ABSTRACT
The EMC Directive 2004/108/EC [1] sets out ‘essential requirements’ for the electromagnetic compatibility of ‘fixed installations’. The delayed EMF Directive 2004/40/EC [2] sets out the exposure limits for ‘employees’. These requirements need to be addressed by the power industry and lead to the need for power station, sub-station, etc, sites to be characterised and managed from an EMC/EMF viewpoint.

INTRODUCTION
The ‘new’ EMC Directive (EMCD) was published in the Official Journal of the European Union on 31/12/04, 2004/108/EC [1].

The EMCD 89/336/EEC [2] as amended, became fully effective from 01 January 1996. In 1997 the Commission issued an informal guide [3] to clarify a number of issues and in order to ensure a homogenous application of the Directive. This guide had no legal standing and therefore the Commission identified the EMCD as a candidate for the SLIM (Simpler Legislation for the Internal Market) initiative.

During 1998 the SLIM panel presented their opinion, taking account of the 1997 guide and presented a report making 20 recommendations. The Commission endorsed most of these recommendations in its communication (COM(1999)88) to the Council. The Commission then set up a working party to help it draft a proposal for revision of the EMCD. During 1999 and 2000 several drafts were produced and circulated for comment and consultation. The new EMCD 2004/108/EC has been drafted taking account of this extensive and wide ranging consultation.

This paper aims to identify the issues concerned with Fixed Installations raised by the new EMCD; particularly the requirements that need to be addressed by the power industry. The new EMCD has been implemented by the Member States since 20 July 2007. Apparatus compliant with 89/336/EEC may continue to be sold until 20 July 2009.


THE EMC DIRECTIVE AND FIXED INSTALLATIONS
The 2004 EMC Directive requires that all new fixed installations brought into service, and all updates to existing fixed installations made after 20/07/07 must meet the essential requirements.

Fixed installations are identical to the ‘excluded installation’ defined in the 1991 Guidelines [3] and the UK EMC Regulations, SI 1992 No. 2372 [4]. Fixed installations are assemblies of various apparatus and other devices, carrying the CE Marking, ‘applying good engineering practices’ (Annex I specific requirements) and intended to be used permanently at a pre-defined location within the EU (eg. electricity distribution networks, telecoms networks, large machinery and assemblies of machinery on manufacturing sites). A fixed installation is not subject to conformity assessment; it must, however, meet the protection requirements. The good engineering practices shall be documented and the documentation held by ‘person(s) responsible’ for inspection by the national authorities for as long as the FI is in operation.

The national authority may request evidence of compliance of the FI with the protection requirements and when appropriate initiate an assessment. Member States are required to set out the provisions for the identification of the person(s) responsible for the compliance of a FI. If a fixed installation is identified as an unacceptable source of emissions, a national authority can request that the responsible person brings it into compliance with the protection requirements.

Since the constituent apparatus of the fixed installation will conform to the EMCD and this conformance is likely to have been demonstrated by compliance with harmonised standards, then the Commission argue, the EM environment of the fixed installation is defined allowing for addition of apparatus employing ‘rapidly changing technologies’ itself conforming to harmonised standards.

Where apparatus is designed and built for incorporation into a specific fixed installation and is not otherwise commercially available, it is not required to undergo formal conformity assessment procedures. The manufacturer may choose to either follow conformity
assessment procedures or to provide accompanying documentation detailing the name and site of the FI and the EMC precautions to be taken for the incorporation of the apparatus in order to maintain the conformity of the installation. The manufacturer must also provide identification of the apparatus and his name and address; if the manufacturer is outside the EEA, the person within the Community responsible for placing the equipment on the market (this may be the manufacturer’s authorised representative) must provide the name and address of both manufacturer and agent inside the Community.

Member States were required to implement the new EMCD into regulations by 20 January 2007 and to apply these from 20 July 2007 (Article 16). These regulations immediately applied to fixed installations.

