

TGN 34 on Modes of operation for EMC testing.**EUANB Technical Guidance Note 34 on Modes of operation for EMC Testing.****1. Summary**

The EMC testing industry is mature but test labs are simply not always testing products as per the requirements of standards. The standards not always take due account of modern human-machine interfaces, leaving variations in the way products can and should be tested. This EUANB TGN is prepared to help Notified Bodies when confronted with issues related to modes of operation for EMC testing.

It provides the background on the issues and concludes that if a manufacturer wants to ensure that their product will function in an acceptable way in the 'real world' all modes of the product should be assessed during the validation stage of the products design.

EMC is an emotive issue and has the ability of destroying a product brand if non-compliance is observed. The increased powers of market surveillance authorities will mean that comprehensive EMC testing is a cheaper alternative to a product recall or withdrawal of the product from the market. The TGN highlights the responsibilities of EMC test labs when requiring NB's to perform an Technical File assessment on a product.

2. Background

CE Marking is an essential aspect of market entry for products onto the EU market and EMC testing is an integral part of this in all but a small number of categories of products. Prior to CE marking manufacturers were required to comply with a variety of National regulations in each Member State thus increasing the time to market, incurring increased costs and logistical issues in organising a multitude of assessments in each country.

Consequently CE marking was mandated across the whole of the EU to create a level playing field for manufacturers such that they can compete equally and to increase the health and safety of products on the EU market.

Although EMC is a requirement for virtually all products, it has nothing to do with health and safety since it only relates to the functionality of the product and hence is a quality issue. Safety issues relating to electromagnetic phenomena are covered by the corresponding safety directives (Low Voltage Directive, Machinery Directive, Medical Devices Directive etc.).

2.1 Requirements of the EMC Directive 2014/30/EU

For the avoidance of doubt the EMC Directive requires that

Equipment shall be so designed and manufactured, having regard to the state of the art, as to ensure that:

a) the electromagnetic disturbance generated does not exceed the level above which radio and telecommunications equipment or other equipment cannot operate as intended;

b) it has a level of immunity to the electromagnetic disturbance to be expected in its intended use which allows it to operate without unacceptable degradation of its intended use.

A manufacturer typically achieves this objective by their products compliance with harmonised standards. The legal framework is not specific on how products should be tested – it is simply a requirement that they should work in their electromagnetic environment. This means that due consideration should be made to harmonised standards and any other phenomena that are known to be present in the environment in which the product will be used.

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Most products are not always EMC tested properly, and we do not seem to have a big EMC problem, so does it matter?

Well actually it does, as indicated above it is a legal requirement that those placing these products on the market in Europe construct and maintain a Technical File that demonstrates how and why their product meets the relevant Directives one of which is EMC and this specifically defines the essential requirements as defined in 2.1 above.

The standards that support legislative approval (i.e. CE marking) provide sufficient detail and guidance for the user of the standard to adequately understand how the product should be tested to fully meet the requirements of the standard. However, as products become more complex and have, in some cases, many modes of operation, the cost of testing in all these modes can become a significant burden.

With the exception of a few manufacturers, EMC testing is performed by 3rd party test houses and their test results are part of the Technical File. These companies operate in a competitive environment and seek to provide the best value for their customers by having keen pricing, a high quality service and access to multiple approval requirements from a single test center (i.e. use of MRA's etc.).

From a customer (manufacturers) perspective, cost is a big driver for the decision of where testing is performed. Due to the complex nature of the test standards, it is easy to overlook some test modes and hence the subsequent cost from one test house varies dramatically to another (each additional mode is a multiplier of the test cost).

This TGN therefore seeks to raise the issue of modes of operation for the purposes of EMC testing and draws the attention of Notified Bodies and highlights what is un/acceptable.

3.1 The role of Test Laboratories

If the EMC Test Laboratories are going to continue to provide a service to the designers, importers and manufacturers of electrical and electronic products and not be the scapegoat if a product ever causes trouble or fails in service due to its EMC environment then we need to make a much better attempt at persuading the customers to part with the essential information needed to properly test their product at the time a quotation is prepared, and to convince them that more detailed exercising and monitoring of their product is required during the tests so as to properly demonstrate the essential requirements detailed above.

Now we must accept that the EMC Directive is NOT a Safety Directive and relates only to protecting the users from purchasing product that is fit for purpose, not ensuring any aspect of safety, there are other Directives covering those issues.

