# IEC TS 62239-2

Edition 1.0 2017-02

# TECHNICAL SPECIFICATION

## Process management for avionics – Management plan – Part 2: Preparation and maintenance of an electronic COTS assembly management plan

IEC TS 62239-2:2017-02(en)

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

**About the IEC**

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

**About IEC publications**

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

**IEC Catalogue - webstore.iec.ch/catalogue**

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

**IEC publications search - www.iec.ch/searchpub**

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,…). It also gives information on projects, replaced and withdrawn publications.

**IEC Just Published - webstore.iec.ch/justpublished**

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

**Electropedia - www.electropedia.org**

The world's leading online dictionary of electronic and electrical terms containing 20 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

**IEC Glossary - std.iec.ch/glossary**

65 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

**IEC Customer Service Centre - webstore.iec.ch/csc**

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

# IEC TS 62239-2

Edition 1.0 2017-02

# TECHNICAL SPECIFICATION

## Process management for avionics – Management plan – Part 2: Preparation and maintenance of an electronic COTS assembly management plan

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 03.100.50; 31.020; 49.060

ISBN 978-2-8322-3905-6

# CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

# PROCESS MANAGEMENT FOR AVIONICS – MANAGEMENT PLAN –

## Part 2: Preparation and maintenance of an electronic COTS assembly management plan

## FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

The main task of IEC technical committees is to prepare International Standards. In exceptional circumstances, a technical committee may propose the publication of a technical specification when

- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC TS 62239-2, which is a technical specification, has been prepared by IEC Technical Committee 107: Process management for avionics.

The text of this technical specification is based on the following documents:

| Enquiry draft | Report on voting |
|---|---|
| 107/288/DTS | 107/293/RVDTS |

Full information on the voting for the approval of this technical specification can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 62239 series, published under the general title *Process management for avionics – Management plan*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

# INTRODUCTION

The purpose of this document is to define the requirements for developing an electronic commercial off the shelf (COTS) assembly management plan (CAMP), hereinafter also called the plan, to assure customers that all of the electronic COTS assemblies in the equipment of the plan owner are selected and applied in controlled processes, and that the technical requirements detailed in this document are accomplished. In general the owners of an electronic COTS assembly management plan are original (electronic) equipment manufacturers (OEMs) and system integrators for the aerospace, defence and high performance (ADHP) electronics industry.

The objective is to define and document, as necessary, processes to assure the adequacy of electronic COTS assemblies selected for use in electronic systems. This document states objectives to be accomplished; it does not specify how tasks are performed, specific data collected or reports issued. Those who prepare plans in compliance with this document are encouraged to document processes that are the most effective and efficient for them in accomplishing the objectives of this document. In order to allow flexibility in implementing and updating the documented processes, plan authors are encouraged to refer to their own internal process documents instead of including detailed process documentation within their plans.

Organizations that prepare such plans are called the plan owners and may prepare a single plan, and use it for all relevant products supplied by the organization, or may prepare a separate plan for each relevant product or customer.

# PROCESS MANAGEMENT FOR AVIONICS – MANAGEMENT PLAN –

## Part 2: Preparation and maintenance of an electronic COTS assembly management plan

## 1 Scope

This part of IEC 62239, which is a technical specification, applies to the development of COTS assembly management plans (CAMPs) for the integration and management of electronic COTS assemblies (see 3.1.13 and 3.1.20) in electronic systems used in the ADHP markets where reliability is generally critical.

NOTE 1 Best practices for managing the electronic components within the electronic assemblies are described in IEC TS 62239-1 and SAE EIA-STD-4899 which describe the electronic component management program (ECMP). In cases where the electronic components can be identified and managed at the component level, ECMP can be considered as an option to manage the components.

NOTE 2 The distinction between an electronic component and an electronic assembly is provided by the definitions in Clause 3. This distinction between an electronic component and an electronic assembly is not always recognized by industry: for example, filters, contactors, power supply modules, relays, magnetic assemblies, etc., can be considered as either components or assemblies. In each application it is considered a best practice for the user of this document to clarify this distinction.

Depending on program or product line requirements and/or the technical characteristics of the electronic COTS assemblies and in agreement with the customer, the electronic COTS assembly management plans (CAMPs) could consider tailoring the requirements of this document. See Annex A.

Although developed for the avionics industry, this document can be applied by other high performance and high reliability industries at their discretion.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

There are no normative references in this document.

## 3 Terms, definitions and abbreviated terms

For the purposes of this document, the following terms, definitions and abbreviated terms apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

## 3.1 Terms and definitions

**3.1.1**
**analysis**
utilization of data, reference materials, actions, or test results previously obtained that can be utilized for comparison to verify that a requirement, a characteristic, a parameter or a criteria has been met

Note 1 to entry: Test results and associated data can be part of the analysis.

**3.1.2**
**assembly characterization**
process of testing and/or analysis of assembly capability when configuration control of the assembly's internal details is inadequate to support traditional qualification

Note 1 to entry MIL-STD-1521 provides information on qualification purposes.

**3.1.3**
**assembly manufacturer**
organization responsible for the assembly specification and its production

**3.1.4**
**assembly obsolescence management**
range of management and engineering actions taken to avoid or resolve the effects of assemblies not being procurable due to the manufacturer(s) ceasing production

**3.1.5**
**assembly qualification**
process used to demonstrate that the assembly is capable of meeting specified requirements for all required conditions and environments

Note 1 to entry: This may include qualification beyond the assembly manufacturer’s limits for the assembly.

**3.1.6**
**assembly quality assurance**
all activities and processes providing adequate confidence that each individual assembly meets specified requirements

**3.1.7**
**assurance**
result of planned and systematic actions necessary to provide adequate confidence and evidence that a product or process satisfies given requirements

**3.1.8**
**component**
**piece part**
electrical, optical, electro/optical-mechanical or electronic device that is not subject to disassembly without destruction or impairment of design use

Note 1 to entry: Resistors, capacitors, diodes, integrated circuits, hybrids, busbars, circuit cards/modules, printers, laptop computers, disk drives, application specific integrated circuits, wound components and relays, etc. are examples of component.

**3.1.9**
**configuration**
performance, functional, and physical attributes of an existing or planned product or a combination of products

Note 1 to entry: Generally each variation of a product leads to a configuration change.

**3.1.10**
**configuration change management**
**configuration control**
systematic process which ensures that changes to released configuration documentation are properly identified, documented, evaluated for effect, approved by an appropriate level of authority, incorporated and verified

Note 1 to entry: Generally configuration management activity concerns systematic proposal, justification, evaluation, coordination, and disposition of proposed changes, and implementation of all approved and released changes into

- applicable configurations of a product,
- associated product information, and
- supporting and interfacing products and their associated product information.

**3.1.11**
**configuration documentation**
technical information whose purpose is to identify and define a product's performance functional and physical attributes (for example specifications, drawings)

**3.1.12**
**configuration verification**
action verifying that the product has achieved its required attributes (for example performance requirements, functional constraints) and the product's design is accurately documented

**3.1.13**
**COTS product**
**commercial off-the-shelf product**
one or more components, assembled and developed for multiple commercial consumers, whose design and/or configuration is controlled by the manufacturer's specification or industry standard

Note 1 to entry: COTS products can include electronic components, subassemblies or assemblies, or top level assemblies. Electronic COTS subassemblies or assemblies include circuit card assemblies, power supplies, hard drives, and memory modules. Top-level COTS assemblies include a fully integrated rack of equipment such as raid arrays, file servers to individual switches, routers, personal computers, or similar equipment.

[SOURCE: IEC TS 62668-1:2016, 3.1.3]

**3.1.14**
**COTS assembly management plan**
**CAMP**
document that defines the processes and practices for integrating and managing assemblies in an equipment or system

Note 1 to entry: Generally, it addresses all relevant aspects of managing assemblies during system design, development, production, and post-production support.

**3.1.15**
**COTS assembly manufacturer**
organization responsible for the specification and the production of the COTS assembly

Note 1 to entry: Generally the COTS assembly manufacturer controls the design and the configuration (even if subcontracted), but it is not a rule in this market segment which is not fully dedicated to avionics, and the COTS assembly manufacturer ensures generally also the sale of the product to the commercial market.

**3.1.16**
**dependability**
measure of consistency in meeting reliability, availability and obsolescence expectations, using logistical support methods

**3.1.17**
**derating**
design method which increases the operational margins of items by imposing modified item usage limitations which are more restrictive than the usual or manufacturer's item operational ratings

**3.1.18**
**design process**
process of creating an item, equipment or system from a set of requirements

Note 1 to entry: In general, the design process follows a set of sub-processes such as requirements capture, conceptual design, detailed design, implementation and production transition. Functional and physical verification, as well as qualification, can be part of the design process which may be called in some organizations "development process".

**3.1.19**
**durability analysis**
structured analysis of the assembly's response to the stresses resulting from operation, maintenance, shipping, storage, and other activities throughout its specified life in order to estimate its expected life

**3.1.20**
**electronic assembly**
electrical or electronic device that is not subject to disassembly without destruction or impairment of design use

EXAMPLE Electronic circuit cards or modules, displays, storage devices, printers, laptop computer, electro/optical devices, etc.

**3.1.21**
**electronic equipment**
functioning electronic device produced by the plan owner, which incorporates electronic components

Note 1 to entry: End items, sub-assemblies, line-replaceable units and shop-replaceable units are examples of electronic equipment.

[SOURCE: IEC TS 62239-1:2015, 3.1.20]

**3.1.22**
**failure**
inability of an item to perform a required function within specified limits

Note 1 to entry: A failure may be produced when a fault is encountered.

**3.1.23**
**form**
shape, size, dimensions, and other physically measurable parameters that uniquely characterize a product

**3.1.24**
**franchised distributor or agent**
individual or corporate organization that is legally independent from the franchiser (in this case the electronic component manufacturer or OCM) and agrees under contract to distribute products using the franchiser's name and sales network

Note 1 to entry: Distribution activities are carried out in accordance with standards set and controlled by the franchiser. Shipments against orders placed can be despatched either direct from the OCM or the franchised distributor or agent. In other words, the franchised distributor enters into contractual agreements with one or more electronic component manufacturers to distribute and sell the said components. Distribution agreements may be stipulated according to the following criteria: geographical area, type of clientele (avionics for example), maximum manufacturing lot size. Components sourced through this route are protected by the OCM's warranty and supplied with full traceability.

[SOURCE: IEC TS 62668-1:2016, 3.1.9]

**3.1.25**
**function**
action or actions that a product is designed to perform

**3.1.26**
**guidance**
advice or counselling for complying with requirements

**3.1.27**
**hardware**
products made of material and their components (mechanical, electrical, electronic, optical, hydraulic, pneumatic)

Note 1 to entry: Computer software and technical documentation are excluded.

**3.1.28**
**implementation**
action of generating a physical reality from a specification

**3.1.29**
**integrity**
state where the performance, technical characteristics, accuracy and consistency of an item are maintained and assured over its entire life cycle

Note 1 to entry: Integrity applies to item like electronic components, electronic circuit cards, equipment, systems, data, etc., and is a critical aspect to their design, implementation and usage conditions.

Note 2 to entry: Environmental conditions can affect physical, electrical and functional performances, for example electromechanical faults, electromagnetic compatibility (EMC) perturbation (for example emission, immunity), design flaws, material fatigue, corrosion, power outages, natural radiation disturbance, etc.

