The Current Status of EC-92

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WHAT IS EC-92?

Twelve European countries (soon to be nineteen) have united to form a single common market called the European Community (EC). The EC is unique in its ability to adopt laws which are binding on all EC member countries, individuals and companies. These new laws apply to EMC, safety and marketing requirements, and are referred to as EC-92. Now, all products that meet the EC-92 requirements can display the CE mark, which indicates conformity and allows these products to be sold in any of the twelve member countries. Currently, the list of EC member countries includes Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain and the United Kingdom.

Achieving the free movement of goods is the goal behind the creation of a single European market. Previously, all European Community countries had individual laws on product safety and these different laws created technical barriers to trade. The establishment of the single entity is expected to enhance the importance of the European market, facilitate sales growth and reduce costs.

This EC-92 approach has led to directives written in general terms (community laws) which spell out the essential requirements; the electromagnetic compatibility directive is one such directive. The directives must be met before products may be sold anywhere in the community. European standards fill in the details of the directives and are the way for businesses to satisfy these essential requirements.

What makes the EC unique is its ability to adopt laws which are binding on EC member countries, individuals and companies.

Based on the EC Directive 89/336/EEC, the European Economic Community (EEC) had intended to begin imposing various requirements on products being imported into member countries on January 1, 1992.

However, a transition period has been implemented from January 1, 1992 to January 1, 1996. During this period, manufacturers can follow either the new EC rules or continue to meet the requirements of each individual country as they have in the past. Manufacturers and importers will not be required to meet the EC requirements until January 1, 1996. This will allow for a more orderly transition and all the specifications will be better understood by the time they are required by law.

Many U.S., European and Japanese companies are working on meeting the EC requirements, and many are displaying the CE mark already. This mark allows them unrestricted movement of their products throughout the European Community today. Companies displaying the CE mark may also have a marketing advantage since the purchaser may perceive the CE mark to indicate quality, and absence of the mark may be perceived as a lack of quality. This quality issue can have a major negative marketing impact for those that do not display the mark.

With the new EC directives, manufacturers of electronic products will be required to meet a wide range of product safety, RF emission and immunity (susceptibility) requirements. Most U.S. manufacturers are familiar with some type of emission regulations, such as FCC Part 15, but immunity will be introduced to them for the first time by the EC Directive. Table 1 outlines the new EMC requirements. Manufacturers can expect to reduce the risk of noncompliance if they design their product keeping the requirements in mind.

Of course, all companies who develop new products will eventually need to meet the EC requirements. EC requirements should be taken into account during the design of the product and preliminary tests should be performed during development.

MEETING THE EC REQUIREMENT

Manufacturers of many products can choose to meet the requirements through a declaration of conformity on their own or by using a competent body. To self-declare conformity, the manufacturer must meet all the requirements of the directive, including EMC and safety regulations, and must issue a self-declaration statement to the importer who then keeps it on file. The manufacturer also puts the CE mark with the introduction date on the product. Some manufacturers will opt against this alternative. They believe that self-declaration

risks losing the public's confidence in the product.

The manufacturer's second alternative is to meet the requirements through a declaration of conformity through a competent body. In this case, all the work is either done by the competent body or witnessed and/or reviewed by the notified body. When this procedure is used, credibility is gained for the manufacturer, since a mark containing the identification of the competent body along with the normal CE letters and date of compliance can be displayed. This method allows a manufacturer to enter the European market with:

- the assurance that the declaration will not be challenged in the marketplace.
- the additional image of quality added to the product with a recognized mark.
- a possibility of reducing some of the liability of the manufacturer.
- credibility, giving the importer confidence that they are importing a product which has been certified to meet the requirements.

Certain products require that the declaration of conformity be obtained through a notified body. Telecom products (connected to phone lines), radio transmitters, and some medical devices are expected to require this procedure.

The CE mark (Figure 1) is reserved exclusively to indicate conformity to all directives in effect at the time. The mark indicates that the product complies with the basic requirements and that the manufacturer (importer) or third party has carried out the relevant assessment.

Although usually affixed to the product, specific directives may allow the CE mark to be affixed on the packaging or the accompanying documentation. The mark is accompanied by figures showing the year in which the mark was first affixed and, where appropriate, the distinctive letters of the approved body that issued the EC type examination certificate.

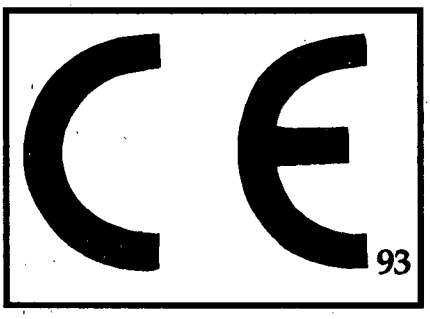

FIGURE 1. *The CE Mark.*

GENERIC, PRODUCT FAMILY AND PRODUCT SPECIFIC STANDARDS

Products which emit or are sensitive to electromagnetic disturbances may be subject to one or more categories of standards.

