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Using Procedural Technical Files for compliance with the EMC Directive

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Using "Procedural" Technical Files for compliance with the EMC Directive

For manufacturers who do not want to do a great deal of EMC testing

(*Note:* manufacturers of one-off and custom equipment intended for use in a specified 'Fixed Installation' (as defined in the EMCD) can use an alternative approach, read: https://www.emcstandards.co.uk/files/2004_108_and_fixed_installations.pdf)

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This article was written in 1997 and there is now (in 2018) no legal requirement to involve a Competent Body. See the last page for updates in 2003, 2010, and 2018.

The Technical Construction File (TCF) route to EMC compliance is available for everyone except those who make radiocommunication transmitting products. (By the way – TCFs for EMC are not the same as the Technical Files required by the Machinery and LVD directive, because TCFs need a certificate or report from an EMC Competent Body.) Engineering companies (rather than those manufacturing mass-produced electronic products) often find the TCF route to be better than the self-certification to standards route, as it can reduce EMC testing costs.

Where products are very large, or only come together on the customer's premises, it may be impossible to test to harmonised standards anyway, in which case the TCF route may be the only one possible for EMC compliance.

One type of TCF that can be very powerful indeed is the "Procedural" TCF. This relies on the Competent Body assessing how a manufacturer designs, constructs, and tests his products, and allows a manufacturer to include a number of different products in a single TCF and a single Declaration of Conformity, even if those products have not yet been designed!

For example, the TCF or Declaration of Conformity might state that it applies to: "All goods manufactured by the XYZ Co. Ltd. after 1st July 2003 and following their EMC procedure: XYZ-123". (1st July 2003 in this example being the date at which their EMC procedure became accepted by the Competent Body and came under the control of their BS EN ISO 9001 QA system.)

The Procedural TCF can be very valuable for the custom engineering company, for example in machinery or robotics manufacture, or industrial and process instrumentation and control. I have seen examples of Procedural TCFs for such companies, but with a little imagination the principles they embody might be able to be very widely applied.

Custom machinery manufacturers do not usually know what features their next design will have, or what form it will take. Many manufacturers of "standard" machines also provide a range of variants and options, and often a variable amount of customisation too, with the result that many of their machines could be classed as custom.

Modern machines generally use PLCs or computers with LCD or VDU displays, employ variable speed DC or AC motors and drives or use electronic control of pneumatics and/or hydraulics, and also contain relays, contactors, power supplies, instrumentation and control (such as temperature controllers). Touch screens are often used, as are communications such as RS485 or Ethernet for other systems such as SCADA.

Taking the example of a custom machinery manufacturer: he will generally stick with a small range of electronic and electrical "components" – those he is familiar with, likes the performance and price of, and knows how to program and install. He will also tend to use a small range of cabinets and enclosures and have reasonably consistent ways of assembling and installing them.

Some test laboratories and Competent Bodies insist that custom or modified machines are fully tested for EMC, on-site if necessary, but this is usually overkill. The key point is that although the machines produced by a manufacturer may perform different jobs, they generally share common electrical and electronic technology, enclosures, and assembly methods, and so have similar EMC characteristics. This is what makes the "Procedural" TCF approach possible.

For our example custom machinery manufacturer, a typical "Procedural" TCF will involve some or all of the following:

1. A procedure for specifying the electromagnetic environment and the acceptable performance degradations during interference events. These specifications may vary from one job to another. Many industrial environments do not seem to correspond to the relevant generic standard for immunity, so it is worthwhile agreeing these details with the customer at the contract stage. Salespeople can't be expected to be EMC experts, so a multiple-choice form is usually written for them to fill in with the customer.

2. Limiting design to a list of bought-in equipment and sub-assemblies. Design will generally be limited to a listed range of items that the manufacturer wishes to standardise on, typically the cabinets and "components" used in the EMC tested example machine, or ones that are known to have essentially the same EMC performance (usually from the same suppliers). The use of the "RSS" technique to add up emissions, as I described in an EMJ article in October 1997, could do away with the need for this list.

3. Control of the "EMC quality" when purchasing equipment and sub-assemblies. Sorry, but merely checking that things have CE marks is not an adequate purchasing procedure for this. “EMC quality” can usually be assessed by looking at supplier documentation and QA procedures. Rarely, it might require some EMC testing too, see my article: “CE + CE Does Not Equal CE”.

4. Control of internal assembly methods and wiring techniques. This will involve the use of proven good EMC practices in assembly (which follow appropriate IEC and other guidance).

5. Some in-house EMC testing capability. This is not essential, but can allow the manufacturer more freedom to vary his machines within the scope of his TCF, especially if his Competent Body approves his testing methods and skills. The same EMC test personnel can also test systems after installation, to satisfy customers that the final system or installation is EMC compliant.

