The European EMC Directive

Knowledge of implementation approaches within the EU is essential for manufacturers.

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INTRODUCTION

The EMC Directive (89/336/EEC) is now in force in Europe. The Directive is not a federal law applied directly to individuals, but a requirement that member state governments introduce legislation for their country.

Each member state has transposed the Directive in its own style, and although conflicting national laws are not allowed, interpretations of the requirements of the Directive have differed slightly in some countries. This article will describe some of those differences, and clarify some previous areas of uncertainty (the so-called *grey areas*), but first will describe the common aspects of the legislation.

THE EUROPEAN ECONOMIC AREA

The Directive applies in a slightly larger number of countries than those of the *European Union* (EU), because three members of the *European Free Trade Association* (EFTA) have agreed to apply EU trade directives as if they were Member States. The countries forming this larger alliance are known as Member States of the *European Economic Area* (EEA) (Table 1).

Although Switzerland is a member of EFTA, it is not party to the EEA Agreement. The EMC Directive does not, therefore, apply in Switzerland. However there are national laws implementing substantially the same EMC standards.

EUROPEAN UNION MEMBER STATES	
Austria	Ireland
Belgium	Italy
Denmark	Luxembourg
Finland	Netherlands
France	Portugal
Germany	Spain
Greece	Sweden
	UK
EFTA MEMBER STATES	
Iceland	
Liechtenstein	
Norway	

Table 1. *European Economic Area (EEA).*

THE "NEW APPROACH"

The main purpose of the EMC Directive is to help secure the free movement of goods across Member State borders to establish a single market. The proliferation of different technical requirements in each member state was seen as a significant non-tariff barrier to free trade.

Products complying with all relevant directives carry a CE Mark to signify conformity (Figure 1). Products with such a mark cannot be stopped at the borders of member states without positive evidence of a problem, as the mark carries a presumption of conformity.

Early European Directives set out all their requirements within the document, which could contain many tens of thousands of words, even for simple provisions. Representatives spent many years reaching agreement. The EMC Directive is one of the first so-called *New Approach* directives under the Treaty of Rome. These lay down only the essential requirements together with administrative provisions; the detailed technical requirements are provided elsewhere.

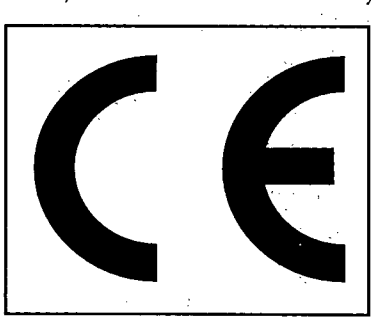

Figure 1. *CE Mark.*

For the EMC Directive, the technical requirements are contained within *harmonized standards*. These are produced by the European electrical standards body, CENELEC, as European Norms (ENs) and by the European Telecommunications Standards Institute (ETSI) as European Telecommunications Standards (ETSs). Such standards are not considered to be *harmonized* until they are accepted by the European Commission as *relevant standards* under the EMC Directive, and listed as such in the *Official Journal of the European Communities* (OJEC). At present, only ENs have been listed as harmonized standards, but some ETSs will be so listed in the future.

It is not the intention of this article to look at the technical requirements. An overview of these was given in ITEM 1996.[1]

THE ESSENTIAL REQUIREMENTS

The protection objectives of the EMC Directive (*the Essential Requirements*) embody the principles of EMC as follows:

Apparatus shall be so constructed that:

- The electromagnetic disturbance it generates does not exceed the level which allows other relevant apparatus to operate as intended.
- The apparatus has a level of intrinsic immunity which is adequate to enable it to operate as intended when it is properly installed and maintained and used for the purpose for which it is intended.

Immunity should be sufficient taking into account the levels of disturbance generally expected in the intended environment and the level of performance reasonably expected

of the apparatus. The latter should be based on the intended function and any specification for an acceptable level of performance degradation provided to the end user by the manufacturer, bearing in mind the consequences of any such degradation.