**Definition of Apparatus**

Apparatus is defined as ‘goods’ which, once they comply with the EMCD can be placed on the market and/or put into service anywhere within the European Economic Area (EEA). It is the responsibility of the manufacturer to carry out a conformity assessment to show that the apparatus complies with the ‘essential requirements’ of the EMCD. Apparatus is defined as ‘any finished appliance, or combination thereof [a system] made commercially available as a single functional unit, intended for the end user, and liable to generate EM disturbance, or the performance of which is liable to be affected by such disturbance.’

Apparatus also includes: “components” or “sub-assemblies” intended for incorporation by an end user, which are ‘liable to generate EM disturbance, or the performance of which is liable to be affected by such disturbance.’ Mobile Installations are also treated as apparatus, since these can cross borders between Member States.

Compliant apparatus must carry the CE marking, based on Technical Documentation demonstrating the apparatus meets the essential requirements of the EMC Directive. Apparatus already placed on the market before July 2007 and compliant with the previous EMC Directive 89/336/EEC may remain on the market until 20 July 2009, a transition period of two years. To remain on the market after this date, its documentation must be updated to the requirements of 2004/108/EC. This may require re-testing to updated harmonised standards.

**Issues**

It is not altogether clear whether a large machine or installed system is apparatus or a FI. It is not clear what is meant by ‘apparatus otherwise not commercially available’. It is also left to member states to define the responsible person.

In the preamble to the Directive there are several references to FIs:

(6) – which makes the distinction between the free movement of apparatus and FIs being permanently used at a predefined location

(18) – states that FIs include large machines and networks

(20) – the rationale for allowing apparatus ‘otherwise not commercially available’ is presented

A manufacturer can decide whether to document a large system as apparatus or as a fixed installation. This is only possible if the system is (or could be made) commercially available as a single functional unit. Ultimately, such a decision will be based on the manufacturer’s requirements regarding consistency of documentation practices. When a manufacturer regularly supplies and installs large systems into fixed installations, treating the systems as apparatus reduces the required workload.

Similar systems can share Technical Documentation, streamlining the testing and documentation requirements.


The UK provided further guidance in URN 07/1614 [6], particularly the responsible person is defined:

‘Such a person must hold a position of responsibility sufficient to control the configuration of the fixed installation, and to be satisfied that the documentation is and continues to be sufficient to demonstrate that good engineering practices have been followed. The responsible person does not have to be an EMC expert, and may seek appropriate advice in fulfilling their obligations. However they cannot delegate their responsibility.’

For a complex or large FI, knowledge of the electromagnetic characteristics of the site allows for effective management and planning of new and existing assets, and demonstrates good engineering practice. This is especially important when incorporating apparatus ‘otherwise not commercially available’; but for all apparatus, respecting its intended use requires knowledge of the expected environment.

**Managing Fixed Installations**

Infrastructure controllers will need to appreciate the implications, enact policy and ensure its implementation. In the case of new build the ‘responsible person’ will be the Prime Contractor, who will oversee and co-ordinate
all collaborators/suppliers, and collate EMC installation and approvals documentation. After commissioning and handover, the infrastructure controller will become the responsible person who will arrange to hold all the EMC documentation. It is therefore necessary for the Controller and Contractor to agree on the required documentation and on a strategy for achieving it.

This documentation will be ‘living’ documentation; as upgrades occur information will be added.

For existing build the new EMC Directive is not retrospective. So the EMC documentation will be built up over time by upgrade project documentation, plus any extant data/documentation.

So the questions remaining are:
- Will there be enforcement?
- Are there benefits?

Enforcement seems unlikely, since Competent Authorities have shown little appetite to enforce the EMC requirements for products. This latter should actually be easier under the new requirement for TD retention as authorities can demand to see the TD not just a DoC.

There are benefits. The FI requirements lend weight to the need for a structured approach to EMC encompassing: safety aspects, interoperability and EMC Directive conformance.