**3.1.30**
**life cycle**
generic period of time relating to the entire period of conception, definition, build, distribution, operation, and disposal of a product

**3.1.31**
**open system architecture**
collection of interacting assemblies that has the following attributes as required to satisfy stated needs such as:

- scalable,
- evolvable,
- robust (for example with regard to environmental constraints (thermal, vibrations, etc.)),
- controlled coupling among system elements,
- guaranteed timing and real time execution,
- graceful degradation,
- information assurance and protection,
- systems of systems interoperability,
- technology independence and obsolescence mitigation

Note 1 to entry: The interface specifications of assemblies are generally fully defined, available to the public and maintained according to group consensus.

**3.1.32**
**plan owner**
**COTS assembly integrator**
original design authority responsible for all aspects of the design, functionality and reliability of the delivered equipment in the intended application and responsible for writing and maintaining their specific CAMP

Note 1 to entry: The plan owner, or COTS assembly integrator, typically integrates the electronic COTS assembly into the ADHP electronic system and is the owner of the COTS assembly management plan (CAMP).

**3.1.33**
**reliability**
probability that an item will perform its intended function for a specified interval under stated conditions

**3.1.34**
**requirements**
specified essential attributes

**3.1.35**
**risk**
measure of the potential inability to achieve overall program objectives within defined cost, schedule, and technical constraints

[SOURCE: IEC TS 62239-1:2015, 3.1.28]

**3.1.36**
**risk management**
act or practice of dealing with risk that includes planning for risk, assessing (identifying and analysing) risk areas, developing risk handling options, monitoring risks to determine how risks have changed, and documenting the overall risk management program

[SOURCE: IEC TS 62239-1:2015, 3.1.29]

**3.1.37**
**safety**
state in which risk is lower than the boundary risk

Note 1 to entry: The boundary risk is the upper limit of the acceptable risk. It is specific for a technical process or state. The risk is defined by the rate or probability or occurrence and the expected damage or injury.

**3.1.38**
**safety analysis**
disciplined approach to identifying hazards and their causes, and to assessing their risks

**3.1.39**
**similarity analysis**
structured comparison of the elements of the assembly being assessed with those of predecessor assemblies for which test or in-service reliability data are available

**3.1.40**
**single event effect**
**SEE**
response of a component caused by the impact of a single particle (for example galactic cosmic rays, solar energetic particles, energetic neutrons and protons)

Note 1 to entry: The range of responses can include both non-destructive (for example upset) and destructive (for example latch-up or gate rupture) phenomena.

[SOURCE: IEC 62396-1:2016, 3.53]

**3.1.41**
**specification**
document that explicitly states essential technical attributes and/or requirements for a product

Note 1 to entry: A specification can include procedures to determine that the product's performance meets its requirements or attributes.

**3.1.42**
**subcontractor**
person or entity to which the holder of obligations under a contract has delegated part or all of such obligations

[SOURCE: IEC TS 62239-1:2015, 3.1.32]

**3.1.43**
**substitute assembly**
assembly used as a replacement in equipment or system after the equipment or system design has been approved

Note 1 to entry: In some contexts, the term "alternate assembly" is used to describe a substitute assembly that is "equal to or better than" the original assembly.

**3.1.44**
**system safety assessment**
**SSA**
ongoing systematic, comprehensive evaluation of the proposed system to show that relevant safety requirements are satisfied

**3.1.45**
**test**
verification actions, assessment and/or trials conducted and specific data obtained, analyzed, corrected eventually to standard conditions, and compared to acceptance criteria to verify performance requirements

Note 1 to entry: Test can apply to functional or environmental (for example thermal, vibrations, etc.) verification.

Note 2 to entry: Where "test" is the designated verification method, it is understood that some degree of analysis is inherent in the verification process and need not be so identified.

**3.1.46**
**testability**
ability to test an item sufficiently to guarantee that all possible states of the item perform to its specification

Note 1 to entry: This includes the ease with which an item can be tested to provide evidence of compliance with its requirements.

**3.1.47**
**traceability**
ability to have for an electronic component its full trace back to the original component manufacturer

Note 1 to entry: This traceability means that every supplier in the supply chain is prepared to legally declare in writing that they know and can identify their source of supply, which goes back to the original manufacturer and can confirm that the electronic components are brand new and were handled with appropriate ESD and MSL handling precautions. This authenticates that the electronic components being supplied are unused, brand new components with no ESD, MSL or other damage. This ensures that the electronic components are protected by any manufacturer's warranties, have all of their useful life remaining and function according to the manufacturer's published datasheet, exhibiting the expected component life in the application for the OEM's reliability predictions and product warranty.

[SOURCE: IEC TS 62668-1:2016, 3.1.22]

**3.1.48**
**useful life**
period of time from delivery of a product to the usage activity until its identity is destroyed by classifying it as salvage

Note 1 to entry: Sometimes “useful life” is referred to as “life cycle”.

**3.1.49**
**validation**
method of qualifying components at the plan owner, when no in-service data from prior use is available and there is no manufacturer’s qualification data to analyse

[SOURCE: IEC TS 62239-1: 2015, 3.1.35]

**3.1.50**
**verification**
determination, at each design stage, that the design meets requirements

### 3.2 Abbreviated terms

| | |
|---|---|
| ADHP | aerospace, defence and high performance |
| ARP | Aerospace Recommended Practice |
| ASIC | application-specific integrated circuit |
| BGA | ball grid array |
| BIT | built-in-test |
| BoM | bill of material |
| CAMP | COTS assembly management plan |
| COTS | commercial off-the-shelf |
| DMS | diminishing manufacturing sources |
| DMSMS | diminishing manufacturing sources and material shortages |
| ECMP | electronic components management plan |
| EMC | electromagnetic compatibility |
| EMI | electromagnetic interference |
| EOP | end of production |
| EOS | end of support |
| ESD | electrostatic discharge |
| ESS | environmental stress screening |
| FCA | functional configuration audit |
| FMEA | failure modes and effects analysis |
| FMECA | failure modes, effects and criticality analysis |
| FOD | foreign object debris |
| FPGA | field-programmable gate array |
| GIDEP | Government-Industry Data Exchange Program |
| HAST | highly accelerated stress test |
| IBIT | initiated bit |
| LBO | last buy order |
| LCC | leadless chip carrier |
| LFCP | lead-free control plan |
| LRU | line replaceable unit |

| | |
|---|---|
| LTB | last time buy |
| LTS | last time shipment |
| MCM | multichip module |
| MEMS | micro-electro-mechanical systems |
| MSL | moisture sensitive level |
| MTBF | mean time between failure |
| MTTF | mean time to failure |
| OEM | original equipment manufacturer |
| PCA | physical configuration audit |
| PCB | printed circuit board |
| PCN | product change notice |
| PBIT | performance bit |
| PDN | product discontinuance notification |
| PCA | physical configuration audit |
| PEM | plastic electronic microcircuit |
| RFI | request for information |
| RoHS | Restriction of the use of certain Hazardous Substances (European Union directive) |
| REACh | Registration, Evaluation, Authorisation and Restriction of Chemicals (European Union directive) |
| RTV | room temperature vulcanization |
| SBIT | start-up bit |
| SEE | single event effects |
| SEL | single event latch-up |
| SEU | single event upset |
| SMT | surface mount technology |
| SOW | statement of work |
| $T_j$ | junction temperature (highest operating temperature of semiconductor in an electronic component) |
| TOC | total ownership cost |
| TVS | transient voltage suppressor |
| UAV | unmanned aerial vehicle |

# 4 Technical requirements

## 4.1 General

The plan owner shall have an electronic COTS assembly management plan (CAMP) addressing each requirement of this document, based on its existing quality management system where applicable, to assure customers that electronic COTS assemblies are selected and applied in the plan owner's equipment using controlled processes (see 5.7).

The plan may be specific to one electronic COTS assembly, a range of electronic COTS assemblies or to all electronic COTS assemblies.

The following annexes are informative for guidance and support purposes only:

- Annex A – Template for tailoring the requirements of IEC TS 62239-2;

- Annex B – Cross-reference between IEC TS 62239-2 and SAE EIA-933B;
- Annex C – Electronic COTS assembly design guidelines and COTS assembly manufacturer's risk assessment; Annex C provides risk considerations and guidance on selecting electronic COTS assembly manufacturers and electronic COTS assemblies for supporting the accomplishment of the requirements of Clause 4;
- Annex D – Typical electronic COTS assembly mitigation methods and techniques; Annex D provides typical mitigation methods or techniques that can be considered as necessary by the plan owner according to their application;
- Annex E – Requirements matrix for IEC TS 62239-2.

NOTE 1 The requirements of Clause 4 can be substituted by the requirements of SAE EIA-933B (see Annex B) where applicable, to enable the plan owner to harmonise its plan for both specifications and Annex A for potential tailoring.

NOTE 2 It is appropriate to have a good working relationship with the electronic COTS assembly manufacturer, preferably using non-disclosure agreements or other types of legal instruments in order to facilitate sharing of technical data sufficiently to meet the requirements of Clause 4. Where this is not possible, the plan owner could consider carefully the potential risks (see Annex C) regarding the electronic COTS assembly manufacturer selection and the consideration of the requirement of this document.

NOTE 3 Many electronic manufacturers that would previously have sold custom assemblies into the avionics market are now willing to work with original equipment manufacturers (OEMs) to produce electronics COTS assemblies. Such electronic manufacturers are typically the best type of electronic COTS assembly manufacturer, as they are familiar with avionics requirements, will share data probably more easily and will be more prone to work with the OEMs to comply with the requirements of this document. However, there are many other more commercial electronic COTS assembly manufacturers that only support a few avionics requirements and will present higher risks to the application.

NOTE 4 The plan owner is responsible for the cross-reference matrix identifying the clauses waived when SAE EIA-933B is revised.

## 4.2 COTS assembly selection

### 4.2.1 General

The plan owner should consider the following and use the guidelines of Annex C.

### 4.2.2 Design assurance

The processes documented in the plan shall:

- provide design assurance for all applicable assemblies;
- assure that requirements for each assembly are identified and evaluated against the manufacturer's electronic COTS assembly specification and/or datasheet and any additional relevant data to ensure suitability in the end application;
- assure that if additional performance is required (for example up-screening, uprating, additional parameters defined) then the electronic COTS assembly shall be considered as a specific one and shall be uniquely identified (see 4.3.6 and 4.4.8).The documented process shall assure that these evaluations are documented (see 4.4.10);
- assure that availability and level of obsolescence risk are considered as major assembly selection criteria (see 4.4.14).

NOTE 1 RTCA DO-254 / EUROCAE ED-80 and EASA CM – SWCEH – 001 provide guidance on design assurance for airborne electronic hardware and are relevant practices for meeting the objectives of this document for designing in particular specific components such as ASICs and FPGAs.

NOTE 2 Relevant data can include the electronic COTS assembly manufacturer's request for information (RFI) response, as well as the results of plan owner's analyses, characterization testing, qualification testing, etc.

## 4.3 COTS assembly application

### 4.3.1 General

The following is to be considered by the plan owner:

### 4.3.2 Functionality

The documented processes shall:

- verify that the allocated equipment/system's electrical and functional requirements for each electronic COTS assembly are clearly specified by the plan owner;
- assure that the selected electronic COTS assemblies satisfy the electrical and functional requirements for each application; see 4.3.6 for integrity aspects.