APPLICATION

One of the greatest areas of uncertainty in the implementation of the Directive has been the scope of its application. This is because the use of the word *apparatus* has been interpreted differently not just in member states, but often by different bodies within each country. The European Commission has recently updated its guidance, first published in 1993, which goes some way to clarifying certain grey areas. Unfortunately, it does not appear to have been published as widely as the 1993 edition.

The Directive applies to "*all electrical and electronic appliances together with equipment and installations containing electrical and/or electronic components liable to cause electromagnetic disturbance, or the performance of which is liable to be affected by such disturbance.*"

It therefore applies to a vast range of equipment, including all electrical appliances, equipment, and installations, energy distribution and telecommunications networks, and transport. There are no upper or lower limits on size or power usage.

SYSTEMS

Within the terms of the Directive, a system is a single functional unit which is a combination of apparatus designed and manufactured to operate together to perform a specific task.

If a system is placed on the market as a single functional unit, then the system as a whole, not each constituent part, must comply with the protection objectives of the Directive and the conformity assessment procedures. The Directive applies also to installations placed on the market or taken into service as a single entity.

COMPONENTS

The Directive does not apply to components. Until the publication of the updated guidance, there was uncertainty over the interpretation of this statement. The Commission has clarified its position to state that the Directive contains no provisions for components, subassemblies, devices or other units intended for incorporation in electrical or electronic apparatus, equipment or installations.

It recognizes, however, that such components are also placed directly on the market and intended for an end user. Components and subassemblies placed on the market do not have to comply unless they perform a *direct function* for an end user. The Commission has defined a direct function as "*any function which meets the needs of a user and which can be directly used by such a user, without the need to make any further adjustments other than any connections essential for its electrical power supply or for the exchange of analogue or digital signals.*" Examples from the guidance are given in Table 2.

EXCLUSIONS

Not all products are included in the scope of the Directive. There are a number of exclusions of a general or specific nature, and the EMC requirements for some products are partly or wholly covered by other directives. Excluded apparatus includes:

- Apparatus for export to a third country (outside the EEA). The supplier must believe (with reasonable cause) that the apparatus will not be used inside the EEA, and the apparatus must not have the CE Mark affixed. Similarly, goods imported into the EEA, but intended for re-export outside the EEA are excluded.
- Spare parts, provided that they replace parts of existing apparatus, and do not upgrade the performance of the apparatus.
- Second-hand apparatus, if it has previously been used by an end-user *inside* the EEA, and not been altered or upgraded.
- Electromagnetically benign apparatus, which is defined as apparatus which will not cause interference

Components performing no direct function (excluded from the scope)	Components performing a direct function (included in the scope)
Resistors, capacitors, coils, miniaturized transformers, diodes, transistors, thyristors, triacs, integrated circuits	Slide-in electronic cards for computer systems, microprocessor cards, CPU cards, electronic mail cards, telecommunications cards
Cables and cabling accessories	Control cards, cards for regulating industrial processes
Plugs, sockets, terminal blocks	Modular numeric control equipment for machine tools and lift controls
Accumulators, batteries	PC disc readers
Cathode-ray tubes, LEDs, liquid crystal display screens	Electricity supply units, where they take the form of autonomous equipment
	Battery chargers
	Electronic temperature controls
	DIY kits

Table 2. *Components Included and Excluded from the Scope of the EMC Directive.*

and will not be degraded by electromagnetic disturbance.
- Radio amateur apparatus which is not available commercially, but not CB radio.

Apparatus which is covered by other directives includes:
- Active implantable medical devices (Covered by 90/385/EEC).
- Medical devices (Covered by 93/42/EEC after transitional period to 14 June 1998; either Directive may apply in the interim).
- Motor vehicles having four wheels for use on roads, components and after sales products (Covered by 72/245/EEC, amended by 95/54/EEC).
- Equipment intended for use in operating aircraft in flight (Council Regulation (EEC) No. 3922/91).
- Marine equipment covered by the proposal for a Directive COM (95) final, when the Directive is adopted and implemented in full.

