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THE CE MARKING OF ACOUSTIC INSTRUMENTATION

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1. INTRODUCTION

On the 1st January 1996, the European Union Directive number 89/336/EEC "on the approximation of the laws of the Member States to electromagnetic compatibility" became compulsory. In practice this means that all electronic equipment manufactured on or after this date must be tested in accordance with the Directive and , when complying with the Directive, be marked with the CE mark before it can legally be offered for sale anywhere within the European Union. Any product not complying cannot legally be offered for sale and can be refused import to any EU country.

This Directive applies irrespective of the manufacturing origin of the product, and has caused considerable concern amongst almost all electronic equipment manufacturers wishing to sell in Europe. The word "approximation" in the original title is well placed, because, at the time of writing, many of the Standards relating to Electromagnetic Compatibility are still being prepared, revised, and in many cases have yet to be written, so what is the position with regards to electro-acoustic instrumentation and what does it mean for the supplier and the user?

2. ELECTROMAGNETIC COMPATIBILITY REQUIREMENTS

The Directive has many sections, but in general these fall into 3 categories.

First, the instrumentation must not emit more than certain permitted levels of electromagnetic radiation, to avoid causing interference to other electronic equipment, often referred to as the Emissions from the instrument.

Second, the instrument must not alter its performance beyond defined characteristics when in the presence of standardized electromagnetic fields, often referred to as the Immunity of the instrument.

Third, the instrument must survive, in a defined manner, discharges of static voltages of standardized magnitudes onto any part of the unit.

Many Standards now exist within International Electrotechnical Commission (IEC), CENELEC and other related bodies that attempt to define the exact requirements, but many more are still in preparation. Given that the law is now in force, what does this mean? For most of the equipment normally encountered in the acoustic measurement field, the Standards EN 50081 (1) and EN 50082 (2), both of which come in 2 parts, give the generic, or basic, requirements, whilst the IEC 1000 series (3), which is currently in 56 parts and still growing, give more specific requirements and tests. The EN standards are divided in two parts depending on the expected location of the instrument. This may be either Residential, Commercial and Light Industry, or Industrial. The requirements for the two types of location are similar but significant differences do exist in the severity of the testing.

2.1 Emissions

This requirement is probably the best defined at present. It basically requires the airborne radiation from the instrument to be measured at a fixed distance and shall not be more than a certain field strength. As an example, for equipment containing microprocessors in a Residential environment, the Frequency range that must be measured is from 30 - 1000 MHz at a distance of 10m, and the permitted field strengths are 30 dB(μV/m) up to 230 MHz and 37 dB(μV/m) at all higher frequencies considered. If the instrument is powered by a mains supply, then additional tests are performed on the emissions found on the power cable to ensure that interference is not transmitted to the supply, and typically cover the frequency range 0 - 30 MHz with a variety of limits. If the instrument can be fitted with any external cables, or connected to another piece of apparatus that in itself is not CE marked, then the tests must be carried out with all these cables and assemblies connected. In theory a separate test should be made for each configuration, but evidence supporting similarity between systems reduces the amount of testing required.

2.2 Immunity

This subject is undoubtedly the most problematic at present. The generic standards only define the electromagnetic environments into which the instrument is to be placed. They do not say what should happen to it! This is supposed to be the province of Product Standards, the vast majority of which do not exist yet. For most of the commonly encountered Electroacoustical instruments such as Sound Level Meters, Calibrators etc. there are no Product Standards in existence, although some are in preparation by a new Working Group within TC29 of the IEC, formally established in October 1995 and of which the author is a member. In order to satisfy the CE marking criteria today, manufacturers must define their own criteria for passing or failing this test at present and there is no legal requirement to divulge these criteria unless specifically asked to do so! It could be argued that unscrupulous sources could define a very simple-to-pass test and qualify for the CE mark on an instrument that perhaps produces huge errors whilst others struggle to eliminate any effect from their instrument. Only a defined set of tests for the given product will close this loophole.