### 4.3.3 COTS assembly compatibility

The processes documented in the plan shall:

- assure the electronic COTS assembly and integration processes are identified and are compatible throughout the equipment/system integration, shipping, handling, storage, test, repair and rework conducted by the plan owner;
- assure that any identified effects on assemblies are addressed.

NOTE Of concern is protection of electronic COTS assemblies from electrostatic discharge (ESD) damage. Relevant sections of BS EN 100015, MIL-HDBK-263, IEC 61340-5-1, and IEC TR 61340-5-2 can aid in controlling ESD damage.

### 4.3.4 Assembly materials

The processes documented in the plan shall assure that the electronic COTS assembly design is assessed against applicable materials' requirements, such as reduction of hazardous, restricted or banned substances (for example RoHS, REACh), foreign object debris (FOD), fungus resistance, and flammability.

For electronic COTS assemblies that are determined to be critical, the electronic COTS assembly should meet the requirements of IEC TS 62647-1 or SAE GEIA-STD-0005-1 for defining a lead-free control plan (LFCP).

NOTE 1 According to the situation a negotiation between the plan owner and the electronic COTS assembly manufacturer can be considered for obtaining all or part of LFCP data.

NOTE 2 IEC 62647 (all parts) provides guidance for dealing with lead-free components and constitutes a relevant practice with regard to lead-free implementation.

### 4.3.5 Heat dissipation and cooling

The documented processes shall verify that each electronic COTS assembly’s heat dissipation and cooling requirements are consistent with the equipment/system specification.

### 4.3.6 Integrity analysis

#### 4.3.6.1 General

The documented processes shall:

- verify that the electronic COTS assembly is consistent with equipment/system integrity requirements (see definition in 3.1.29);
- determine whether the electronic COTS assembly will be used within the environmental, electrical and functional operating conditions and limits specified by the electronic COTS assembly manufacturer and will keep its whole performances (for example electrical, functional).

Integrity assessments may be potentially tailored if agreed with the customer (see Clause 4) otherwise they shall be conducted with sufficient details to understand their use conditions, limitations, and uncertainties for the specific application with additional mitigations as necessary (see Annex C and Annex D for further guidance).

According to the application needs some technical analysis and tests can be conducted to verify and demonstrate use limits; this includes technical analysis and tests in domains like: thermal, mechanical aspects (for example vibrations, shocks...), combined environment durability (fatigue), moisture/corrosion resistance, electrical stress, natural radiation, induced radiation, electromagnetic compatibility (EMC) and other potential environmental and/or electrical domains.

NOTE 1 SAE ARP 5890 provides guidance on durability assessment and is a relevant practice to meet the objectives of this document: Annex C provides information to help the user understand the durability analysis' method of assessment.

NOTE 2 Assembly level moisture/corrosion tests are generally inadequate to verify the moisture/corrosion resistance of components for long life exposure in severe moisture/corrosion environments, due to the difference in failure mechanisms and acceleration factors. EIA SSB-1 provides guidelines for using plastic encapsulated electronic components.

NOTE 3 Temperature cycling exposure typically has an extremely significant effect on how well PEMs perform in moisture/corrosion environments. Testing of PEMs includes generally a full life time of temperature cycling prior to exposure to the moisture/corrosion environment.

NOTE 4 IEC 62396 (all parts) provides guidance on dealing with natural radiation and is a relevant practice.

#### 4.3.6.2 Electronic COTS assembly not used within its specified operating conditions and limits or those not specified

When an electronic COTS assembly is not used within the operating conditions and limits specified by the electronic COTS manufacturer, the plan owner shall:

- document all the instances; see Annex C with regard to potential identification risks;
- document either corrective action or mitigation to bring the planned usage within the specified operating conditions and limits, or document justification showing that all equipment/system requirements will be met while not satisfying each criterion (all the documentation becoming part of the electronic COTS assembly data package).

For those aspects (for example environmental, electrical, functional, etc.) where the electronic COTS assembly manufacturer does not specify operating conditions and limits, the electronic COTS assembly is by definition being used beyond its operating conditions and limits. In such cases the user can characterize the usage operating conditions and limits and their repeatability or can request to, or negotiate with, the electronic COTS assembly manufacturer to make the characterization. In any case the equipment/system integrity and requirements shall be respectively demonstrated and met, and the results recorded into the electronic COTS assembly data package.

Nevertheless, despite the potential dispositions described within the previous paragraph, the use of an electronic COTS assembly outside its specified operating conditions and limits, or if these ones are not specified, is a risk, is discouraged and considered as an exception when no reasonable alternatives are available. Additionally, operation of the electronic COTS assembly beyond the manufacturer’s operating conditions and limits may result normally in loss of warranty by the electronic COTS manufacturer.

NOTE IEC TR 62240-1 can provide guidance on temperature uprating of electronic components.

### 4.3.7 Reliability analysis

The documented processes shall:

- verify that the electronic COTS assembly when integrated into the deliverable equipment/system is managed with relevant mitigations if needed to be consistent with equipment/system reliability requirements;
- ensure that reliability assessments are conducted with sufficient detail to understand their uses, limitations, and uncertainties with potential mitigations as considered necessary for the application, or consider potential tailoring if agreed with the customer (see Annex A).

IEC 62396 (all parts), and IEC 62396-1 in particular, provide guidance on the management of atmospheric radiation SEE effects.

IEC TS 62239-1:2015, 4.6.8, and SAE ARP 6338, provide guidance on semiconductor wear-out and life time effects.

NOTE 1 IEC 60300 (all parts) and SAE ARP 5890 provide guidelines for preparing reliability assessment plans, are relevant practices for meeting the objectives of this document and provide guidelines for the quantification reliability assessment limitations and uncertainties.

NOTE 2 The ANSI/VITA 51 family of standards provides guidance on application of MIL-HDBK-217 as well as the physics of failure analyses and are relevant practices.

### 4.3.8 Useful life

The documented processes shall verify that the electronic COTS assembly useful life is managed using relevant mitigations if needed to be consistent with the equipment/system requirements. The plan owner can potentially consider tailoring if agreed with the customer (see Annex A).

NOTE 1 IEC TS 62239-1:2015, 4.6.8, and SAE ARP 6338 provide guidance on semiconductor wear-out and life time effects which can result in electronic COTS assemblies and can impact both the reliability and operating life in the application.

NOTE 2 The electronic COTS assembly useful life can be less than the equipment/system useful life and can be addressed through mitigations with associated demonstrations.

NOTE 3 Electronic COTS assembly useful life can be assessed through means that can include analysis of electronic COTS assembly manufacturer specifications, datasheet, and/or application notes, experience with similar items, or other methods.

NOTE 4 Negotiation of a realistic useful life requirement with the customer is an essential element of minimizing TOC.

### 4.3.9 Storage life

The documented process shall verify that the electronic COTS assembly storage life is managed using potential mitigations if needed (see Annex D) to be consistent with the equipment/system requirements. The plan owner can potentially consider tailoring if agreed with the customer (see Annex A).

NOTE 1 The electronic COTS manufacturer’s datasheet or documentation provides generally information on storage life conditions.

NOTE 2 IEC 62435-1, IEC 62435-2 and IEC 62435-5 contain information on long term storage.

NOTE 3 SAE GEIA-STD-0003 is under development and contains information on long term storage.

### 4.3.10 Failure modes and effects analysis

The documented process shall include failure modes and effects analysis (FMEA) as part of the design process integrating the electronic COTS assembly when required by the design assurance process. Subclause 4.4, Table 1, and Annex C provide support on selecting electronics COTS assembly manufacturers and electronic COTS assemblies for meeting the requirements of 4.3.11.

NOTE Development efficiency can be enhanced by integrating FMEA with hazard analysis and testability analysis.

### 4.3.11 Maintainability and testability

The documented process shall assure that the electronic COTS assembly, as incorporated in the equipment/system, meets maintainability and testability requirements.

NOTE Emphasis is put on isolation from the faulty modules during equipment/system test. Built-in-test (BIT) can include start-up bit (SBIT), initiated bit (IBIT) and performance bit (PBIT).

#### 4.3.12 Markings

The documented processes shall ensure that the electronic COTS assembly markings meet the requirements for identification, warnings, traceability, etc.

#### 4.3.13 Safety

The documented process shall assure equipment/system environmental, personnel, and equipment/system safety requirements are met.

NOTE 1 MIL-STD-882, along with SAE GEIA-STD-0010, provides guidance on the system safety assessment process and is a relevant practice for meeting the objectives of this document.

NOTE 2 SAE ARP 4761 provides guidelines for the use of reliability assessment results for a safety analysis.

The documented processes shall verify that the electronic COTS assembly does not contain or use materials known to produce toxic gasses when overheated or burned, in sufficient quantity, to compromise the safety or health of personnel associated with the application.

NOTE 3 A suitable method to evaluate toxicity of materials is described in ASTM E1678-15.

#### 4.3.14 Acceptance by the plan owner

The documented process shall define the plan owner's electronic assembly, equipment and system acceptance tests as applicable.

NOTE RTCA DO-254, EUROCAE ED-80 and EASA CM – SWCEH – 001 provide guidance on acceptance test and are relevant practices for meeting the objectives of this document.

### 4.4 Electronic COTS assembly manufacturer selection

#### 4.4.1 General

The plan owner shall conduct a risk assessment of potential electronic COTS assembly manufacturers to determine their suitability in order to meet the requirements of this document.

Annex C may be used to support this risk assessment.

Table 1 shows recommendations depending on the output of this risk assessment.

**Table 1 – Electronic COTS assembly manufacturer selection recommendations**

| Electronic COTS assembly manufacturer | Plan owner's risk classification in the end application | Risk assessment of electronic COTS assembly manufacturer's ability to share product data and meet the requirements of this specification | Suggested recommendation with regard to selection | Comments |
|---|---|---|---|---|
| Example A | High or critical | Poor and not willing to cooperate | Do not select | Select another electronic COTS assembly manufacturer or design the function in-house or redesign to eliminate the non-cooperating electronic COTS assembly or 'tailor' with agreement from the customer. |
| Example B | Low to medium | Poor or not willing | Review the gaps between what the application requires and what the electronic COTS assembly manufacturer offers to determine if the plan owner could risk not mitigating the missing data and not managing the overall risk (see Annex C for guidelines) | The plan owner should put more effort into sharing their product family roadmap to encourage the electronic COTS assembly manufacturer to cooperate better and/or pay for additional testing and mitigations.<br>The plan owner should manage the gaps or 'tailor' with agreement from the customer. |
| Example C | High to critical | Good to average | Review the gaps between what the application requires and what the electronic COTS assembly manufacturer offers to determine if the plan owner could risk not mitigating the missing data and not managing the overall risk using the guidelines of Annex C | The plan owner should put more effort into sharing their product family roadmap to encourage the electronic COTS assembly manufacturer to cooperate better and/or pay for additional testing and mitigations.<br>The plan owner should manage the gaps or 'tailor' with agreement from the customer. |

### 4.4.2 Electronic COTS assembly manufacturer quality system

The plan owner shall verify that the electronic COTS assembly manufacturer has a documented quality management system. Unless otherwise specified by the customer, the quality system should be assessed to an internationally recognised quality management system or equivalent.

NOTE 1 An internationally recognised quality management system can be relevant parts of ISO 9001 or preferably AS/EN/JISQ 9100 or equivalent.