Many of our EMC tests can be performed in and around the test laboratory where the test personnel can operate buttons, switches, touchscreens, and controls during the tests as necessary to demonstrate the requirements are achieved, however the conducted and radiated RF tests need to be performed within a shielded room, either to protect the airwaves from unintentional transmission across the spectrum or to provide an environment allowing a uniform field to be established in which to place the product under test. How then do we operate these same controls within this environment? Depending on the test levels it may be harmful to the engineer to venture inside and besides safety his pillar of salt would disrupt the carefully established field as would anything else that we could automate unless it is built out of a non RF invasive material.

With the advances in technology over the last ten years this problem is simply getting worse with multi-function products controlled from touch controls and none of the standards giving any guidance on how these tests can be performed. For example few failures occur in very narrow bands of operation and essential functions could be properly exercised and monitored at a number of spot frequencies where the dwell time at the individual frequencies could be extended long enough to make meaningful confirmations of the functions.

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We have to do something, if we are to test every function at every frequency exposing every cable and every face of the product to the RF source it could take weeks and costs would simply rocket.

Test labs must make it clear in reports exactly what has and has not been tested and why, and the customers of EMC test services must work more closely with the test laboratories in establishing what is really needed to properly test the product.

4. Modes of Operation

As indicated previously, the point of EMC testing is to simulate the electromagnetic environment in the 'real world' before a product is launched onto the market and find that unexpected events happen or even it doesn't work at all.

The test standards have been carefully written by a mixture of experts in the field of EMC and also by industry groups who know what is to be expected from a given product – i.e. perhaps it would be acceptable for a remote controlled toy to suffer from a loss of function during a lightning storm however if the product was monitoring the critical signs of a patient, it would not be.

It is the manufacturer that determines what modes of operation a product should be tested in – a test organisation can only provide guidance based on what the standards require. If of course the modes proposed deviate so far from the requirements of the standard, the deviations would be such that testing is no longer against the standard but some generic requirement.

As an example, a multimedia PC may be tested to the product specific standards for such a device (EN55022/24 or EN 55032/35). These standards provide clear guidance on the modes of operation. In this case, the following modes may be identified:-

- Display function
- Networking functions
- Audio output function
- Data processing and storage functions

Some of these functions may be able to be monitored simultaneously (i.e. playing a DVD which provides an audio and video output) however there are 4 distinct modes that should be assessed. If the product is equipped with wireless functionality (i.e. Bluetooth, WiFi etc), these additional features should be assessed additionally.

As highlighted above, the decision process of modes of operation is a detailed exercise which requires a joint effort between the test engineer and manufacturer. Getting the modes of operation wrong could lead to functions of the product not working properly when in the hands of the end-user. The consequences of this can be extreme since the product would not comply with the legal requirements (i.e. the EMC Directive) which could result in complete withdrawal of the product from the market and a recall of units sold. Additionally the reputation of the company can be shattered since consumers will associate the brand as one of poor quality.

Under these circumstances the manufacturer will want to know how they got into this position and seek to claim possible compensation from the experts who tested their product and provide the guidance on what and how to test.

5. Resolution to the Issues

In order to protect the EMC Test industry from possible criticism, it is important that best advice is always given. Consequently this means that records of discussions regarding modes of operation and the subsequent decisions need to be kept. If the deviations proposed to the standard are so great that it is no longer in the spirit of the standard, the manufacturer should be advised of such matters.

Quotations and offers of test work should always be prepared based on following the letter of the standard – if a manufacturer does want to follow this proposal, these decisions should be documented and clearly noted in subsequent test reports (i.e. statements along the lines of 'the product was only tested in the following modes at the request of the manufacturer...')

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In order to aid the above, the following aspects should be considered at point of enquiry and act as a guidance tool for discussions on modes of operation:-

1. Identify the most appropriate standard, noting there may be more than one that applies
2. Read the standard and follow the guidance on modes of operation
3. Discuss if any modes of operation can be combined to reduce the overall test time
4. Ensure that adequate support equipment is available to support the various modes of operation including artificial loads, jigs and exercising equipment
5. Record the thought processes and decisions made
6. Highlight the deviations on quotations and subsequent test reports if necessary

6. Conclusions

EMC is a complex phenomenon and testing is the only way to understand if it has been achieved or not. It is a quality issue and is so important that it would quickly rubbish the brand of the product if not adequately addressed before the product is launched.

Testing in multiple modes of operation is an expensive exercise however is a much cheaper alternative to a product recall and brand damage.

Due consideration should be given to the requirements of the standards and the manufacturers understanding of how/where the product will be used to mitigate the risks of interference.

Test labs have a duty of care to highlight these issues to their customers and engage better on the modes of operation required for test.

Disclaimer

This guidance document does not replace the text of the EMC Directive and is for guidance only. In legal disputes the text of the Directive, or its implementation in National legislation, takes precedence.