Basic standards are standards which give the general basis for the specifying requirements and describe how to perform tests for specific applications. They are phenomena oriented. Examples include CISPR 22 and IEC 801-1, 801-2, 801-3, and 801-4, which have been given EN numbers. Basic standards are not used to determine levels or applicability; they specify how to perform the test.

Generic standards specify general requirements, levels and test requirements for all kinds of equipment located in a given environment. Examples are EN50081-1, EN50081-2, prEN50082-1, and prEN50082-2.

Product family and product specific standards are the third category. Each committee responsible for a product emitting or sensitive to electromagnetic disturbances may specify appropriate EMC standards on the basis of the basic and generic standards. Examples include directives which have already been written for telecom products, medical devices and pacemakers. EN55022 is considered to be a product emission standard for ITE and EDP. When a product family or product specific standard exists, it takes precedence over a generic standard. The committee is expected to use the generic requirement except when they can show cause. Then additional requirements can be added.

Emissions (whichever of the following is appropriate)	
Information technology equipment	CISPR F22 becoming EN55022
Hand tools	CISPR 14 becoming EN55014
Industrial scientific & medical	CISPR 11 becoming EN55011
Emissions (appliances, possibly in the future or for product specific standards)	
Will vary with product type	IEC555-2&3 becoming EN60555-2&3
Immunity (All are expected to be required.)	
ESD	IEC 801-2 becoming EN55101-2
Radiated susceptibility	IEC 801-3 becoming EN55101-3
Fast transient	IEC 801-4 becoming EN55101-4
Immunity (possibly in the future or for product specific standards)	
Surge	IEC 801-5 becoming EN55101-5
Conducted	IEC 801-6 becoming EN55101-6

TABLE 1. *Outline of EC Requirements.*

RF EMISSION REQUIREMENTS

CISPR 22 (EN55022) describes the emission requirements for products covered under the generic standard EN50081-1 as well as those classified as Information Technology Equipment (ITE) and Electronic Data Processing (EDP) (Table 2). This is electronic equipment which generally has a clock signal of 9 kHz or greater. The

requirements are broken into radiated and conducted using Class A and Class B. The levels (for non-ITE/EDP equipment) are determined by the generic or product standard, not the basic standard.

Some Nordic countries have adopted CISPR 22 "Limit B" as mandatory requirements. CISPR 22 has been in effect in Germany since December 1991, but the Germans have also added some of their old low frequency national deviations to the new law.

Information Technology Equipment (ITE) is equipment designed for the purpose of:

- receiving data from an external source (such as a data input line or via a keyboard).
- performing some processing functions on the received data (such as computation, data transformation or recording, filing, sorting, storage, transfer of data).
- providing data output either to other equipment or by the reproduction of data or images.

Note: This definition includes electrical/electronic equipment or systems which predominantly generate a multiplicity of periodic binary pulsed electrical/electronic waveforms and are designed to perform data processing functions such as word processing, electronic computation, data transformation, recording, filing, sorting, storage, retrieval and transfer, and reproduction of data as images.

CISPR 14 (EN55014) is for equipment not intentionally generating RF, such as brush motors and 50 Hz speed controls, etc. CISPR 14 requires conducted and radiated emissions to be performed.

CISPR 11 (EN55011) defines limits for radiated and conducted emissions from industrial, scientific and medical equipment. At present this is intended to be equipment other than that covered in CISPR 22 and 14. CISPR 11 consists of two groups. Group I generates and uses RF internally and is basically CISPR 22 type equipment. Group II generates RF internally and uses this energy both internally and externally. The high level RF signals emitted must fall in the ISM frequency range. These ISM frequencies do not have limits on their emission levels but other frequencies are covered by limits. The levels are the same as CISPR 22 except for the ISM frequencies. There is also a low frequency radiated test for Class II group equipment which is not part of CISPR 22.

IEC 555-2&3 (EN60555-2&3) covers harmonic and voltage fluctuations on the ac power leads caused by household appliances and similar electrical equipment. Limits of harmonic currents are given in Table 3. This test is not required for non-appliance equipment at this time, but is expected to apply eventually. Anyone developing a new concept switching

	Frequency Range	Limits	Basic Standard	Test Setup	Remarks
Enclosure	30-230 MHz 230-1000 MHz	30 dBµV/m at 10 m 37 dBµV/m at 10 m	EN 55022 Class B	EN 55022	See Note 1. The statistical evaluation in the basic standard applies.
AC Mains	0-2 kHz		EN 60555-2 EN 60555-3	EN 60555-2 EN 60555-3	See Note 2.
	0.15-0.5 MHz limits decrease linearly with log frequency.	66-56 dBµV quasi peak 56-46 dBµV average	EN 55022 Class B	EN 55022	The statistical evaluation in the basic standard applies.
	0.5-5 MHz	56 dBµV quasi peak 46 dBµV average			
	5-30 MHz	60 dBµV quasi peak 50 dBµV average			
	0.15-30 MHz	See basic standard clauses: discontinuous interference.	EN 55014	EN 55014	

Note 1: Applicable only for apparatus containing processing devices, e.g., microprocessors, operating at frequencies greater than 9 kHz.
Note 2: Applicable to apparatus covered within the scope of EN 60555-2/3. Limits for apparatus not currently covered by EN 60555-2/3 are under consideration.