Where the plan owner conducts or enables an assessment or audit on the assembly manufacturing facility, then the assessment or audit should be conducted by suitably trained auditors in accordance with an internationally recognised quality management system.

NOTE 2 AS/EN/JISQ 9100 contains now the requirement for an anti-counterfeit management for all types of electrical and mechanical components and materials and can satisfy the need to consider a strategy for avoiding counterfeit and fraudulent recycled components, see 4.4.6. Some documents such as IEC 62668 (all parts), SAE AS5553 and SAE AS6174 can aid for anti-counterfeit management.

### 4.4.3 Franchised distributor quality system

If the electronic COTS assembly is purchased from a franchised distributor, then the requirements of AS/EN/JISQ 9120 or SAE AS 6496 should apply to the franchised distributor.

### 4.4.4 Electronic COTS assembly derating and stress analysis

The documented process shall:

- determine the derating criteria that the electronic COTS assembly manufacturer used in its design process;
- consider where appropriate the derating criteria and methods if provided by the electronic COTS assembly manufacturer;
- document an appropriate estimate of the derating criteria and methods used by the electronic COTS assembly manufacturer if the electronic COTS assembly manufacturer does not provide this information or if it is not appropriate;
- ensure that this data is used to validate the reliability assessment assumptions.

NOTE SAE GEIA-STD-0008 can aid with derating criteria.

### 4.4.5 Electronic COTS assembly qualification/characterization

The processes documented in the plan shall ensure by whatever means appropriate (for example derating, analysis, testing, and screening) that the electronic COTS assembly is qualified or characterized against the requirements of the equipment/system specification.

NOTE1 Lack of insight into the internal configuration, or lack of control of the internal configuration can preclude “qualification” of the electronic COTS assembly in the traditional sense that supports functional configuration audit (FCA)/physical configuration audit (PCA) as defined in MIL-STD-1521. In that case, “characterization” analysis and/or testing combined with a risk assessment can be substituted for the traditional “qualification”.

NOTE 2 In-service experience with the electronic COTS assembly in question can be used to the extent allowed by the customer’s specification and SOW to meet the requirements of 4.4.5.

NOTE 3 Qualification of similar electronic COTS assemblies can be used to the extent allowed by the customer’s specification and SOW to meet the requirements of 4.4.5.

NOTE 4 SAE ARP 5890 provides guidance on similarity analysis and is a relevant practice to meet the objectives of this document.

NOTE 5 IEC TR 62240-1 provides guidance on uprating of electronic assemblies.

#### 4.4.6 Electronic components used in electronic COTS assembly: Selection/qualification and acceptance

The plan owner shall:

- document and assess the electronic COTS assembly manufacturer's electronic components selection/qualification and acceptance process;
- otherwise provide alternative assurance based on an assessment of the adequacy of the electronic COTS assembly manufacturer's selection/qualification and acceptance effort and description of any additional effort required to assure that the electronic COTS assembly will meet all specified requirements.

The electronic COTS assembly manufacturer should have an electronic component management plan (ECMP) compliant with IEC TS 62239-1 and/or SAE EIA-STD-4899 as this is a best practice for managing electronic components in a global product life cycle. This should include anti-counterfeit mitigations.

NOTE 1 ECMP according to IEC TS 62239-1 and/or SAE–STD-4899 is a relevant practice for high end defence/aerospace COTS assemblies regardless of assembly criticality level.

NOTE 2 Assessment to IEC TS 62239-1 and/or SAE EIA-STD-4899 by an assessment body is a relevant best practice for high end aerospace and defence electronic COTS assemblies regardless of assembly criticality level. A relevant assessment body can be IECQ.

NOTE 3 IEC 62668 (all parts), DFAR 252.246.7007, Defence Standard 05-135, SAE AS5553, SAE AS6174 and AS/EN/JISQ 9100 provide uniform requirements, practices and methods to mitigate the risks of receiving and installing counterfeit electronic components and are relevant practices for high end aerospace and defence electronic COTS assemblies regardless of the assembly criticality level.

#### 4.4.7 Electronic COTS assembly manufacturing and handling

The processes documented in the plan shall verify that the electronic COTS assembly manufacturer has process capability utilizing manufacturing and handling technologies which are repeatable and sufficient to meet equipment/system requirements.

#### 4.4.8 Electronic COTS assembly qualification approval

The processes documented in the plan shall:

- assure that the electronic COTS manufacturer's qualification processes for the electronic COTS assembly are documented and assessed;
- otherwise assure that alternative assurance is provided that the electronic COTS assembly will perform as required in the application specified usage.

#### 4.4.9 Electronic COTS assembly final acceptance

The plan owner shall:

- document and assess the electronic COTS assembly manufacturer's final acceptance process (for example acceptance test procedure);
- otherwise provide alternative assurance that the electronic COTS assembly will perform as required in the application specified usage.

#### 4.4.10 Configuration management and documentation

The process documented in the plan shall:

- include a configuration management process appropriate to the electronic COTS assembly;
- verify that the equipment/system configuration is maintained relative to the electronic COTS assembly usage in the application;

- verify that tools used for design and verification are under configuration control and included with the design control and design changes;
- propose, when the configuration management of the electronic COTS assembly cannot be guaranteed (for example not appropriate, missing in whole or in part), an alternative approach to assure that contract requirements are met and that the electronic COTS assembly will perform as required in the specified application usage.

In the last case, and despite these potential dispositions, the use of the electronic COTS assembly is at risk and is discouraged and considered as an exception when no reasonable alternative is available.

NOTE 1 RTCA DO-254, EUROCAE ED-80, and EASA CM – SWCEH – 001 provide guidance on the configuration management process and are relevant practices.

NOTE 2 SAE EIA-649 provides a national consensus standard for configuration management.

NOTE 3 Guidance on configuration management is also given in ISO 10007.

NOTE 4 The internal configuration control of many electronic COTS assembly militates against the successful completion to qualification, functional configuration audit (FCA) and physical configuration audit (PCA) as defined in MIL-STD-1521.

### 4.4.11 Plan owner documentation

The processes documented in the plan shall ensure that a system exists at the plan owner that collects, stores, provides retrieval, analysis and reporting capability, for all relevant data from the electronic COTS assembly, equipment/system integration and equipment/system use in service, and for keeping the data according to customer or regulatory requirements.

Data should include:

- electronic COTS assembly datasheet and/or specification data (for example electrical / functional / environmental specified conditions of use, input and output parameters, voltage rating, packaging dimensions, availability data, etc.);
- electronic COTS assembly technical and application notes, reliability data, availability information, storage conditions, integration data (for example ESD and MSL sensitivity, etc.);
- electronic COTS assembly bill of materials (for example electronic components list, etc.);
- electronic COTS assembly qualification data (for example electronic COTS assembly manufacturer's qualification test data, manufacturing assembly process validation, environmental tests results, etc.);
- electronic COTS assembly quality assurance data (for example electronic COTS assembly manufacturer's statistical process control data, assembly manufacturer's assembly and/or component screening data, etc.);
- application data (for example functional simulation data, breadboard test data, thermal analysis data, structural analysis data, electromagnetic emission and susceptibility data, assembly screening data collected by the equipment/system manufacturer/integrator or a test house, environmental stress screening (ESS) data from higher-level screening, etc.);
- qualification data collected by the plan owner or a test house, similarity analysis results, assembly in-service data used for qualification;
- electronic COTS assembly characterization data (for example data from testing conducted by the plan owner when assembly internal configuration control is inadequate for qualification);
- manufacturing, assembly and integration data (for example plan owner's statistical process control data at equipment/system manufacturing/integration, ESS data from manufacturing, assembly and integration, and in process and final functional test);
- customer reject data;

- in-service data. The plan owner needs to consider during its risk assessment (see 4.4 and Annex C) the potential impacts of unavailability of some of these data with regard to consistency with the equipment/system requirements.

#### 4.4.12 Electronic COTS assembly manufacturer documentation

The process documented in the plan shall:

- include a process to request electronic COTS assembly data according to 4.4.11 when available from the electronic COTS assembly manufacturers to assure dependability and to facilitate related analyses (for example integrity, reliability);
- identify an adequate engineering link between the electronic COTS assembly user and the electronic COTS assembly manufacturer with access to the related information/process for each electronic COTS assembly type/manufacturer;
- ensure that in the event that the plan owner is unable to document the electronic COTS assembly's configuration in adequate detail to assure dependability then the plan owner shall provide alternate assurance that the assembly will perform as required in the specified application usage, see 4.4.10.

#### 4.4.13 Life cycle management

The documented processes shall ensure that the life cycle objectives are met and activities have been completed as outlined in plans or that deviations have been addressed.

NOTE RTCA DO-254, EUROCAE ED-80 and EASA CM – SWCEH – 001 provide guidance on process assurance and are relevant practices for meeting the objectives of this document.

#### 4.4.14 COTS assembly availability risk management

The documented processes shall:

- ensure that risks associated with availability of the electronic COTS assembly and technology changes are identified, evaluated using appropriate metrics, and that methods to mitigate those risks are identified;
- assure tracking and reporting of the status of risk mitigation efforts when required by customer or business needs;
- document the processes used by the plan owner to resolve obsolete electronic COTS assembly occurrences to assure continued production and support of the equipment/systems in which the electronic COTS assembly is integrated as required, including logistics supportability and life cycle management issues when required by customer or business needs.

NOTE 1 Critical dates in an electronic COTS assembly's life cycle such as product discontinuance notification (PDN), end of production (EOP), last buy order (LBO), last time buy (LTB), last time shipment (LTS) and end of support (EOS) are important for life cycle planning and supportability. Market surveillance of suppliers, such as that outlined in ANSI/VITA 53 and/or use of diminishing manufacturing sources and material shortages (DMSMS) tools that provide life cycle information such as EOS and EOP for electronic COTS electronic assemblies, can be considered by the plan owner as part of the obsolescence management process and are recommended practices for meeting the objectives of this document.

NOTE 2 IEC 62402, SAE STD-0016, and EIA GEB1 include proactive DMSMS mitigation methods applicable for electronic assemblies during system design.

NOTE 3 EIA-724 provides definitions for the purpose of describing the life cycle of electronics.

NOTE 4 Information relative to the electronic COTS assembly, for consideration of metrics, includes: technology risk and maturity, life cycle, level of confidence in manufacturer, predicted obsolescence, sole source assembly, imprecise manufacturer specification of assembly performance (specified as "typical", not specified, etc.), assemblies other than those readily available in large volumes and identified on applicable technology roadmaps.

The plan owner shall document the processes utilized for obsolescence management.

NOTE 5 This includes processes used to manage existing and impending electronic COTS assembly situations that can result in electronic COTS assemblies becoming unavailable.

#### 4.4.15 Equipment/system corrective action and product (electronic COTS assembly) change notices

The plan shall document the process used by the plan owner, or systems in place for:

- data collection and analysis;
- use of factory data, customer reject data, and in-service data if available to improve the equipment/system (for example performance, operating, etc.) in which the electronic COTS assembly is integrated;
- receipt of manufacturer product change notices (PCNs) that affect the electronic COTS assembly and those that are not DMSMS or obsolescence related (for example, a GIDEP or safety alert on the product, manufacturing assembly process change, factory location change, etc.), and evaluation of the potential effects on the equipment/system.

NOTE RTCA DO-254, EUROCAE ED-80, and EASA CM – SWCEH – 001, provide guidance on problem reporting, tracking and corrective action and are relevant practices for meeting the objectives of this document.