The type and frequency range of these tests is diverse, and are specified in EN 50082. Broadly speaking, the instrument is subjected to a radiated field of 3V/m or 10 V/m over the range 80 - 1000 MHz, cabling and power supply cords to frequencies from 0.15 - 80 MHz, and a test for all at 50 Hz. In addition, for mains powered equipment, a variety of voltage surges, dips, fast transients and interruptions are induced on the supply for the instrument to withstand in some fashion. Although by no means easy to ensure immunity to all these fields, criticism has been levelled at the radiated field strength for being too low. The ANSI Committee looking into the same effects in the USA has drawn a parallel with their Standard on permissible exposure of Humans to electromagnetic fields and has suggested that all instruments used by humans should withstand the same levels. in similar terms to EN 50082, this would give field strengths of 63V/m! Very few test sites are able to generate this size of field at present.

2.3 Electrostatic Discharge.

This test comes in two parts. Static discharges are made directly in contact with any exposed surface of the instrument usually up to + and - 4 kVolts, and attempts are made to discharge in the air to any point up to + and - 8 kVolts. Three grades of performance are available in the generic standards, ranging from no effect at all to stopping the instrument working, but after the tests it must be capable of being restored to full working order by use of its controls and it must not lose or corrupt any stored data. Unlike the tests for Emissions and Immunity, this test is carried out with no cables connected, so that any sockets are exposed, but the contact discharge is not expected to be actually pushed into any of the sockets.

3. ACOUSTIC INSTRUMENT PRODUCT STANDARDS

As stated in 2.2, there are no Product Standards for most types of Acoustic Instrumentation at present. In order to attempt to standardize the testing performance limits for most well known product types, Addenda are being written for each of the Instrument Standards to define acceptable performance.

To date, there has been little time for the Working Group to meet and formulate from available test data limits that could be deemed reasonable, but almost every manufacturer in the field appears to have experienced significant problems in defining and passing tests that give correlation to the tolerances of measurement accuracy defined for the instrument type.

As an example, a draft text for Sound Level Meters complying with IEC 651 has been written in which it is proposed that all meters shall be tested in a sound field of 74 dB. At any frequency, the reading on the meter when exposed to the electromagnetic field shall be the same as that when no e.m. field is present within +/- 0.5 dB for Type 0 and 1 meters, and within +/- 1.5 dB for Type 2 and 3 meters.

Manufacturers may test to lower levels than 74 dB and claim superior immunity if all readings from 74 dB down to the claimed level are within these tolerances. It remains to be seen whether this will find general agreement, but is at least a step towards a level playing field for users to be able to compare performance of different manufacturer's offerings. As soon as the Product Standard is published, it takes precedance over any other EMC Standard, so compliance should become uniform soon after publication.

4. CE MARK CERTIFYING OF INSTRUMENTS.

There are two basic means of complying with the CE marking requirements. These are usually referred to as the Technical Construction File and the Standards Route often known as Self Certification.

For the first route, the designer and manufacturer must define every parameter of the instrument, specify its construction down to every item, and then submit the file to an appointed Competent Body for approval that all aspects of EMC are covered. Competent Bodies are established by each Country in the EU as test laboratories with sufficient expertise in EMC that they are allowed to certify the Technical Construction File as acceptable.

A probability factor is usually allowed, and this is around 85%, which in practice means that on any random sample of the product leaving a manufacturer's premises, there is an 85% probability that the unit meets the EMC requirements in full. Note that the actual product does not necessarily have to be tested to comply with this method, although often test results will be included to support the claims.

For the Standards route, the manufacturer will compile a file of relevant information on the product identifying which Standards are being claimed and will identify a responsible person authorised to make the declaration of conformance with these Standards. In most cases, this is supported by test results from an approved EMC testing laboratory that show that a sample of the product has been subjected to all tests relevant to the claimed Standards and that the defined tolerances and peformance complied with those Standards.

Note that this laboratory does not actually certify the product by this route; the certification is made by the manufacturer or his appointed representative.

