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The Revised EMC Directive Versus the Current EMC Directive

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Abstract — A "revised" EMC Directive has been published on the last day of 2004. Manufacturers will be able to take advantage of its provisions as from 20 July 2007. This paper presents the main differences between the "current" and "revised" EMC Directives, with an emphasis on several key aspects: items subject to the directive, installations, the compatibility assessment procedure and EMC standards. In general, the "revised" EMC Directives provides more flexibility, but also requires a more rigorous approach.

I. INTRODUCTION

The EMC Directive [1] of 3 May 1989 is applicable in the European Community (now the European Union) since 1 January 1992. Since 1 January 1996, *all apparatus liable to cause electromagnetic disturbance, or the performance of which is liable to be affected by such disturbance*, must comply with the requirements of the EMC Directive before being placed on the market or taken into service in the territory of the Member States. In this Directive, *apparatus* means *all electrical and electronic appliances together with equipment and installations containing electrical and/or electronic components*.

It was found early that the implementation of this legal document presented several areas where clarification was needed. In 1997, the Commission issued a Guide [2], which was a substantial contribution toward homogeneous application of the EMC Directive. Unfortunately, it was only an informal document which did not provide the necessary legal certainty.

The Simpler Legislation for the Single Market (SLIM) initiative was launched by the Commission in May 1996 with strong encouragement and support from Internal Market Ministers. The first task was to identify ways in which the existing single market legislation could be simplified. The resulting EMC SLIM report [3] is the foundation of the revision of the EMC Directive which was completed on 31 December 2004 with the publication in the *Official Journal of the European Union*. The European Communities also published a document [4] referred to as the *Independent study*, which was prepared within the revision process†.

† The employer of the authors (Excem) was awarded a study contract with the European Commission to provide technical support to the activities carried out within the context of the revision of the EMC Directive. The authors worked on this project from February 2000 to November 2000. During this period, they took part in the activities of the *EMC SLIM Working Group* in charge of the revision process and produced the *Independent study*.

This paper discusses the main differences between the "revised" EMC Directive [5] of 15 December 2004 (hereafter referred to as REMCD) and the "current" EMC Directive [1] (hereafter referred to as CEMCD). The above-mentioned Guide shall be called "Guide for CEMCD" hereunder.

II. GENESIS AND DATE OF APPLICATION OF THE REVISED EMC DIRECTIVE

The Commission, helped by a working group including representatives of the member states and representatives of enterprises, reached the stage of a draft Directive, during the first quarter of 2001. In December 2002, this document became a proposal for a new EMC Directive, presented in the document COM(2002)759 final [6]. It contained significant changes. For instance, according to its Article 7 and to the paragraph 1 of its Annex II, the manufacturers would become entitled to deviate from harmonized standards, provided they can demonstrate that they comply with the essential requirements of the Directive. Today, Article 10.2 of the "current" EMC directive [1] requires that any such deviation be investigated by a "competent body".

The paragraph 7 of the explanatory memorandum of this proposal for a Directive indicates that the technical findings of the independent study have brought to "include ready-made connecting devices within the scope of the Directive and to regulate specifically fixed installations".

In 2004, the European Parliament introduced 39 amendments to the proposal, 33 of which were adopted after a vote [7]. Considering that all adopted Parliament's amendments were acceptable, the Commission introduced an amended proposal in June 2004, which was finally approved by the Council on 29 November 2004 and became a directive [5] on December 15, 2004. This REMCD entered into force on 20 January 2005, but this date is without practical significance for manufacturers, because European Directives are not directly applicable to them. European Directives rather define provisions which each Member State (currently, 25 Member States) must transpose into laws and other regulations. Specifically, the provision which the Member States shall adopt to comply with the REMCD shall be applicable as from 20 July 2007, at which date the CEMCD shall be repealed. It will nevertheless remain possible to place on the market and/or put into service equipment complying with

the requirements of directive 89/336/EEC, if they were placed on the market before 20 July 2009.