#### 4.4.16 Electronic COTS assembly substitution or alternative source

##### 4.4.16.1 Approach for acceptability

Any substitute or alternative source of an electronic COTS assembly shall be form, fit and function alternatives which are identified and documented in the plan owner's equipment/system assembly database. This is to reduce potential risks of electronic COTS assembly procurement or to solve an obsolescence or unavailability problem of the previous source or sources.

##### 4.4.16.2 Customer notifications and approvals

Customer notifications and approvals shall be defined between plan owner and customer, if required. Since the customer notification and approval process is likely to be unique to each customer-supplier (generally the plan owner) relationship, related requirements are beyond the scope of the baseline electronic COTS assembly management process described in this document, and should be documented in the contractual agreements between the plan owner and the customer.

## 5 Plan administration

### 5.1 Plan content and organization

The plan shall be organized in such a manner that each of the requirements of Clause 4 is addressed clearly, concisely and unambiguously.

The plan shall state clearly, concisely, and unambiguously:

- what the plan owner does to accomplish each of the objectives;
- how compliance to the plan is demonstrated;
- that the evidence is available to show that the objectives have been accomplished; and
- where the plan owner obtains electronic COTS assemblies (from the manufacturer itself, or a distributor or other source) and that the relevant requirements of this document also apply to that source.

All the requirements given in Clause 5 apply to deliverable equipment and/or systems as stated in Clause 4. These requirements may be accomplished by either the plan owner including the potential support service under its authority or the electronic COTS assembly manufacturer in whole or in part according to the contract terms. In either case, the plan owner has the responsibility for ensuring all objectives and requirements are met.

NOTE Ground support test equipment, flight demonstrator assemblies, and prototypes are typically exempt from these requirements, unless the plan owner states otherwise in its plan, see Clause 4.

### 5.2 Plan terms, definitions and abbreviated terms

The terms, definitions and abbreviated terms used in the plan shall be those of Clause 3 of this document, unless they are clearly defined otherwise in the plan.

### 5.3 Plan focal point

The plan shall:

- identify an authority or an organization to serve as the primary interface between the plan owner and outside parties (for example customer, electronic COTS manufacturer) in matters pertaining to the plan;
- assure that it is reviewed and updated as necessary.

### 5.4 Plan references

The plan shall include a list of references to all the documents necessary to accomplish the electronic COTS assembly management, including this document, other industry and government documents, and plan owner's internal documents.

### 5.5 Plan applicability

The plan shall document all the electronic COTS assembly types including potential tailoring details agreed with the customer (see Annex A) for the range of equipment and/or systems manufactured and/or integrated by the plan owner to which the plan applies.

NOTE The range of equipment and/or systems is not intended to be a list of part numbers. It can include, for example, the applicable market segment (for example "This plan applies to all equipment manufactured for aerospace applications."). It also can include an affectivity date (for example "This plan applies to all new equipment and/or systems, and to components substituted into existing equipment and/or systems."). The range of equipment and/or systems also can be limited or required by certain contractual agreements.

### 5.6 Plan implementation

The plan owner shall:

- implement and follow the processes documented in the plan, within its range of applicability;
- provide objective evidence that the provisions of this document are met, and that the plan has been implemented.

### 5.7 Plan acceptance

The plan shall be accepted when the plan owner and the customer agree that the plan is acceptable. Certification by an assessment body may be used as evidence that the plan satisfies the requirements of this document.

NOTE A relevant body can be IECQ.

# Annex A
(informative)

## Template for tailoring the requirements of IEC TS 62239-2

Depending on program or product line requirements, the plan owner may, with appropriate justification, amend the objectives of Clause 4 by adding to or deleting them. This can be accomplished by tailoring the requirements.

Annex A provides a tailoring template that can be used in this regard. This method is best when the plan owner is starting new designs for specific customers who interact directly with the plan owner.

Tailoring the requirements can be an option enabling discussion and exchanges between the plan owner and the customer for preparing for example a customer's contract review. In any case the potential tailoring of the requirements shall be concurred upon between plan owner and customer. If this is done, then the plan will be assessed according to the amended list of requirements.

Table A.1 provides a template for tailoring the requirements for IEC TS 62239-2.

**Table A.1 – Template for tailoring requirements of IEC TS 62239-2**

| Requirement no. | Clause / subclause | Requirement description | Tailored requirement | Plan owner sign-off | Customer representative sign-off |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| Additional lines can be added as needed. | | | | | |

# Annex B
(informative)

## Cross-reference between IEC TS 62239-2 and SAE EIA-933B

Table B.1 provides a cross-reference table between IEC TS 62239-2 and SAE EIA-933B that may be used to satisfy the requirements of IEC TS 62239-2.

**Table B.1 – Cross-reference between IEC TS 62239-2 and SAE EIA-933B requirements**

| IEC TS 62239-2:2017 – clause/subclause number | Satisfied by SAE EIA-933B:2015 – clause/subclause number [a] | Comments |
|---|---|---|
| 4 Technical requirements | 3. Technical requirements | |
| 4.1 General | 3. Technical requirements | |
| 4.2 COTS assembly selection | | |
| 4.2.1 General | N/A | |
| 4.2.2 Design assurance | 3.6 Reliability and note of 3.1 Functionality | SAE EIA933 does not address this |
| 4.3 COTS assembly application | N/A | IEC TS 62239-2 heading |
| 4.3.1 General | | |
| 4.3.2 Functionality | 3.1 Functionality | |
| 4.3.3 COTS assembly compatibility | 3.4 Compatibility with System Assembly Process | |
| 4.3.4 Assembly materials | 3.13 Materials | |
| 4.3.5 Heat dissipation and cooling | 3.2.3 Heat dissipation and cooling | |
| 4.3.6 Integrity analysis | 3.1, 3.2, 3.5 | IEC TS 62239-1 requirement covered by many SAE EIA-933B clauses |
| 4.3.8 Useful life | 3.5 Aging | |
| 4.3.9 Storage life | 3.2 Operating, storage and transportation environment stresses | |
| 4.3.10 Failure modes and effects analysis | 3.6 Reliability | |
| 4.3.11 Maintainability and testability | 3.6 Reliability | |
| 4.3.12 Markings | Included in 3.10 configuration control | |
| 4.3.13 Safety | 3.7 Safety | |
| 4.3.14 Acceptance by the plan owner | 4.7 Plan acceptance | |
| 4.4 Electronic COTS assembly manufacturer selection | N/A | IEC TS 62239-2 heading |
| 4.4.1 General | Annex A | |
| 4.4.2 Electronic COTS assembly manufacturer quality system | 3.13 Quality assurance | |
| 4.4.3 Franchised distributor quality system | Not included | |
| 4.4.4 Electronics COTS assembly derating and stress analysis | 3.3 Derating | |
| 4.4.5 Electronics COTS assembly qualification/characterisation | 3.9 Qualification | |

| IEC TS 62239-2:2017 – clause/subclause number | Satisfied by SAE EIA-933B:2015 – clause/subclause number [a] | Comments |
|---|---|---|
| 4.4.6 Electronic components used in electronics COTS assembly: Selection/qualification and acceptance | 3.14 Internal parts | |
| 4.4.7 Electronic COTS assembly manufacturing and handling | 3.12 Quality assurance | |
| 4.4.8 Electronics COTS assembly qualification approval | 3.9 qualification | |
| 4.4.9 Electronics COTS assembly final acceptance | 3.8 Maintainability and testability | |
| 4.4.10 Configuration management and documentation | 3.10 Configuration management | |
| 4.4.11 Plan owner documentation | 3.10 and 4.4 | |
| 4.4.12 Electronic COTS assembly manufacturer documentation | 3, 3.1, 3.11 | |
| 4.4.13 Life cycle management | 3.16 Obsolescence management | |
| 4.4.15 Equipment/system corrective action and product (electronics COTS assembly) change notices | 3.10 configuration control | |
| 4.4.16 Electronic COTS assembly substitution or alternative source | Not included | |
| 5 Plan administration | Plan administration | |
| 5.1 Plan content and organization | | |
| 5.2 Plan terms, definitions and abbreviated terms | | |
| 5.3 Plan focal point | | |
| 5.4 Plan references | | |
| 5.5 Plan applicability | | |
| 5.6 Plan implementation | | |
| 5.7 Plan acceptance | | |
| [a] The plan owner is responsible for maintaining this cross-reference matrix when SAE EIA-933B is revised. | | |

# Annex C
(informative)

# Electronic COTS assembly design guidelines and COTS assembly manufacturer's risk assessment

## C.1 COTS assembly design guidelines

### C.1.1 Open system architecture

See 3.1.31 for a definition. The documented processes should assure that adequate consideration is given to selection of electronic COTS assemblies that adhere to open principles and standards where applicable with regard to the application.

NOTE 1 Selection of electronic COTS assemblies with well-defined standard non-proprietary interfaces as part of an open architecture that is scalable and evolvable is an essential element of minimizing total ownership cost (TOC) through mitigation of diminishing manufacturing sources (DMS) effects, and maximizing technology independence/ease of technology insertion.

NOTE 2 ANSI/VITA 47 provides an open architecture standard for environments, design and construction, safety and quality, and its use, where applicable, is a relevant practice.

### C.1.2 Risk assessment and performance

The documented processes should assure that adequate consideration is given to selection of electronic COTS assemblies

NOTE 1 SAE ARP 5890 provides guidance on the use of reliability assessment results to substantiate business decisions and is a relevant practice for meeting the objectives of this document.

NOTE 2 ISO 31000 which describes risk management and ISO/IEC 31010 which describes risk management techniques, together with ISO Guide 73 which provides risk management vocabulary, are relevant practices for meeting the objectives of this document.

### C.1.3 Assembly criticality

The documented processes should ensure that the electronic COTS assembly criticality is identified and the corresponding design assurance level is implemented. The process for electronic COTS assembly criticality assessment and rating, and the corresponding design assurance levels, when not specified in the equipment/system specification, should be identified by the plan owner and the metrics documented.

NOTE 1 Item criticality assessment and rating is a two-step process. First, the equipment/system functional criticality is determined. Next, individual item criticality is defined based on system redundancy. A failure modes, effects and criticality analysis (FMECA) can be used to define equipment/system item criticality through an analysis of system architectures and consequence of equipment/system item failure.

NOTE 2 RTCA DO-254, EUROCAE ED-80 and EASA CM – SWCEH – 001 provide guidance on determination of development assurance levels and are relevant practices for meeting the objectives of this document.

NOTE 3 RTCA DO-254, EUROCAE ED-80 and EASA CM – SWCEH – 001 Levels A and B compose an acceptable definition of "flight critical."

## C.2 COTS assembly manufacturer's risk assessment

Table C.1 is an example of a risk assessment process which may be used to risk assess the data available from the electronic COTS assembly manufacturers.

The intent of Table C.1 is that the questions in column 1 are sent out to each electronic COTS assembly manufacturer and column 2 (or column 3) is destined to the electronic COTS manufacturer's responses. Alternatively the plan owner can complete this on their behalf based on data they acquire from the electronic COTS assembly datasheet and/or specification and other data made available to them.

Using Table C.2, the plan owner can then review the answers from Table C.1, adding in column 2 all the plan owner's risk mitigation considerations and summarising in column 3 the areas of risk when using the electronic COTS assembly in the application which may result in 'tailoring' (see Annex A).

