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IEEE Standard for Techniques and Measurement to Manage Functional Safety and Other Risks with Regards to Electromagnetic Disturbances

IEEE Electromagnetic Compatibility Society

Developed by the
Standards Development and Education Committee

IEEE Std 1848™-2020

IEEE

IEEE Standard for Techniques and Measures to Manage Functional Safety and Other Risks with Regard to Electromagnetic Disturbances

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Standards Development and Education Committee
of the
IEEE Electromagnetic Compatibility Society

Approved 4 June 2020

IEEE SA Standards Board

Abstract: A set of practical methods is provided for helping to manage the levels of risks due to electromagnetic (EM) disturbances throughout the lifecycles of electronic equipment. These risks include the consequences of all types of errors, malfunctions, or failures in products, equipment, and systems that employ modern electronic technologies (i.e., in hardware and/or software).

The work done in creating IEC 61000-1-2:2016 (Electromagnetic compatibility (EMC) - Part 1-2: General - Methodology is supplemented by this standard for the achievement of functional safety of electrical and electronic systems including equipment with regard to electromagnetic phenomena) by providing requirements for detailed practical techniques and measures for helping to manage risks (not just functional safety) that could be caused by EM disturbances.

These techniques and measures would be used in the management, specification, design, implementation, verification and validation, and through-life operation, maintenance, repair, refurbishment, upgrading, and eventual dismantling for disposal of equipment and systems employing digital electronic systems, for both hardware and software (firmware).

Keywords: digital systems, electromagnetic interference, EMI, electromagnetic compatibility, EMC, electromagnetic disturbances, functional safety, IEEE 1848™, risk management, risk reduction

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PDF: ISBN 978-1-5044-6750-6 STD24215
Print: ISBN 978-1-5044-6751-3 STDPD24215

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Introduction

This introduction is not part of IEEE Std 1848-2020, IEEE Standard for Techniques and Measures to Manage Functional Safety and Other Risks with Regard to Electromagnetic Disturbances.

This IEEE Standard provides guidance on the assessment and application of techniques and measures that can help reduce the risks associated with the interfering effects of electromagnetic disturbances on digital electronic systems, especially safety- or mission-related systems.

When competently selected and applied, a set of such techniques and measures can provide the part of the evidence relevant to EMI required for justifying functional safety decisions and for compliance with functional safety standards (including all applicable parts of IEC 61508 Ed.2:2010 or functional safety standards that are based on IEC 61508).[1]

The scope of this standard does not cover human health effects caused by electromagnetic fields (EMF); HERF (Hazards of Electromagnetic Radiation to Fuel); or HERO (Hazards of Electromagnetic Radiation to Ordnance).

Beneficial comments (recommendations, additions, deletions) and any pertinent data that may be of use in improving this document should be addressed to IEEE, EMC Society, Standards Development and Education Committee, and P1848 Working Group.

A committee consisting of representatives of academia, government, and industry prepared this document under the IEEE EMC Society Standards Development and Education Committee.

[1] Information on references can be found in Clause 2.

Contents

IEEE Standard for Techniques and Measures to Manage Functional Safety and Other Risks with Regard to Electromagnetic Disturbances

1. Overview

This IEEE Standard provides guidance on the assessment and application of techniques and measures that can reduce the risks associated with the interfering effects of electromagnetic disturbances on digital electronic systems, especially safety- or mission-related systems.

When competently selected and applied, a set of such techniques and measures can provide the part of the evidence relevant to EMI required for justifying functional safety decisions and for compliance with functional safety standards (including all applicable parts of IEC 61508 Ed.2:2010 or functional safety standards that are based on IEC 61508; see the partial list in Annex C).

They can also provide part of the evidence relevant to EMI for medical/healthcare systems for which risks are managed in accordance with ISO 14971:2007 [B11].[2]

This standard supports the adoption of adequate electromagnetic resilience engineering practices throughout the functional safety lifecycle by offering further guidance and practical advice on the application of risk management activities, including the techniques and measures set out in IEC 61000-1-2:2016.

While it is primarily intended to be used by those who have responsibilities for functional safety, the methodologies, techniques, and measures it describes can also be used for the reduction of other kinds of risks in any systems that employ electronic technology, such as security risks and non–safety-related risks (for example, risks to the operation of commercial IT systems). However, this standard does not address the risks to human health that can be caused by electromagnetic fields (EMF); HERF (Hazards of Electromagnetic Radiation to Fuel); or HERO (Hazards of Electromagnetic Radiation to Ordnance).

[2] The numbers in brackets correspond to those of the bibliography in Annex B.

1.1 Scope

This standard provides a set of practical methods for managing functional safety and other risks due to electromagnetic (EM) disturbances throughout the life of a product.

This includes all types of errors, malfunctions or failures in products, equipment, and systems that employ modern digital technologies (i.e., hardware and software).

1.2 Purpose

The purpose of this standard is to provide requirements for the techniques and measures used in the design, verification, and validation of systems, hardware, and software (firmware).

These would be applied where EM disturbances could cause errors, malfunctions, or failures leading to unacceptable risks over the lifetime of equipment, whether safety or any other kind of risk is to be managed.

1.3 How to use this standard

This standard requires a structured justification of adequate electromagnetic resilience of a system to be individually provided for each safety function in that system, following the approach taken by the IEC's Basic Standard on Functional Safety, IEC 61508.

Clause 4 describes the use of this standard in detail, and the required structured justification for each of a system's safety functions is achieved by completing the cells in the right-hand-most column of the checklist in Clause 5 plus providing all the documents referenced in those cells.

In general, it is expected that most systems requiring safety risk management will have several safety functions, each one of which will be associated with its own, completed, Clause 5 checklist. In some circumstances, two or more different safety functions may be able to be addressed by a single Clause 5 checklist.

IEC 61508 provides a well-proven process for assessing functional safety-related risks and by how much they need reduction (its SILs 1-4), and then it prescribes the well-proven techniques and measures that shall or should be employed to reducing those risks to the extent required. Unfortunately, neither it nor its 'daughter' standards (see the partial list in Annex C) contains a complete set of techniques and measures suitable for reducing the functional safety risks due to EM disturbances to the extent required.

This standard relies on IEC 61508's hazard analysis and risk assessment process having been completed as part of the overall risk management of functional safety for a system, and merely adds the missing techniques and measures necessary for fully controlling the functional safety risks that could be affected by EM disturbances.

1.4 The relationship between this IEEE Standard and IET 2017 [B8]

These two documents are closely related. Because the risk management of EM disturbances is such a new field, a conscious effort was made by the IEEE's working group to keep the texts of the two documents identical as far as possible.