III. MAIN DIFFERENCES

The major differences between the REMCD of 2004 and the CEMCD of 1989 are the following:

- the definition of apparatus is changed;
- two classes of items are subject to the directive, *apparatus* and *fixed installation*, different obligations and procedures being applicable to each class;
- a conformity assessment procedure is defined for apparatus, which prescribes the creation of a technical documentation providing evidence of the conformity;
- the competent bodies are replaced by *notified bodies*, but their intervention is not mandatory, even where the manufacturer has not applied harmonized standards, as explained above;
- when a manufacturer does not apply all the relevant harmonized standards, the manufacturer must perform an *electromagnetic compatibility assessment* demonstrating that the apparatus meets the protection requirements;
- a specific regulatory regime is applicable to fixed installations.

IV. ITEMS SUBJECT TO THE DIRECTIVE

The general principle is that the CEMCD and REMCD apply to all items which can generate electromagnetic disturbances, or the performance of which may be affected by electromagnetic disturbances. However, several categories of items covered by more specific directives are totally or partially excluded from the CEMCD and REMCD, such as radio and telecommunications terminal equipment, medical devices, motor vehicles and equipment to be fitted in cars, some marine equipments, etc. Some other categories of items not covered by specific directives are also excluded, such as home-made radio equipment used by radio amateurs (in CEMCD and REMCD), aircraft covered by regulation (EC) No. 1592/2002 (in REMCD only), etc.

Let us now consider items which are not excluded by such provisions (i.e. Article 2 of CEMCD or Article 1 of REMCD). If we for instance consider an integrated circuit, or a printed circuit assembly, or a microcomputer, or a network of information technology equipment in a building, we clearly see that EMC requirements cannot be uniformly applied to them. The CEMCD is not satisfactory in this respect because it considers a single category of items, called *apparatus* (see section I above). Consequently, areas where the clarifications of the Guide for CEMCD [2] have been most needed (and still are) cover:

- defining categories of items subject to the directive,
- expressing meaningful protection requirements,
- modulating the protection requirements according to the categories of items,
- designating which item should be CE marked.

This Guide for CEMCD presents a "decision flow chart" and states that "the manufacturer has to determine the classification of his electrical apparatus as component, finished product, system or installation". In the end, the Guide for CEMCD uses five classes to which different obligations apply: "component without direct function", "component with direct function", "finished product", "system" and "installation". This is an objective classification, based on properties of the item, but of course it has loopholes. The Guide for CEMCD says that components without direct function (e.g. the integrated circuit) are not considered as apparatus within the meaning of the CEMCD, and explains that the applicability of the directive to fixed installations is limited, contrary to the words of the CEMCD, but in line with the contents of recognized EMC standards and practices.

The approach of the REMCD as regards the different classes of items is more satisfactory; it contains an objective classification of items, and prescribes obligations applicable to installations. In order to achieve this, the definition of *apparatus* is changed in the REMCD to the following:

- *any finished appliance, or combination thereof made commercially available as a single functional unit intended for the end-user, and liable to generate electromagnetic disturbance, or the performance of which is liable to be affected by such disturbances*, or
- a component or a sub-assemblies *intended for incorporation into an apparatus by the end-user, which are liable to generate electromagnetic disturbances, or the performance of which is liable to be affected by such disturbances*, or
- a mobile installation *defined as a combination of apparatus and where applicable, other devices, intended to be moved and operated in a range of locations*.

Two other classes of items are defined in the REMCD:

- *fixed installation means a particular combination of several types† of apparatus and, where applicable, other devices, which are assembled, installed and intended to be used permanently at a predefined location*,
- *equipment means any apparatus or fixed installation*.

The REMCD *regulates the EMC of equipment*, apparatus and fixed installation being subject to the same protection requirements, but different procedures are applicable.

Apparatus are subject to a *conformity assessment procedure* and to *"CE" marking* prior to placing on the market and/or putting into service. The manufacturer of an apparatus must provide information on any specific precautions needed to obtain the conformity to the protection requirements, and, in cases where compliance with the protection requirements is not ensured in residential areas, a restriction of use must be indicated.