The responses from all the electronic COTS assembly manufacturers surveyed can then be analysed in the same way by completing columns 4 and 5, etc.

According to the electronic COTS assembly type (see definitions in 3.1.13 and 3.1.20), the contents (for example questions) of Table C.1 and Table C.2 can be tailored.

A final review is made to assess which of the electronic COTS assembly manufacturers investigated presents the lowest overall risk when used in the application (see 4.3). This can allow to select one or a short-list of electronic COTS assembly manufacturer(s) and to make deeper assessment on key topics if needed.

In some situations, for example if there is only one possible electronic COTS assembly manufacturer, the interest to continue in the electronic COTS assembly way can be supported by additional questions relating to program logistics (for example lead-time, development resources required, design schedules, costs (for example non-recurring cost for designing, testing, industrialization)) for comparing to an in-house design and development activity.

**Table C.1 – Template for electronic COTS assembly manufacturer's risk assessment**

| IEC TS 62239-2:2017 – subclause number | Ref. No. | Column 1 | Column 2 | Column 3 [a] |
|---|---|---|---|---|
| | | **Questions for the COTS assembly manufacturer with regard to its specific part number** | **Electronic COTS assembly manufacturer # 1 answers**<br>**(documents can be referred to: in that case, list the documents titles and references supporting the answer)** | **Electronic COTS assembly manufacturer # 2 answers**<br>**(documents can be referred to: in that case, list the documents titles and reference supporting the answer)** |
| 4.4.2 | 1 | What assessment approval or certifications does the electronic COTS assembly manufacturer have (relevant assessment standards can be ISO 9001, AS/EN/JISQ 9100, ISO TS 16949)? | | |
| 4.4.6 | 2 | Is the electronic COTS assembly manufacturer assessed or certified to IEC TS 62239-1?<br>If yes, provide copies of your ECMP, LFCP, obsolescence management plan and anti-counterfeit management plan for review and approval. | | |
| 4.3.12, 4.3.5 | 3 | Did the electronic COTS assembly manufacturer conduct a safety or integrity assessment and does this meet the application requirements? | | |
| 4.4.6 | 4 | Does the electronic COTS assembly manufacturer have an anti-counterfeit (for example fraudulent, recycled) electronic components policy or management plan? | | |
| 4.4.10, 4.4.12 | 5 | What is the latest published datasheet and/or specification version of the electronic COTS assembly?<br>Are there any published errata?<br>Are there any application guidelines or user manuals? | | |
| 4.3.1, 4.4.5, 4.4.8, 4.4.9, 4.4.12 | 6 | Do the electrical performance and/or use conditions of the electronic COTS assembly meet the application requirements? | | |

| IEC TS 62239-2:2017 – subclause number | Ref. No. | Column 1 | Column 2 | Column 3 [a] |
|---|---|---|---|---|
| | | **Questions for the COTS assembly manufacturer with regard to its specific part number** | **Electronic COTS assembly manufacturer # 1 answers**<br><br>**(documents can be referred to: in that case, list the documents titles and references supporting the answer)** | **Electronic COTS assembly manufacturer # 2 answers**<br><br>**(documents can be referred to: in that case, list the documents titles and reference supporting the answer)** |
| 4.4.5, 4.4.8, 4.3.6 | 7 | Do the environmental performance and/or use conditions of the electronic COTS assembly meet the application requirements?<br><br>Is there reliability data? | | |
| 4.2.1, 4.3.5 | 8 | How long has the electronic COTS assembly been in production?<br><br>Is its design mature? | | |
| 4.2.1, 4.3.5 | 9 | What's the in-service experience (functional hours, number of COTS assemblies in the field, type of applications)? | | |
| 4.2.1, 4.3.5 | 10 | Has the electronic COTS assembly been designed and verified (for example ASIC, FPGA) according to RTCA DO-254, EUROCAE ED-80 guidance and requirements?<br><br>If yes, to which design assurance level?<br><br>Are there RTCA DO-254, EUROCAE ED-80 assessments? By a customer or by an assessment body?<br><br>If yes, are the results positive?<br><br>Does this match the application RTCA DO-254, EUROCAE ED-80 level? | | |
| 4.2.1, 4.3.1, 4.4.10, 4.4.12 | 11 | Is there a block diagram explaining the overall architecture of the design? Is this in the datasheet and/or specification or other user document?<br><br>If not, can you provide it? | | |

| IEC TS 62239-2:2017 – subclause number | Ref. No. | Column 1 | Column 2 | Column 3 [a] |
|---|---|---|---|---|
| | | **Questions for the COTS assembly manufacturer with regard to its specific part number** | **Electronic COTS assembly manufacturer # 1 answers**<br>**(documents can be referred to: in that case, list the documents titles and references supporting the answer)** | **Electronic COTS assembly manufacturer # 2 answers**<br>**(documents can be referred to: in that case, list the documents titles and reference supporting the answer)** |
| 4.2.1, 4.3.3, 4.3.4, 4.3.5, 4.3.6 | 12 | What is the internal construction of this electronic COTS assembly (for example does it use surface mount technology (SMT) packaged components soldered to the printed circuit board (PCB), conformal coating, other coating encapsulation, chip and wire hermetic construction, etc.) ? Explain. | | |
| 4.3.5, 4.3.6, 4.3.7 | 13 | What design mitigations are there for SEE atmospheric radiation effects (for example IEC 62396-3), semiconductor wear-out (SAE ARP 6338) and life time, single point failures? | | |
| 4.4.6, 4.3.5, 4.3.6 | 14 | Is there for the electronic COTS assembly a bill of material (BoM) identifying the individual electronic components by original component manufacturer and part number that you can share with the customer? Please attach. | | |
| 4.3.9 | 15 | Does a failure modes and effects analysis (FMEA) been performed at functional and/or design and/or process level?<br>Are there any single point failures and what are the targeted electronic component part numbers? | | |
| 4.3.5, 4.3.6 | 16 | Are the manufacturing technologies used in the electronic COTS assembly mature or are there any new cutting edge technologies (for example microvias, buried vias at PCB level; lead-free soldering at circuit card assembly, etc.)? | | |
| 4.3.5, 4.3.6 | 17 | Does the electronic COTS assembly design contain any MEMS devices? | | |
| 4.3.5, 4.3.6 | 18 | Is there use of software? | | |
| 4.3.5, 4.3.6 | 19 | How was this software verified? | | |

| IEC TS 62239-2:2017 – subclause number | Ref. No. | Column 1 | Column 2 | Column 3 [a] |
|---|---|---|---|---|
| | | **Questions for the COTS assembly manufacturer with regard to its specific part number** | **Electronic COTS assembly manufacturer # 1 answers**<br>**(documents can be referred to: in that case, list the documents titles and references supporting the answer)** | **Electronic COTS assembly manufacturer # 2 answers**<br>**(documents can be referred to: in that case, list the documents titles and reference supporting the answer)** |
| 4.4.5 | 20 | Is there any generic family environmental qualification test data available for the electronic COTS assembly to review (for example RTCA DO-160 or MIL-STD-810 or MIL-STD-883 test data for endurance, temperature cycling, humidity testing, altitude testing, vibration, shock, etc.)? | | |
| 4.4.7 | 21 | Explain the workmanship standards used in the manufacturing assembly of the electronic COTS assembly.<br>Regarding the assembly soldering processes, are operators trained towards IPC guidance and requirements? | | |
| 4.4.9 | 22 | How is the electronic COTS assembly inspected and tested before delivery? Please explain. | | |
| 4.4.9 | 23 | What are the ESS parameters (environmental constraints, functional setup and monitoring) used to screen the COTS assembly? | | |
| 4.3.3, 4.3.6 | 24 | Is this a lead-free COTS assembly and which lead-free solder do you use? | | |
| 4.3.3, 4.3.6 | 25 | If the electronic COTS assembly has an internal cavity or is supplied as a PCB assembly, is this electronic COTS assembly conformal coated and which conformal coating is used (for example acrylic, parylene, urethane or other nano-coating)? | | |
| 4.4.4 | 26 | Explain the derating procedure if any. | | |
| 4.3.5, 4.4.5, 4.4.10 | 27 | What is the operating temperature range of this electronic COTS assembly? | | |

| IEC TS 62239-2:2017 – subclause number | Ref. No. | Column 1 | Column 2 | Column 3 [a] |
|---|---|---|---|---|
| | | **Questions for the COTS assembly manufacturer with regard to its specific part number** | **Electronic COTS assembly manufacturer # 1 answers**<br>**(documents can be referred to: in that case, list the documents titles and references supporting the answer)** | **Electronic COTS assembly manufacturer # 2 answers**<br>**(documents can be referred to: in that case, list the documents titles and reference supporting the answer)** |
| 4.3.5, 4.4.5, 4.4.10 | 28 | Identify all electronic components which are uprated in the design and advise what their maximum operating $T_j$ temperatures are when the assembly is operated at the maximum electronic COTS assembly temperature limit. | | |
| 4.3.5, 4.4.5, 4.4.10 | 29 | How are these electronic components uprated? Is this according to IEC TR 62240-1? | | |
| 4.3.5, 4.4.5, 4.4.10 | 30 | Could this electronic COTS assembly be manufactured with higher temperature range components so as to avoid uprating? | | |
| 4.3.6, 4.3.7 | 31 | What is the electronic COTS assembly MTBF and MTTF?<br>Does this calculation take account of any semi-conductor wear-out and life time of electronic components with small geometry technologies? | | |
| 4.4.13 | 32 | What is the lead-time | | |
| 4.4.13 | 33 | Is the electronic COTS assembly available off the shelf? | | |
| 4.3.10 | 34 | How is the electronic COTS assembly repaired or is this a throw away item? | | |
| 4.4.12 | 35 | Are the electronic COTS assembly drawings under configuration control (for example electronic design, mechanical parts design)? | | |

| IEC TS 62239-2:2017 – subclause number | Ref. No. | Column 1 | Column 2 | Column 3 [a] |
|---|---|---|---|---|
| | | **Questions for the COTS assembly manufacturer with regard to its specific part number** | **Electronic COTS assembly manufacturer # 1 answers**<br>**(documents can be referred to: in that case, list the documents titles and references supporting the answer)** | **Electronic COTS assembly manufacturer # 2 answers**<br>**(documents can be referred to: in that case, list the documents titles and reference supporting the answer)** |
| 4.3.12 | 36 | Does the electronic COTS assembly manufacturer issue product change notices (PCNs) for all types of changes?<br>If not, would the electronic COTS assembly manufacturer issue PCNs when it changes any internal complex electronic components such as microprocessors, ASIC, FPGA, memories, etc.?<br>If not can this be negotiated? | | |
| 4.3.3 | 37 | Does the electronic COTS assembly contain any hazardous materials or substances (for example RoHS, REACh)? | | |
| 4.4.13, 4.4.14, 4.4.15, 4.4.16 | 38 | Does the electronic COTS assembly manufacturer have a proactive as well as a reactive obsolescence management plan? | | |
| 4.4.13, 4.4.14, 4.4.15, 4.4.16 | 39 | How are product discontinuance notification (PDN)/end of production (EOP), last buy order (LBO)/last time buy (LTB), last time shipment (LTS) and end of support (EOS) managed and how is stock stored?<br>Are customers asked for their future buy quantities?<br>Are the product roadmaps shared with customers?<br>Does the electronic COTS assembly manufacturer have plans for pin-compatible upgrades which can manage obsolescence? | | |
| a Extra columns can be added if investigating more than two electronic COTS assembly manufacturers. | | | | |