Some apparatus is partly covered by other directives for specific circumstances:
- Emission and Immunity — Telecommunications Terminal Equipment (TTE) (covered by 91/263/EEC) and Satellite Earth Station (SES) equipment (covered by 93/97/EEC) where these directives make specific provision supported by CTRs; otherwise the EMC Directive applies.
- Emission only — Agricultural and forestry tractors (emission covered by 75/322/EEC).
- Immunity only — Electrical energy meters (immunity covered by 76/89/EEC), and non-automatic weighing instruments (immunity covered by 90/384/EEC).

REQUIREMENTS

Products placed on the market must conform with the protection requirements of the EMC Directive, and the conformity assessment procedures must have been fulfilled. The CE mark must have been properly affixed by the manufacturer or the authorized representative, and the manufacturer or the authorized representative must have properly issued an EC declaration of conformity.

There are three routes by which conformity assessment may be demonstrated: the standards route (self-certification), the Technical Construction File route and the EC Type Examination route.

THE STANDARDS ROUTE (SELF-CERTIFICATION)

The manufacturer declares that the apparatus meets the relevant harmonized standards published in the *Official Journal*, but they must cover all aspects of emissions and immunity. There is no specific requirement in the EMC Directive to perform tests.

THE TECHNICAL CONSTRUCTION FILE ROUTE

This route is used where there are no applicable harmonized standards, where harmonized standards are not applied or applied only in part, or where harmonized standards do not make a complete provision. It may also be used where nonharmonized standards (e.g., those issued by ANSI) have been employed.

The manufacturer creates a file which describes how compliance with the protection objectives was achieved. This must be accepted and certified by an organization called a Competent Body which has been appointed by a member state administration.

The Technical Construction File route is unique to the EMC Directive. (See Technical Construction File sidebar.)

THE EC TYPE EXAMINATION ROUTE

This route applies only to radio transmitters or combined transmitters and receivers, and must be used for this type of apparatus unless it is covered by the TTE or SES Directives. Testing must be performed, and the procedure also requires a Type Examination Certificate from a Notified Body which has been appointed by a member state administration.

DECLARATIONS OF CONFORMITY

The manufacturer or authorized representative must create and sign a declaration of conformity, which must be held by the so-called *responsible person.* This is the company within the EEA which first places the product on the market in the EEA. It could be an agent of a U.S. company, or an importer. The declaration of conformity should:
- Be in a language of a Member State of the EEA
- Give the name and address of the Responsible Person (and the manufacturer, if the responsible person is not the manufacturer)
- Be signed by or on behalf of the manufacturer or an authorized representative and identify that signatory
- Bear the date of issue
- Give identifying particulars of the relevant apparatus
- State the numbers and titles of the applicable EMC standards applied by the manufacturer, and/or the reference number of the Technical Construction File, and where appropriate, reference to the EC Type Examination Certificate
- Certify that the apparatus to which it relates conforms with the protection requirements of Council Directive 89/336/EEC on the approximation of the laws of member states relating to electromagnetic compatibility

CE MARKING

All apparatus placed on the market in conformity with a new approach directive must bear the CE conformity marking. CE stands for Communauté Européene, and shows that the apparatus complies with *all* relevant directives. The mark must follow the proportions given, and not be smaller than 5 mm in height (Figure 1).

The mark must be fixed to the apparatus, and if this is not possible, to the packaging, instructions for use, or guarantee certificate. It must be affixed visibly, legibly, and indelibly.

TECHNICAL CONSTRUCTION FILE CONTENT

The Department of Trade and Industry (DTI) in the UK has provided the following guidance on the content of these files, which has generally been accepted throughout Europe.

Description of the apparatus

- Identification of the apparatus, including the brand name, model number, and the name and address of the manufacturer.
- Description of the intended use of the apparatus, including any limitation on the intended operating environment. For installations, the physical location.
- External photographs.
- A block diagram showing the interrelationship between the different functional areas of the apparatus.
- Relevant technical drawings, including circuit diagrams, assembly diagrams, parts list, installation diagrams.
- Description of intended interconnections with other products, devices, etc.
- Descriptions of product variants.