TABLE 2. *EN50081-1 Generic Emission Standard.*

power supply should consider IEC 555-2.

TEST UNIT CONFIGURATION

Emissions tests should be set up in accordance with the following guidelines.

- The emissions should be maximized consistent with the typical applications by varying the configuration of the test sample.
- Interface cables should be connected to the available interface ports of the test unit.
- The effect of varying the position of the cables should be investigated to find the configuration that produces maximum emission.
- Interconnecting cables should be of the type and length specified in the individual equipment requirements. If the length can be varied, the length should be selected to produce maximum emission.
- If shielded or special cables are used during the tests to achieve compliance, then a note should be included in the instruction manual advising of the need to use such cables.
- For systems, one of each type of unit that can possibly be included in the system configuration should be included in the test unit.
- In the case of test units which functionally interact with other ITE, including any ITE that is dependent on a host unit for its power interface, either the actual interfacing ITE or simulators may be used to provide representative operating conditions, provided the effects of the simulator can be isolated or identified.
- It is important that any simulator or actual interfacing ITE properly represent the electrical, and in some cases the mechanical characteristics of the interfacing ITE. This is especially true of the RF signals and impedances.
- The test unit situation relative to the ground plane shall be equivalent to that occurring in use, i.e., floor-standing equipment is placed on a ground

plane, and portable equipment is placed on a nonmetallic table.

The power and signal cables shall be oriented with respect to the ground plane in a manner equivalent to actual use.

IMMUNITY REQUIREMENTS

New for many companies will be the EC requirements to show that their equipment is not subject to susceptibility. Here the EC has developed susceptibility (called immunity) standards to demonstrate that the equipment is not susceptible to radiated and conducted energy external to the device under test. These requirements are called out in the Generic Immunity Standards EN50082-1 and 2, and for the most part follow the IEC 801 series.

The equipment which is subject to the EN 50082-1 standards until product specific standards are developed includes:

- commercial radio and TV transmission equipment.
- domestic radio and TV receivers.
- mobile radio and commercial radio-telephone equipment.
- information technology equipment.
- medical and scientific apparatus.
- domestic appliances and household electronic equipment.
- educational electronic equipment.
- aeronautical and marine radio apparatus.
- telecommunications networks and apparatus.
- lights and fluorescent lamps.
- electronic equipment for measurement and control.
- transport vehicles, except those with Priority 1.
- utility power equipment.
- high voltage, 1000 VAC, 1500 VDC.
- low voltage.

PERFORMANCE CRITERIA

The performance criteria is called out in the generic or product standard but at no time should apparatus become dangerous or unsafe as a result of the application of the tests defined in this standard. A functional description and a definition of performance criteria, during or as a consequence of the EMC testing, shall be provided by the manufacturer and noted in the test report. Immunity tests are given in Table 4.

HARMONIC ORDER	MAXIMUM PERMISSIBLE HARMONIC CURRENT (AMPERES)
ODD HARMONICS	
3	2.30
5	1.14
7	0.77
9	0.40
11	0.33
13	0.21
$15 \leq n \leq 39$	$0.15 \cdot 15/n$
EVEN HARMONICS	
2	1.08
4	0.43
6	0.30
$8 \leq n \leq 40$	$0.23 \cdot 8/n$

TABLE 3. *Limits of Harmonic Currents.*

IEC 801-1 (EN55101-1):	General Introduction
IEC 801-2 (EN55101-2):	Electrostatic Discharge Requirements 5 ns rise time 30 ns pulse width @ 8 kV air required 15 kV air and 8 kV direct recommended
IEC 801-3 (EN55101-3):	Radiated Electromagnetic Field 27-500 MHz @ 3 V/m required 27 MHz-1000 MHz @ 10 V/m recommended
IEC 801-4 (EN55101-4):	Electrical Fast Transient Requirements 5 ns rise time 50 ns pulse width @ 1 kV, 5 kHz required 4 kV, 2.5 kHz recommended

TABLE 4. *EN50082-1 Generic Immunity Requirements Recommendations.*

CONCLUSION

The adoption of EC-92 EMC standards will ultimately affect the way electronics companies design, manufacture and market their products. Organizations that plan to compete in the world marketplace must become familiar with the technical requirements and re-evaluate their European marketing programs.

Author's note: This article is a summary of the paper "EC Thoughts and Comments." For the complete paper, call the author at 708-699-9060.

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