**Table C.2 – Template for the plan owner's mitigation and risk assessment of the electronic COTS assembly manufacturer analysed in Table C.1**

| IEC TS 62239-2:2017 – subclause number | Table C.1 Ref. No. | Column 1 (same as Table C.1 column 1) | Column 2 [a] | Column 3 |
|---|---|---|---|---|
| | | **Questions for the electronic COTS assembly manufacturer with regard to its specific part number** | **Plan owner's review and mitigations with regard to the electronic COTS assembly from** Table C.1**, column 2 (manufacturer # 1)**<br>**(documents can be referred to: in that case, list the documents titles and references supporting the answer)** | **Areas of outstanding risk which if not mitigated further may result in tailoring (see Annex A)** |
| 4.4.2 | 1 | What assessment approval or certifications does the electronic COTS assembly manufacturer have (relevant assessment standards can be ISO 9001, AS/EN/JISQ 9100, ISO TS 16949)? | | |
| 4.4.6 | 2 | Is the electronic COTS assembly manufacturer assessed or certified to IEC TS 62239-1?<br>If yes, provide copies of your ECMP, LFCP, obsolescence management plan and anti-counterfeit management plan for review and approval. | | |
| 4.3.12, 4.3.5 | 3 | Did the electronic COTS assembly manufacturer conduct a safety or integrity assessment and does this meet the application requirements? | | |
| 4.4.6 | 4 | Does the electronic COTS assembly manufacturer have an anti-counterfeit (for example fraudulent, recycled) electronic components policy or management plan? | | |
| 4.4.10, 4.4.12 | 5 | What is the latest published datasheet and/or specification version of the electronic COTS assembly?<br>Are there any published errata?<br>Are there any application guidelines or user manuals? | | |

| IEC TS 62239-2:2017 – subclause number | Table C.1 Ref. No. | Column 1 (same as Table C.1 column 1) | Column 2 [a] | Column 3 |
|---|---|---|---|---|
| | | **Questions for the electronic COTS assembly manufacturer with regard to its specific part number** | **Plan owner's review and mitigations with regard to the electronic COTS assembly from** Table C.1**, column 2 (manufacturer # 1)**<br><br>**(documents can be referred to: in that case, list the documents titles and references supporting the answer)** | **Areas of outstanding risk which if not mitigated further may result in tailoring (see Annex A)** |
| 4.3.1, 4.4.5, 4.4.8, 4.4.9, 4.4.12 | 6 | Do the electrical performance and/or use conditions of the electronic COTS assembly meet the application requirements? | | |
| 4.4.5, 4.4.8, 4.3.6 | 7 | Do the environmental performance and/or use conditions of the electronic COTS assembly meet the application requirements?<br><br>Is there reliability data? | | |
| 4.2.1, 4.3.5 | 8 | How long has the electronic COTS assembly been in production?<br><br>Is its design mature? | | |
| 4.2.1, 4.3.5 | 9 | What's the in-service experience (functional hours, number of COTS assemblies in the field, type of applications)? | | |
| 4.2.1, 4.3.5 | 10 | Has the electronic COTS assembly been designed and verified (for example ASIC, FPGA) according to RTCA DO-254, EUROCAE ED-80 guidance and requirements?<br><br>If yes, to which design assurance level?<br><br>Are there RTCA DO-254, EUROCAE ED-80 assessments? By a customer or by an assessment body?<br><br>If yes, are the results positive?<br><br>Does this match the application RTCA DO-254, EUROCAE ED-80 level? | | |

| IEC TS 62239-2:2017 – subclause number | Table C.1 Ref. No. | Column 1 (same as Table C.1 column 1) | Column 2 [a] | Column 3 |
|---|---|---|---|---|
| | | **Questions for the electronic COTS assembly manufacturer with regard to its specific part number** | **Plan owner's review and mitigations with regard to the electronic COTS assembly from** Table C.1**, column 2 (manufacturer # 1)**<br><br>**(documents can be referred to: in that case, list the documents titles and references supporting the answer)** | **Areas of outstanding risk which if not mitigated further may result in tailoring (see Annex A)** |
| 4.2.1, 4.3.1, 4.4.10, 4.4.12 | 11 | Is there a block diagram explaining the overall architecture of the design? Is this in the datasheet and/or specification or other user document?<br><br>If not, can you provide it? | | |
| 4.2.1, 4.3.3, 4.3.4, 4.3.5, 4.3.6, | 12 | What is the internal construction of this electronic COTS assembly, for example does it use surface mount technology (SMT) packaged components soldered to the printed circuit board (PCB), conformal coating, other coating encapsulation, chip and wire hermetic construction, etc.? Explain. | | |
| 4.3.5, 4.3.6, 4.3.7 | 13 | What design mitigations are there for SEE atmospheric radiation effects (for example IEC 62396-3), semiconductor wear-out (SAE ARP 6338) and life time, single point failures? | | |
| 4.4.6, 4.3.5, 4.3.6 | 14 | Is there for the electronic COTS assembly a bill of material (BoM) identifying the individual electronic components by the original component manufacturer and part number that you can share with the customer? Please attach. | | |
| 4.3.9 | 15 | Does a failure modes and effects analysis (FMEA) been performed at functional and/or design and/or process level?<br><br>Are there any single point failures and what are the targeted electronic component part numbers? | | |

| IEC TS 62239-2:2017 – subclause number | Table C.1 Ref. No. | Column 1 (same as Table C.1 column 1) | Column 2 [a] | Column 3 |
|---|---|---|---|---|
| | | **Questions for the electronic COTS assembly manufacturer with regard to its specific part number** | **Plan owner's review and mitigations with regard to the electronic COTS assembly from** Table C.1**, column 2 (manufacturer # 1)**<br><br>**(documents can be referred to: in that case, list the documents titles and references supporting the answer)** | **Areas of outstanding risk which if not mitigated further may result in tailoring (see Annex A)** |
| 4.3.5, 4.3.6 | 16 | Are the manufacturing technologies used in the electronic COTS assembly mature or are there any new cutting edge technologies (for example microvias, buried vias at PCB level, lead-free soldering at circuit card assembly, etc.)? | | |
| 4.3.5, 4.3.6 | 17 | Does the electronic COTS assembly design contain any MEMS devices? | | |
| 4.3.5, 4.3.6 | 18 | Is there use of software? | | |
| 4.3.5, 4.3.6 | 19 | How was this software verified? | | |
| 4.4.5 | 20 | Is there any generic family environmental qualification test data available for the electronic COTS assembly to review (for example RTCA DO-160 or MIL-STD-810 or MIL-STD-883 test data for endurance, temperature cycling, humidity testing, altitude testing, vibration, shock, etc.)? | | |
| 4.4.7 | 21 | Explain the workmanship standards used in the manufacturing assembly of the electronic COTS assembly.<br><br>Regarding the assembly soldering processes, are operators trained towards IPC guidance and requirements? | | |
| 4.4.9 | 22 | How is the electronic COTS assembly inspected and tested before delivery? Please explain. | | |
| 4.4.9 | 23 | What are the ESS parameters (environmental constraints, functional setup and monitoring) used to screen the COTS assembly? | | |

| IEC TS 62239-2:2017 – subclause number | Table C.1 Ref. No. | Column 1 (same as Table C.1 column 1) | Column 2 [a] | Column 3 |
|---|---|---|---|---|
| | | **Questions for the electronic COTS assembly manufacturer with regard to its specific part number** | **Plan owner's review and mitigations with regard to the electronic COTS assembly from** Table C.1**, column 2 (manufacturer # 1)**<br>**(documents can be referred to: in that case, list the documents titles and references supporting the answer)** | **Areas of outstanding risk which if not mitigated further may result in tailoring (see Annex A)** |
| 4.3.3, 4.3.6 | 24 | Is this a lead-free COTS assembly and which lead-free solder do you use? | | |
| 4.3.3, 4.3.6 | 25 | If the electronic COTS assembly has an internal cavity or is supplied as a PCB assembly, is this electronic COTS assembly conformal coated and which conformal coating is used (for example acrylic, parylene, urethane or other nano-coating)? | | |
| 4.4.4 | 26 | Explain the derating procedure if any. | | |
| 4.3.5, 4.4.5, 4.4.10 | 27 | What is the operating temperature range of this electronic COTS assembly? | | |
| 4.3.5, 4.4.5, 4.4.10 | 28 | Identify all electronic components which are uprated in the design and advise what their maximum operating $T_j$ temperatures are when the assembly is operated at the maximum electronic COTS assembly temperature limit. | | |
| 4.3.5, 4.4.5, 4.4.10 | 29 | How are these electronic components uprated? Is this according to IEC TR 62240-1? | | |
| 4.3.5, 4.4.5, 4.4.10 | 30 | Could this electronic COTS assembly be manufactured with higher temperature range components so as to avoid uprating? | | |
| 4.3.6, 4.3.7 | 31 | What is the electronic COTS assembly MTBF and MTTF?<br>Does this calculation take account of any semi-conductor wear-out and life time of electronic components with small geometry technologies? | | |
| 4.4.13 | 32 | What is the lead-time? | | |

| IEC TS 62239-2:2017 – subclause number | Table C.1 Ref. No. | Column 1 (same as Table C.1 column 1) | Column 2 [a] | Column 3 |
|---|---|---|---|---|
| | | **Questions for the electronic COTS assembly manufacturer with regard to its specific part number** | **Plan owner's review and mitigations with regard to the electronic COTS assembly from** Table C.1**, column 2 (manufacturer # 1)**<br><br>**(documents can be referred to: in that case, list the documents titles and references supporting the answer)** | **Areas of outstanding risk which if not mitigated further may result in tailoring (see Annex A)** |
| 4.4.13 | 33 | Is the electronic COTS assembly available off the shelf? | | |
| 4.3.10 | 34 | How is the electronic COTS assembly repaired or is this a throw away item? | | |
| 4.4.12 | 35 | Are the electronic COTS assembly drawings under configuration control (for example electronic design, mechanical parts design)? | | |
| 4.3.12 | 36 | Does the electronic COTS assembly manufacturer issue product change notices (PCNs) for all types of changes?<br><br>If not, would the electronic COTS assembly manufacturer issue PCNs when it changes any internal complex electronic components such as microprocessors, ASIC, FPGA, memories, etc.?<br><br>If not can this be negotiated? | | |
| 4.3.3 | 37 | Does the electronic COTS assembly contain any hazardous materials or substances (for example RoHS, REACh)? | | |
| 4.4.13, 4.4.14, 4.4.15, 4.4.16 | 38 | Does the electronic COTS assembly manufacturer have a proactive as well as a reactive obsolescence management plan? | | |

| IEC TS 62239-2:2017 – subclause number | Table C.1 Ref. No. | Column 1 (same as Table C.1 column 1) | Column 2 [a] | Column 3 |
|---|---|---|---|---|
| | | **Questions for the electronic COTS assembly manufacturer with regard to its specific part number** | **Plan owner's review and mitigations with regard to the electronic COTS assembly from** Table C.1**, column 2 (manufacturer # 1)**<br><br>**(documents can be referred to: in that case, list the documents titles and references supporting the answer)** | **Areas of outstanding risk which if not mitigated further may result in tailoring (see Annex A)** |
| 4.4.13, 4.4.14, 4.4.15, 4.4.16 | 39 | How are product discontinuance notification (PDN)/end of production (EOP), last buy order (LBO)/last time buy (LTB), last time shipment (LTS) and end of support (EOS) managed and how is stock stored?<br><br>Are customers asked for their future buy quantities?<br><br>Are the product roadmaps shared with customers?<br><br>Does the electronic COTS assembly manufacturer have plans for pin-compatible upgrades which can manage obsolescence? | | |

[a] Columns 2 and 3 of Table C.2 can be appended, for each electronic COTS assembly manufacturer considered, to Table C.1 to create a large spreadsheet for easier analysis (for example for a manufacturer # 2).

