Operation Guideline

EDM-O-100
Life-cycle Profiling of Electronics
V1.0
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The Operation Guidelines

The Operation Guidelines intend to provide guidelines related to the operation, use, health monitoring, maintenance, repair of stand-alone or end-product integrated electronics.

- The recommendations given in the guidelines are intended to support the user in the management of the operation of electronics and products with integrated electronics.
- The Operation guidelines promote the use of scientific methods such as physical modeling leading to, e.g. reliability physics-based health monitoring and predictive maintenance. Scientific methods extend the capability of predicting the product's properties and operational behavior beyond experience.

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1. Applicable Documents

This Product Life Cycle Management Guideline refers the most recent version of the following documents:

EDM-D-005	Rigid PCB Build-up and Density Classification
EDM-D-008	Technology and Manufacturing Capability Mapping of PBA Designs
EDM-D-012	Mechanical Integration
EDM-D-014	Design-for-Robustness of Electronics
EDM-D-100	Reliability Quantification
EDM-P-200	Predictive Product Life Cycle Management of Electronics
EDM-P-202	New Product Introduction for Electronics
ETS 300 019 series	Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment.
IEC 60721 series	Classification of Environmental Conditions
ISO 16750 series	Road vehicles – Environmental conditions and testing for electrical and electronic equipment
ISO/IEC/IEEE 24748-1	Systems and software engineering – Life cycle management – Part 1: Guidelines for life cycle management

2. Applicability of the Operation Guideline EDM-O-100

- EDM-O-100 provides guidelines to create a comprehensive, unambiguous characterization of the external environment and operational loads that stand-alone or embedded electronics is subjected to during its lifetime. This is called Life-Cycle Profiling or Mission Profiling of electronics.
- Life-cycle profiling provides essential input to Design-for-Reliability and Design-for-Robustness of a new product that must ensure the products reliable operation during its lifetime under the envisaged conditions of storage, transport and operation.
- Life-cycle profiling provides the basis for user instructions that put limits to the range of operational conditions the user can operate the system in, without losing product warranty. An example of such limits are the maximum or minimum environmental temperatures in which the product is intended to operate in.
- Life-cycle profiling provides the basis for a cost-effective maintenance program.
- This guideline describes a method to establish the life-cycle profile of a specific Printed Board Assembly (PBA) in a specific application and/or embedded in a specific product.
- The method to aggregate PBA life-cycle profiles into a multi-application PBA design specification with respect to environmental load and life-cycle requirements is beyond the scope of this guideline.

3. Electronics in systems

3.1. System architecture, configuration and context

3.1.1. This guideline describes how to specify the life-cycle profile of an individual PBA inside an electronic module in a larger system that resides or operates in a time-variable context. For this purpose, the **architecture, configuration and context** of the system in which the electronic module is embedded needs to be defined and described.

3.1.2. The highest hierarchical level 1 of the system is the **End-Product**.

3.1.3. The **System Architecture** describes the build-up of the **System-of-Interest** consisting of **system elements** – which by themselves may be systems - down to the level of the individual PBA, which is the system-element-of-interest in this guideline, see ISO/IEC/IEEE 24748-1, section 4.2 System concepts.

3.1.4. Printed Board Assemblies (PBAs) are the basic electronic building blocks of electronic modules and systems. It is situated at the lowest hierarchical level *M*+1 of the End-Product architecture description relevant for the PBA life-cycle analysis.

3.1.5. A system at a specific system hierarchical level *m* may reside and operate in an open or enclosed local environment together with other systems. This configuration including the definition of the configuration's boundary and its interfacing with its external environment, is called the **System (Level *m*) Configuration**.

3.1.6. The **System (Level *m*) Context** includes the environmental conditions within the **System** (**level *m*) configuration** boundaries. These internal environmental conditions are created by contributions by the systems in the configuration at level *m* as well as the interaction of the System Level *m* Configuration with its external context(s), see Fig. 1.

3.1.7. If parts of the system reside in different enclosures, a system architecture at level *m* may encompass multiple sub-system contexts at level *m*+1, each with its specific sub-system configuration and local environmental conditions, see Fig. 1. An example of such an architecture is a car which has separated and enclosed engine, passenger and luggage compartments.

3.1.8. The End-Product system structure at the highest hierarchical level is identical to that of Fig. 1 with one of the interacting context's potentially being the **outdoor environment**, see Fig. 2. This outdoor environment may also interact and influence the environmental conditions in other external context's that interact with the End-Product.

3.1.9. At the lowest hierarchical level *M*+1 the system-element-of-interest PBA is found. This PBA will typically be part – alone or together with other PBA – of an open or enclosed electronic module containing a single PBA context, see Fig. 3.

3.1.10. The complexity of the system architecture and context description is limited when the number of hierarchical levels is limited. In many cases one or two hierarchical levels will be sufficient to describe the system down to the level of the PBA.

3.1.11. If the context of the PBA or the electronic module in which it resides is sufficiently isolated from its external environment, or these contexts can be described in such a way that the interaction with higher level contexts is irrelevant, only the PBA and/or electronic module level context and architecture needs to be considered.