Failure to comply with the CE marking regulations has a variety of effects, depending in which country the offence occurs. If the product is being imported , Customs Officers can refuse entry. Any customer is at liberty to refuse delivery of unmarked product, and various local officials may get involved. Declarations of Conformity may be challenged by anyone with reasonable grounds for so doing. In the UK, Trading Standards Officers will be responsible for ascertaining whether or not the Declaration of Conformance is valid or not. A false declaration, or evidence showing that the product does not conform can lead in most countries to a fine, but in the UK a conviction with up to 3 months jail sentence is also possible. A Prohibition of Sale notice may be issued and these may be published Europe-wide.

The costs and timescales for ensuring compliance are not insignificant. Test laboratories in the UK are charging in the region of £750 per day and most products take several days to fully test in all aspects. Each product must have its own test results in all permutations offered to the marketplace. On top of this are the manufacturer's paperwork and record keeping aspects and this assumes that the product sails through the tests first time. Where the self certification and test method is used, which seems to be the majority route for existing design products, it is not uncommon for several visits to the test laboratory before products are redesigned to fully comply.This will probably reduce as design engineers become more familiar with the requirements of EMC and new designs with EMC in mind start to appear.

5. WHAT DOES THE CE MARK MEAN TO THE USER ?

At this point in time, it is impossible to give a precise answer to this. It should mean that all products carrying a CE mark have known limits of emissions and therefore the risk of interference between two items of electronic equipment may have been reduced and is certainly of a uniform standard.

It should mean that electrostatic discharges do not cause irreparable harm, but that is highly likely to have been the case before these regulations were enforced anyway. It guarantees nothing for the immunity of a product unless there is a Product Standard in force, which hopefully will happen fairly soon for electroacoustic instrumentation. When implemented, it will ensure that all instruments meet a certain base level of performance, and the evidence is that this will improve significantly the immunity of the instrument in question if the evidence of the alterations to designs that have been made by most manufacturers recently is significant. It is likely to have an impact on the cost of producing the item, which may or may not get passed on to the purchaser, but will influence new designs which may carry additional costs to ensure compliance.

It can only be speculated upon as to whether this additional immunity is actually needed by the user, as the author is not aware of any significant number of complaints about existing designs, even though many of these are being found wanting in some areas of recent EMC testing.

The manufacturer does not have a choice but to comply by some means with the legislation. The user has no choice but to have CE marked products. The consequence of this appears to be that many instruments on sale at the end of 1995 have disappeared from the catalogues in January 1996. It has proved expensive or difficult to gain compliance for many designs and products.

Many old established items and products nearing the end of their marketable life have not proved worthwhile to get certified. This may well result in customer frustration at being unable to reorder a product of which they already have some units, but appears unavoidable. (Of course the old product, non-compliant, can continue to be used for as long as it is still servicable).

6. CONCLUSIONS

It is a little difficult at the present time to get very enthusiastic about the benefits of the CE marking for EMC purposes of electroacoustical instrumentation. Until the Product Standards are introduced and complied with by all manufacturers, there is no easy way for the user to ascertain the advantages of one product offering over another, and it may well be that for the purposes to which most instruments are put, the status quo of today is adequate.

However, as time progresses, the uniformity of all apparatus to meet the same objectives, and the increasing use of electronics in all aspects of daily life, mean that the improvements that will result in the future will be of benefit to all, and the ability to recognise superior performance will be available.

The clock had to be started somewhere, as older equipment already in use will be around for many years to come. This has now happened, and it will be interesting to see what effects it has on other types of electronic equipment. For the acoustician, the work in hand should ensure a guaranteed standard for the future.

7. REFERENCES

(1) EN 50081-1:1992 & EN 50081-2:1993. European Standard - Electromagnetic compatibility - Generic emission standard.

(2) EN 50082-1:1992 & EN 50082-2:1995. European Standard - Electromagnetic compatibility - Generic immunity standard.

(3) IEC 1000. A series of standards from the International Electrotechnical Commission on all aspects of EMC. For full listing consult latest Standards Bodies.