THE EMF DIRECTIVE

Directive 2004/40/EC is concerned with the exposure of workers to harmful electromagnetic fields. The Directive implements the ICNIRP guidelines [7]. The guidelines provide critical analysis of many studies: both biological, based on laboratory studies of humans and animals; and epidemiological, based on reported rates of illnesses and death for groups exposed to various levels and frequencies of EMFs. Based on this analysis, threshold exposure levels are provided, which protect against known adverse health effects.

The implementation of the EMF directive is currently delayed until 2012 because the current requirements cannot be met for medical staff and radiologists using MRI (and similar) machines. Further research into the health effects of the low frequency fields of concern should resolve this issue by 2012.

Whilst the directive is delayed this does not mean that organisations can ignore EMFs, since under existing Health and Safety legislation workers can legitimately challenge employers regarding the levels of EM fields to which they are exposed.

The ICNIRP Guidelines

The guidelines provide protection against “known adverse health effects” on nervous system functions, excessive tissue heating and whole body heat stress. Exposures to EMFs are limited for both occupational populations and the general public. Two sets of levels were formulated.

“Basic restrictions” were placed in various frequency ranges, on current density, specific energy absorption rate (SAR) and power density. A safety margin, reflecting the uncertainty in the threshold levels, the variability in the working population (both in terms of effect and in level of absorption), the effects of severe environments and of high activity levels was used to formulate the basic restrictions.

A further margin was applied to arrive at levels appropriate to protect the general public, to account for greater frailty of the very young, very old and the infirm. The basic restrictions on current density (covering frequencies up to 10 MHz) are shown in Figure 1. The restrictions on SAR (from 10 MHz to 10 GHz) and on power density (from 10 GHz to 300 GHz) are not discussed in this paper.

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Requirements of the EMF Directive

The directive requires that employers ensure their workers are protected from exposures exceeding the basic restrictions. This can be most straightforwardly achieved by meeting the reference levels.

Employees must be informed about the outcome and measures required where risk from exposures exists in the workplace. Employers must take all necessary steps to ensure that employees are not exposed to fields above the basic restrictions. Employers in most sectors will be able to carry out just a simple, asset-based assessment; however, where environments are known to present risks (as is the case with electricity distribution), measurements are likely to be required.

Field strength surveys (E field or B field or both, depending on the impedance and power of the field source) can be taken in conjunction with any EMC measurements, at locations frequented by employees. If necessary, areas can be zoned into those safe for the general public, those safe for employees, and those only safe with protective equipment. If zoning is employed, clear signage is required, together with appropriate barriers.

The need for regular surveys will be based on the acquisition of new assets, any change in use of assets, and on the need to periodically review significant risks.

HOW DO WE ADDRESS THESE ISSUES?

Firstly whilst the EMCD FI documentation requirement is not retrospective, the EMFD will apply to all workplaces, both new and existing. So how can we bring these two requirements under control?

In outline, we need to characterise the EM fields or other EM disturbances within the boundaries of a FI e.g. Power/sub-station Station. Analysis will enable zoning by measured field levels, both in terms of health risks, and for the required immunity of new apparatus.

This gives us two results:

- we will have identified any health risks under 2004/40/EC
- we have identified zoned EM environments for the procurement of apparatus.

In the latter case if we can match these EM environments to relevant EMC standards - we now have standards against which equipment can be procured.

Also if we are using ‘commercial off the shelf equipment’ we can identify for a given environment whether EMC mitigation techniques need to be employed in their installation. These can then be documented as part of our FI ‘good engineering practices’.

By implementing an EMC management plan, as part of the ‘good engineering practices’ then the issues of large installed systems and apparatus otherwise not commercially available can be handled.

REFERENCES


Acknowledgments

The authors greatfully acknowledge the permission of York EMC Services Ltd, University of York to publish this paper.