Procedures used to ensure conformity to the protection requirements

- Details of significant design elements, including design features adopted specifically to address EMC issues.
- Relevant component specifications, e.g., the use of cabling products known to minimize EMC problems.
- Procedures used to control variants in the design, and procedures used to assess whether a particular change in design will require the apparatus to be retested.
- Details of any theoretical modeling of performance aspects.
- Test evidence where appropriate, including a list of EMC tests performed on the product, and test reports relating to them, including details of test methods.
- An overview of the logical processes used to decide whether the tests performed on the apparatus were adequate to ensure compliance with the Directive.
- A list of tests performed on critical subassemblies, and test reports and certificates relating to them.

Report or certificate from a competent body

This documents the agreement of the Competent Body that the apparatus described in the Technical Construction File conforms with the protection requirements.

To affix any marks or inscriptions that are likely to mislead third parties as to the verbal or pictorial significance of the CE Mark is prohibited.

OTHER GREY AREAS

CE MARKING OF COMPONENTS AND SUBASSEMBLIES

Although the scope of the Directive has been clarified with respect to components, the Directive makes no provisions for products outside its scope. There is no requirement in the Directive therefore, prohibiting CE Marking of components and subassemblies without a direct function, and the Commission guidance is also silent on the issue. In general, such marking of items outside the scope of all new approach directives is not prohibited by member states' EMC legislation, but could be illegal under other laws.

SUBCONTRACT MANUFACTURING

In some member states, subcontract manufacturing is common, and uncertainty arises over the responsibility for the declaration of conformity of the finished product. The Commission defines the manufacturer as *the person who accepts responsibility for the design and manufacture of a product covered by the Directive with a view to placing it on the [EEA] market on his own behalf.*

With subcontract manufacture, the design and manufacturing responsibilities are split. However the Commission guidelines have largely removed the confusion by adding the comment that the manufacturer *may sub-contract certain operations, e.g., product design where he himself is responsible for actual manufacture, or production where he handles the design aspects, provided he retains overall control and responsibility for the product as a whole. By the same token, he may use ready-made items or components to produce the product without forfeiting his manufacturing status.*

It is expected that this guidance will remove differences of interpretation between member states.

DIFFERENCES IN MEMBER STATES

The following examples are known differences between member states. The author would be pleased to learn of any experiences of manufacturers which may suggest changes in the policies of individual states, or any additional anomalies.

ENFORCEMENT AND PENALTIES

Enforcement and penalties are matters for national governments, and it is here that the greatest differences are seen. The following information is the official view of Member State administrations.

Austria: National enforcement, mostly in response to complaints. The penalties are up to ATS 35 000 where the law is broken intentionally, or by serious negligence.

Belgium: National enforcement will be active, and will not await complaints. The penalty for noncompliance is prohibition from placing products on the market; stronger penalties of fines or imprisonment would follow if the ban is not followed.

Denmark: Local enforcement under the direct control of the national body, expected to be passive at first, offering advice,

but with active inspections to check for the CE Mark. The penalty will be a fine, determined separately for each case.

Finland: National enforcement will be active. Penalties are a maximum of six months in jail, or a fine of thousands of Finmarks, under existing radio legislation.

France: Position unclear.

Germany: Enforcement will be active, funded by TV licenses and fines. Extra officers have been recruited. The penalties for noncompliance are DM 100 000 where a violation is intentional, and DM 10 000 if the violation is caused by carelessness.

Greece: No information received from the administration.

Iceland: Enforcement will be both active (by market surveillance) and in response to complaints.

Ireland: Enforcement will be in response to complaints. The penalty for noncompliance will be a fine of IR£ 1 500.

Italy: Enforcement will be by national bodies. Noncompliant apparatus is liable to seizure and confiscation. The penalty for placing noncompliant products on the market is a fine of between 50 and 90 million lire. There are other fines as follows: for compliant apparatus which lacks certification, 5 - 30 million lire; for persons wholesaling, retailing, or installing apparatus which lacks certification, 3 - 18 million lire.

