directive**, version 2003/0282 COD, which will be official when submitted to and published in the EU's Official Journal. This new directive explicitly highlights improving and protecting the environment from the negative effects of the waste contained in batteries.