

Another EMC resource from EMC Standards

The IET's new Guide on EMC for Functional Safety

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Keith Armstrong explains the ramifications of this latest publication

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This new Guide (180 pages, August 2008) replaces the IEE's 2000 Guide and is available for free download from: www.theiet.org/factfiles/emc/index.cfm, and as and as a reasonably-priced (£27) colour-printed-book from www.emcacademy.org/books.asp.

The continuing increases in electronic complexity, and the continuing shrinking of the feature sizes in silicon integrated circuits, has made the normal testing-based approach to EMC inadequate where safety is concerned. So the new discipline of "EMC for Functional Safety" has recently been developed to help maintain tolerable levels of safety risks.

To demonstrate that the design of a product, system or installation will be safe enough despite the reasonably foreseeable EM disturbances that could occur during its lifecycle, we must now use *Risk Management* methods as described by the new Edition 2 of IEC TS 61000-1-2* (due to be published before the end of 2008).

The IET's new Guide is a detailed and practical application of IEC TS 61000-1-2 Ed.2, which is written in the language of IEC 61508 (the IEC's basic standard on Functional Safety) so that it can be used as 61508's "missing EMC Annex".

But other functional safety standards such as ISO 14971 (medical) or the draft ISO 26262 (automotive) use different 'languages' to describe the same basic principles – so the IET's Guide has been written to be *universally applicable*, regardless of which Functional Safety standard (or none) is applied.

The figure on the next page shows the nine basic steps employed by the Guide, which includes checklists to aid project management, design and compliance assessment.

Many EMC and safety engineers still think that as long as the normal immunity tests are passed, that is all that is needed where safety risks are concerned. Some go further and apply the normal tests with an increased higher level, which they often (confusingly) say provides a "safety margin". But relying on such EMC testing alone is much too simplistic for modern electronic control systems, because it ignores most of the EM interference issues that can influence safety risks.

This same 'untestability' problem has already been faced by the safety-related software industry, which adopted risk management procedures and developed the necessary design, verification and validation techniques (including *some* testing) during the 1990s. Now we are seeing a similar development in the new discipline of "EMC for Functional Safety", and the IET's new Guide provides detailed and practical assistance.

Manufacturers and system integrators who apply this Guide should benefit from lower financial risks, because improved immunity to EMI should significantly reduce the number of warranty returns/repairs and product liability lawsuits. And because the Guide's procedures require the use of EMC expertise from project start, instead of the usual approach (design/assemble with little attention to EMC, then fiddle around until the EMC tests are passed) this will also help manufacturers get to market more quickly with lower overall manufacturing costs. So, real financial savings can generally be expected when this Guide is correctly applied.

* IEC TS 61000-1-2 Ed.2 "EMC – Part 1-2: General – Methodology for the achievement of functional safety of electrical and electronic systems including equipment with regard to electromagnetic phenomena"

Overview of the EMC for Functional Safety process for a 'Simple' EFS

An EFS is any entity employing electrical and/or electronic technologies that provides one or more functions having a direct impact on safety

EFS Design

To maintain the EM/safety performance of the EFS over its anticipated lifecycle, its EM/physical design and mitigation measures musttake account of the lifecycle physical phenomena (mechanical, climatic, biological, chemical, etc.)

Overall EM safety planning

Determine who is in overall charge, aims of the project, boundaries of the EFS, budgets, timescales, and the personnel and their responsibilities and authorities. Set up activities that manage all the following steps.

1 Determine intersystem EM and physical phenomena

Determine the worst-case EM/physical external environment(s) that the EFS could reasonably foreseeably be exposed to (including emissions from other equipment or systems), over its anticipated lifecycle.

Also determine effects of emissions on other EFS.

2 Determine intrasystem EM and physical phenomena

Determine the worst-case EM/physical en vironment(s) that parts of the EFS could reasonably foreseeably be exposed to due to other parts of the sameEFS over its anticipated lifecycle

3 Specify EM/physical phenomena vs functional performance

Perform hazard identification and risk assessment that takes EMI into account; create a specification for the EFS for each worst-case inter/intrasystem EM phenomenon, that also specifies relevant physical environment phenomena, over the anticipated lifecycle of the EFS

4 Study and design the EFS

Including EM/safety design techniques and EM/physical mitigation for the EFS as a whole, and/orto standard products incorporated within it, plus EFS user instructions, to meet the Step 3 EM/physical/performance specification over the anticipated lifecycle of the EFS.

5 Create EM and physical verification/validation plans

Create verification and validation plans for the EFS
—and for any EM/physical mitigation measures not
incorporated within it—to verify design elements as
design and realisation progress, and to validate the
EFS at its highest practical level of assembly
against its Step 3 specification.

Volume-manufactured standard products' EM and physical specifications

EM/physical/functional performance specifications offered by suppliers of standard volume-manufactured products, for equipment, modules, sub-assemblies, components, software, etc.

Includes standard products supplied by the designer or creator of the EFS

EFS creation

6 Select the volume-manufactured standard products to be used

So that their EM/physical/performance specifications plus the EM/safety design from Step 4 meets the EM/physical/performance specifications for the EFS from Step 3.

The required EM/physical specifications should be in the products' purchasing contracts. CE marking should not be taken as evidence of EM performance. Design iteration may be required (e.g. additional mitigation), if it is desired to use certain products

7 Assemble/install/commission and verify the EFS

Employ QC to ensure that no problems are caused by errors, or by poor quality, materials; goods; services; workmanship, etc. Follow the Step 5 verification plans to verify the EM and physical performance of the EFS—and any measures not incorporated within it.

8 Validate the EFS

Following the Step 5 validation plans, validate that the EM and physical performance of the EFS—and any EM and physical mitigation measures not incorporated within it—meet their Step 3 specifications.

EFS operation, decommissioning, disposal

9 Maintain the EM/physical/performance characteristics of the EFS over its lifecycle

Including operation, maintenance, repair, refurbishment, upgrade, modification, decommissioning, disposal, etc.