Liechtenstein: No information received from the administration.

Luxembourg: The Judicial Police and "Gendarmerie" are responsible for investigating infringements. There are no specific penalties laid down in the legislation.

Netherlands: Enforcement is a national responsibility, and will be both proactive and in response to complaints. Penalties are variable, and will be decided by the court in each case.

Norway: Enforcement is a national responsibility, but resources to enforce and control are limited. Complaints will be investigated, and the market will be controlled by randomized sampling and spot checks. As no manufacturer has yet been prosecuted, the legal consequences are not known.

Portugal: Enforcement is a national responsibility and will be active. Penalties vary according to the offense. For private individuals, fines up to 500 000 escudos may be imposed; for corporate bodies, the maximum is 3 000 000 escudos.

Spain: Position unclear.

Sweden: National enforcement, believed to be tolerant during the first half of 1996. There are no specific penalties other than withdrawal of the product from the market. This and the resulting publicity is considered to be sufficient.

UK: Enforcement will be by local Trading Standards Officers, and will be complaints-driven. The complaint may come from the owner of the apparatus, a third party who suffers interference, or from a competitor. The penalties are a maximum of £5 000 fine for each offence, or three months in jail, or both.

MILITARY EQUIPMENT

Products with a mixed commercial and military use are always included in the scope of the EMC Directive. Austria, Belgium, Germany, Italy, and The Netherlands include apparatus with a purely military use. Denmark, Finland, France (probably), Norway, Portugal, and the UK exclude apparatus with a purely military use from the scope of the Directive. In Ireland, the law is silent on the issue. If military communications equipment interfered with civilian systems, it would probably need to be fixed. In Sweden, the legislation is also silent; it is not considered an issue.

APPARATUS IN THE SUPPLY CHAIN AT YEAR-END 1995

Germany had strict EMC laws prior to the introduction of the EMC Directive. Stock which does not comply with the EMC Directive must have been placed on the German Market prior to the end of 1995, and must have complied with German EMC

TERMS

AUTHORIZED REPRESENTATIVE
A person expressly appointed in the EEA by a manufacturer to act on the manufacturer's behalf with respect to obligations laid down in the Directive.

COMPETENT AUTHORITY
The administration in each Member State, responsible for the promulgation of the legislation, fulfilling the obligations of market control, and the appointment of Competent and Notified Bodies.

COMPETENT BODY
A body appointed to conduct assessments of Technical Construction Files and responsible for issuing technical reports or certificates under Article 10 (2) of the Directive. Such bodies are often, although not exclusively, accredited laboratories.

NOTIFIED BODY
A body appointed to issue EC Type Examination Certificates for radio transmitters under Article 10 (5) of the Directive.

regulations. In other Member States, any item of relevant apparatus that entered the market in the EEA on or before 31 December 1995 can continue to be passed down the supply chain after that date, according to individually set time limits. For Belgium, Denmark, Finland, France, Ireland, Italy, Norway, Portugal and Sweden, that limit expires at the end of 1996. No time limit is imposed in Austria, Iceland, Netherlands and the UK.

The EMC Directive does not apply to items first supplied or taken into service on or before the end of 1995. However, the Directive always refers to individual items of apparatus. The fact that a manufacturer is marketing a model or producing a batch of it on or before 31 December 1995 will not itself entitle the manufacturer to market the model, or the rest of the batch unless it complies with the Directive's protection requirements, has been through the conformity assessment procedures, and carries the CE Marking.

OTHER DIFFERENCES

In the UK regulations, installations are excluded if they consist of two or more pieces of compliant apparatus, are not supplied as a single commercial entity, and are not designed for supply as a single functional unit.

In the UK, apparatus intended for use in a sealed electromagnetic environment is excluded, provided that this is the usual location for such apparatus, and the instructions for use state that it is only suitable for use in that environment.

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REFERENCES

1. Herbert K. Mertel, "The EMC Directive Revisited" *ITEM 1996*, 66 - 72.

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