6. Control of installation methods. This will involve the use of proven good EMC practices in installation (which follow appropriate IEC and other guidance).

7. Control of commissioning methods. A good way to avoid extensive immunity testing for large systems and installations can sometimes be to perform "ambient threat testing" when the machine is running properly, to see if there is anything in its environment that can upset it (hitting the emergency stop on the associated conveyor belt, having the operator and the security staff lean on the control panel whilst using their walkie-talkies and cellphones, switching lights on and off, etc).

8. Instructions for installation, commissioning, and use. Manuals will be provided that describe how the machine is to be installed, covering location, earthing, cable and connector types, cable trays and routes, cable segregation, etc, pointing out that deviation from these instructions will negate EMC compliance. User instructions will also be needed (e.g. no use of walkie-talkie within 6 feet). x Quality control procedures. These will ensure that all the above is done properly, and that any necessary deviations (e.g. a new and untested type of PLC demanded by a customer) are discussed with the Competent Body, who may require additional testing of some sort.

9. A successful EMC test on an example product. This will preferably be done on a large and complicated equipment or machine with the greatest number and power of computers, PLCs, and motor drives, which has been designed and built fully in accordance with these procedures. The testing can take a variety of forms, using any test limits and levels, as long as it is agreed with the Competent Body, and checks that all the EMC procedures are being applied correctly. If the manufacturer has his own EMC

test gear and has been "approved" by the CB he should be able to do some/all of it himself and save cost.

10. Sample testing. Every now and again another EMC test should be done, on a representative or worst-case product, to check that no "compliance drift" is going on. The Competent Body will help determine a suitable period between samples, and may well want to see the results each time, but this will not cost as much as having a new TCF assessed. If the manufacturer has his own EMC test gear and has been "approved" by the CB he should be able to do some/all of it himself and save cost.

Obviously, using a Procedural TCF requires that the company develops sufficient EMC expertise, and this will cost money and take time. Having an ISO 9001 QC system already in place would be a big help, though is not essential.

However, Procedural TCFs cost a whole lot less overall than the usual alternative for custom engineers of EMC testing and/or creating a TCF for each new design of equipment or machine!

Also, because Procedural TCFs are based upon the use of good EMC practices in design, construction, and installation, the resulting products will generally suffer fewer delays in assembly, testing, installation, and commissioning. They will enjoy improved reliability. All of these are valuable improvements in their own right. To save time and cost always involve your chosen Competent Body right from the start of any TCF, which ideally means right from the start of the design of the product(s) to be covered by it.

Note 1: Update 2003

The above is an update of an article first published in the EMC Compliance Journal in February 1997. The EMC Compliance Journal's website is at: http://www.compliance-club.com.

Note 2: Update 2010, for 2004/108/EC

This article was first written in 1998 and updated in 2003. Now the old EMC directive has been replaced by its 2nd Edition, 2004/108/EC, which has replaced Competent Bodies with Notified Bodies (usually the same companies!) and replaced TCFs with Technical Documentation Files (TDFs) that have to be created for every product, not just those that didn't have all relevant tests applied.

Where all relevant EMC tests are not applied in full, the requirements for the TDF are exactly the same as they were for a TCF, but under 2004/108/EC there is now no requirement to have them assessed by a Competent Body, now renamed Notified Bodies. Notified Bodies can be asked to assess a TDF, or just a part of one, but they are not legally required to.

So the "Procedural TCF" approach is still equally valid under 2004/108/EC (although perhaps we should now call it the "Procedural TDF" approach) – but of course there is now no need to satisfy a Competent Body that you have done it correctly, before placing your CE marked products on the EU market.

However, if you don't have dedicated EMC personnel in-house, who are experienced with creating TCFs for products that have not had all the relevant test standards applied in full and getting them approved by Competent Bodies, I recommend that you employ some, or get some existing personnel trained up to do this.

You don't want to be selling non-EMC-compliant products that will have customers complaining and increase warranty returns. This is the real financial issue with the EMC Directive – it's not the threat of fines or product recalls, its really all about not upsetting customers.

Note 3: Update 2018, for 2014/30/EU

The same compliance procedure will work, but would need to be integrated with the 'EMC Compliance Risk Assessment' now required by 2014/30/EU.

The Procedural TDF approach would also need to be acceptable to Agents and Distributors in the supply chain, who are now required to only handle products/equipment that they know to be compliant, and can be legally liable if they do not.

Both of these issues are covered in “The new EMC, LVD and Radio Directives which came into force in 2016” which is available from https://www.emcstandards.co.uk/complying-with-the-emc-directive1