Fixed installation must be installed applying *good engineering practices*, but are not subject to CE marking. When there are indications of non-compliance of a fixed installation, the competent authorities may request evidence of compliance of the fixed installation, and initiate an assessment.

V. INSTALLATIONS

As explained in section II, the approach of the REMCD regarding installations is rooted in the independent study, in which "installing" means placing items in position, and establishing the necessary electrical connection and other technical provi-

† Clearly, the word "type" should not appear in this definition. If a network of different computers is an installation, a network of identical computers should also be an installation. Anyhow, "type of apparatus" is not defined. In fact, if "of several types" had been deleted, this definition would have been more consistent with the definition of mobile installation.

sions for use. An installation is defined as the new item resulting from installing one or several items. In this manner, an installation does not necessarily include any cabling. Even a hand-held, battery-operated, cordless item is installed prior to be used. At the other extreme, an installation may only include cabling. For instance, the cables and connectors laid and fixed in a building for later (eventual) use as a medium for a local area network are installed.

Point 24 of the SLIM report [3] starts with "In practice installation rarely cause EMC problems to neighboring installations". The point of view of the independent study is exactly the opposite: only installations have EMC problems. In fact, using the above definitions of *installing* and *installation*, this statement is almost a tautology because, by definition, it is not possible to use an item that has not been installed. A second aspect is that the larger the installation, the more important the coupling phenomena (couplings between the cables of the installation, couplings between external fields and currents on these cables, couplings between currents on these cables and the fields produced by the installation, etc) are likely to be. This point is well known from EMC specialists who work on systems and installations.

In the REMCD, the requirements concerning installations are different from the one found both in the CEMCD (which says that installations are only a particular specie of apparatus, all requirements therefore applying to them) and in the Guide for CEMCD (which considers that installations can often be disregarded):

- separate provisions are applicable to fixed installations, such as an *a posteriori* assessment in case of complaints about disturbances generated by the installation (as opposed to the *a priori* conformity assessment procedure applicable to apparatus);
- an item which would normally be regarded as an apparatus, may eventually be exempt from conformity assessment procedure and CE marking if it is *intended for incorporation into a given fixed installation and is not otherwise commercially available*;
- when this option is not used, the manufacturer of an apparatus must *provide information on any specific precaution that have to be taken when the apparatus is assembled, installed, maintained or used, in order to ensure that the protection requirements are met*.

Note that networks of electricity-carrying conductors (power networks, telephone networks, etc) are fixed installations.

VI. COMPATIBILITY ASSESSMENT PROCEDURE AND EMC STANDARDS

The Commission periodically publishes a list of harmonized standards for the implementation of the CEMCD. The REMCD also refers to harmonized standards published in the same manner.

For apparatus, the REMCD defines an *electromagnetic compatibility assessment*, the purpose of which is to establish that the apparatus meets the protection requirements, *in all the possible configurations identified by the manufacturer as representative of its intended use*, taking into account *all normal intended operating conditions* and *based on relevant phenomena*. In addition, the manufacturer must draw up a technical documentation on this subject matter, *providing evidences of the conformity of the apparatus with the essential requirements* of the REMCD, not with a given standard. The REMCD even says that *compliance with a "harmonized standard" is not compulsory*. In general, this is a formidable task, even for specialists. However, the REMCD says that *the correct application of all relevant harmonized standards* can replace the electromagnetic compatibility assessment.

We observe that:

- the REMCD is flexible because it allows manufacturers to perform the conformity assessment procedure without reference to particular standards, without control of a third party (the "competent body" of the CEMCD), at the cost of conducting a detailed and documented electromagnetic compatibility assessment;
- the REMCD allows one to bypass the step of the electromagnetic compatibility assessment by merely applying all relevant harmonized standards.

Of course, it is intended that the simplest way of carrying out the conformity assessment procedure should be the use of harmonized standards. However, this route requires *the correct application of* ***all*** *relevant harmonized standards*. At the present time, it could be difficult to establish the list of all harmonized standards among the 111 listed in [8], which could be relevant to an innovative product combining several functions. One hardly needs to mention the fact that one needs to purchase standards to read their scope, and that the cost of these standards is not negligible. Let us hope that this situation will improve before 20 July 2007.

VII. CONCLUSION

The revised EMC Directive (REMCD) offers many improvements over the existing legislation, including clarification and flexibility. Since it accurately defines the compatibility assessment procedure, it also requires a more rigorous approach. Manufacturers will be able to take advantage of its provisions as from 20 July 2007. Note that a Guide for the REMCD is being prepared by the European Commission.

A remark concerns the fact that more equipment implements radio communications. Such equipment will not directly be covered by the REMCD, but will remain covered† by the R&TTE Directive [9], which incorporates the protection requirements of the CEMCD.

Excem is currently providing technical assistance to the Enterprise directorate-general of the European Commission, relating to the application of the EMC Directive and R&TTE Directive. Because of this particular situation, it is necessary to stress that this paper only reflects an approach followed by the authors, independently of any work performed by them for the Commission.

† A *radio equipment* covered by the R&TTE Directive is an item capable of communication by means of the emission and/or reception of electromagnetic waves of frequencies from 9 kHz to 3 THz, propagated in space without artificial guide. Several categories of items are excluded from the R&TTE Directive, among which broadcasting receivers.

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[6] *Proposal for a Directive of the European Parliament and of the Council on the approximation of the laws of the Member States relating to electromagnetic compatibility*, Commission of the European Communities, COM(2002)759 final, December 23, 2002.

[7] *Report on the proposal for a Parliament and Council directive on the approximation of the laws of the Member States relating to electromagnetic compatibility*, European Parliament, PE 337.416, 25 February 2004.

[8] "Commission communication in the framework of the implementation of Council Directive 89/336/EEC", *Official Journal of the European Union* dated April 23, 2004, pages C 98/8 to C 98/21.

[9] Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity.

Biographies

Frédéric Broydé (S'84 - M'86 - SM'01) was born in France in 1960. He received his "ingénieur" degree in physics engineering from the physical engineering department of the Ecole Nationale Supérieure d'Ingénieurs Electriciens de Grenoble (ENSIEG), in 1984, and the Ph.D. in microwaves and micro technologies from the Université des Sciences et Technologies de Lille (USTL), in 2004. He co-founded the Excem Corporation in May 1988, and became its chairman, a position he holds to this day. He supervises engineering or R&D projects related to EMC and electronic design. Some of his most active research areas related to EMC are the development of high data rate transmission systems, the characterization and design of cylindrical shields, and the control of the fields close to linear antennas. He currently takes part in a technical assistance to the European Commission for the implementation of the R&TTE and EMC directives. He is also working on secure transmission in cables, on the design of an advanced RF amplifier for mobile communications and on models for improving the design of switch-mode power circuits. He is a radio amateur (F5OYE) and a member of the Audio Engineering Society (AES). He is author or co-author of 60 technical papers, and inventor or co-inventor in patent applications for 29 inventions. A complete bibliography including published papers and patents applications of Dr. Broydé is available on the http://www.eurexcem.com web site. He may be reached at fredbroyde@eurexcem.com.

Evelyne Clavelier (S'84 - M'85 - SM'02) also with Excem, was born in France in 1961. She received her "ingénieur" degree in physics engineering from the physical engineering department of the Ecole Nationale Supérieure d'Ingénieurs Electriciens de Grenoble (ENSIEG), in 1984. She is cofounder of the Excem Corporation (May 1988), and later became general manager of this company. She is a senior EMC and reliability engineering consultant. She is in charge of scientific and technical software development, and as such works on cylindrical shield and cable modeling. She is also currently working on free-space optical transmissions, on the description of the near field of portable transmitters, and on schemes capable of increasing the efficiency of RF amplifiers. She is a radio amateur (F1PHQ). A complete bibliography of Ms. Clavelier is available on the http://www.eurexcem.com web site, with the full text of a selection of her published papers. She may be reached at eclavelier@eurexcem.com.