# Annex D
(informative)

## Typical electronic COTS assembly mitigation methods and techniques

Table D.1 provides typical electronic COTS assembly mitigation methods and techniques that can be considered during the avionics design process.

**Table D.1 – Typical electronics COTS assembly mitigation methods and techniques**

| Environmental or reliability factor | Select electronic COTS assemblies where the components used inside the assembly are mitigated as follows: | Mitigations for plan owner assembly containing the electronic COTS assembly | Mitigations for the plan owner delivered unit or product that contains the electronic COTS assembly | Aircraft, UAV or satellite bay mitigations | Aircraft, UAV, satellite or space unit mitigations | Aircraft, UAV, satellite or space unit external |
|---|---|---|---|---|---|---|
| **Erroneous electrical output due for example to atmospheric radiation SEE effects** | | Design plan owner's assembly with the ability to completely isolate and de-activate electronic COTS assemblies from the application if the output starts to perform in an erroneous manner with, for example, another parallel circuit or LRU activated to take over that function if the system safety analysis of the application demands this. | Design plan owner's product with the ability to completely isolate and de-activate electronic COTS assemblies from the application if the output starts to perform in an erroneous manner with, for example, another parallel circuit or LRU activated to take over that function etc. if the system safety analysis of the application demands this. | | Include a back-up design or alternative system to take over if the output becomes erroneous if the system safety analysis requires this. | |

| Environmental or reliability factor | Select electronic COTS assemblies where the components used inside the assembly are mitigated as follows: | Mitigations for plan owner assembly containing the electronic COTS assembly | Mitigations for the plan owner delivered unit or product that contains the electronic COTS assembly | Aircraft, UAV or satellite bay mitigations | Aircraft, UAV, satellite or space unit mitigations | Aircraft, UAV, satellite or space unit external |
|---|---|---|---|---|---|---|
| **Temperature** | Consider thermal coefficient of expansion trade studies for materials used in modules, MCMs, hybrids, etc.<br>Select lowest thermal resistance package for power components.<br>Use largest footprint for power components.<br>Consider:<br>– heat sinks,<br>– peltier cooling,<br>– heat pipes,<br>– local fan.<br>Select components which operate within the manufacturer specified maximum operating and storage temperature ranges.<br>Manage derating.<br>Uprate only when no other option available. | Conduct temperature cycling testing on the electronic COTS assembly during selection process and/or plan owner's qualification process to assess suitability of the assembly.<br>Match TCE of assembly materials for electronics assembly mounting.<br>Minimize thermal resistance of COTS assembly within the plan owner assembly.<br>Plan owner could use:<br>– PCB heat ladders,<br>– plenum cooled,<br>– heat planes,<br>– heat pipes,<br>– heat sink,<br>– heaters,<br>– fans,<br>– thermally micromanaged local environment to avoid uprating,<br>– self-heated components prior to operating to specification limits at cold extremes. | Consider:<br>– plan owners' product temperature cycling qualification testing,<br>– position, for example against a cold plate to maximise thermal conduction,<br>– provision of forced air,<br>– spray cooling,<br>– internal cooling,<br>– liquid cooling,<br>– phase change material (exothermic) cooling.<br>Reduce specification requirements | Position electronics in benign environments, for example within cargo bay or cockpit.<br>Keep away from thermal hotspots, for example engines, engine hot air vents, etc., and cold spots, for example external areas such as windscreen or tail.<br>Supply cooling (filtered). | Consider:<br>– cooling on ground,<br>– load sharing,<br>– thermal shielding and/or cooling.<br>Note that worldwide geographical use from artic to tropical regions may have impact on temperature level | Consider:<br>– solar shielding, for example cockpit and windows of aircraft,<br>– solar shielding of satellite. |

| Environmental or reliability factor | Select electronic COTS assemblies where the components used inside the assembly are mitigated as follows: | Mitigations for plan owner assembly containing the electronic COTS assembly | Mitigations for the plan owner delivered unit or product that contains the electronic COTS assembly | Aircraft, UAV or satellite bay mitigations | Aircraft, UAV, satellite or space unit mitigations | Aircraft, UAV, satellite or space unit external |
|---|---|---|---|---|---|---|
| **Humidity** | Use internal conformal coating within the assembly.<br><br>Select plastic encapsulated microcircuits which have passed a HAST humidity test to JEDEC JESD22-A110.<br><br>Select components with finishes which will not corrode in humid environments.<br><br>Manage moisture sensitivity of plastic encapsulated SMT components to IPC/JEDEC J-STD-033. | Conduct humidity testing on the electronic COTS assembly during selection process and/or plan owner's qualification process to assess suitability of the assembly for the application.<br><br>Consider use of plan owner's conformal coating covering the COTS assembly if appropriate or alternative de-humidifying techniques. | Consider:<br>– plan owners' product humidity qualification testing,<br>– desiccants,<br>– hermetic enclosures,<br>– dry air,<br>– enclosure drainage for rain water or liquid runoff. | Consider:<br>– dry air supply,<br>– de-humidifiers,<br>– anti-condensation heaters. | Consider de-humidifiers/ desiccants.<br><br>Note that worldwide geographical use from artic to tropical regions may have an impact on humidity level. | Note that space external environment is a vacuum but launch sites are typically in tropical areas of the world. |

| Environmental or reliability factor | Select electronic COTS assemblies where the components used inside the assembly are mitigated as follows: | Mitigations for plan owner assembly containing the electronic COTS assembly | Mitigations for the plan owner delivered unit or product that contains the electronic COTS assembly | Aircraft, UAV or satellite bay mitigations | Aircraft, UAV, satellite or space unit mitigations | Aircraft, UAV, satellite or space unit external |
|---|---|---|---|---|---|---|
| **Vibration** | Have compliant terminations.<br>Select physically small components with low mass with lead-frame terminations, for example minimize LCCs and BGAs.<br>Consider:<br>– position away from vibration nodes,<br>– RTV,<br>– lacing, local potting.<br>Select vibration ruggedized components for very high vibration levels:<br>1) Use hard gold plated connector contacts to prevent 'fretting'.<br>2) Use high vibration crystals and oscillators.<br>3) Use semiconductor timing microcircuits instead of crystals if operating temperature permits.<br>4) Select high vibration circuit breakers, relays and contactors.<br>5) Consider vibration test of large components, for example displays, power suppliers, as part of component qualification testing to minimize unit qualification risk. | Conduct vibration testing on the electronics COTS assembly during selection process and/or plan owner's qualification process to assess suitability of the assembly for the application.<br>Consider using:<br>– stiffeners (reduce flexing) of PCB,<br>– local anti-vibration mounting,<br>– potting or RTV,<br>– lacing of cables or wires.<br>Keep length of cables and interconnect relatively short, evaluate cable chaffing, ensure sufficient strain relief in cables.<br>Use strain-relief connector back-shells to protect wires. | Consider:<br>– plan owner's product vibration qualification testing,<br>– anti- vibration mounts,<br>– position (benign),<br>– vibration analysis of nodes and redesign as required to minimize PCB deflections and stresses. | Consider:<br>– position (benign),<br>– active cancellation,<br>– anti-vibration mounts.<br>Keep electronics away from engines, gun fire positions, doors, wheel-wells, etc. | Determined by aircraft operation (for example defence, civil or space).<br>Note that defence aircraft may have several additional vibration requirements, for example gunfire, acoustic noise, etc. | Design |

| Environmental or reliability factor | Select electronic COTS assemblies where the components used inside the assembly are mitigated as follows: | Mitigations for plan owner assembly containing the electronic COTS assembly | Mitigations for the plan owner delivered unit or product that contains the electronic COTS assembly | Aircraft, UAV or satellite bay mitigations | Aircraft, UAV, satellite or space unit mitigations | Aircraft, UAV, satellite or space unit external |
|---|---|---|---|---|---|---|
| **EMI/EMC** | Consider:<br>– local shield,<br>– local supply filtering/ regulation.<br>Review COTS transient voltage suppressor (TVS) requirements. | Conduct EMI/EMC testing on the electronic COTS assembly during selection process and/or plan owner's qualification process to assess suitability of the assembly for the application.<br>Consider (not limitative):<br>– system architecture,<br>– circuit function partitioning,<br>– local shielding,<br>– local module,<br>– power supply / filtering,<br>– improved grounding.<br>Check ground loops. | Consider:<br>– plan owners' product EMI/EMC qualification testing,<br>– position,<br>– additional shielding,<br>– reduced electrical connectivity. | Consider:<br>– reduced electrical connectivity,<br>– shielded bay.<br>Maximize optical signalling. | Maximize optical signalling. | Be aware that composite structures may increase EMC requirements. |

| Environmental or reliability factor | Select electronic COTS assemblies where the components used inside the assembly are mitigated as follows: | Mitigations for plan owner assembly containing the electronic COTS assembly | Mitigations for the plan owner delivered unit or product that contains the electronic COTS assembly | Aircraft, UAV or satellite bay mitigations | Aircraft, UAV, satellite or space unit mitigations | Aircraft, UAV, satellite or space unit external |
|---|---|---|---|---|---|---|
| **Altitude** | Privilege void-free component encapsulation, for example transformers, encapsulated modules. | Conduct altitude testing on the electronics COTS assembly during selection process and/or plan owner's qualification process to assess suitability of the assembly for the application.<br>Use void-free PCBs and conformal coatings.<br>Review minimum spacings / gaps or conduct altitude testing to avoid flashover during dielectric withstanding voltage (DWV) and insulation resistance (IR) testing at altitude. | Consider:<br>– plan owner's product altitude qualification testing,<br>– hermetic enclosure/ pressurized enclosure/venting valves | Consider pressurized bay. | Determined by aircraft operational profile, for example defence, civil or space. | |
| **Shock/ acceleration** | As vibration. | | | | | |
| **Power supply** | Consider local supply filtering. | Consider local module power supply. | Consider local conditioning. | | Consider load sharing/filtering. | |

| Environmental or reliability factor | Select electronic COTS assemblies where the components used inside the assembly are mitigated as follows: | Mitigations for plan owner assembly containing the electronic COTS assembly | Mitigations for the plan owner delivered unit or product that contains the electronic COTS assembly | Aircraft, UAV or satellite bay mitigations | Aircraft, UAV, satellite or space unit mitigations | Aircraft, UAV, satellite or space unit external |
|---|---|---|---|---|---|---|
| **Long term dormant storage** | Select plastic encapsulated components which have passed a HAST humidity test to JEDEC JESD22-A110.<br>Store under dry nitrogen.<br>Store wafers under dry nitrogen instead of assembled components. | Determine storage conditions from the electronic COTS assembly manufacturer and formulate a storage plan using as appropriate:<br>– desiccants,<br>– dry bag/desiccants,<br>– storage in dry nitrogen cabinets.<br>Advise the customer if there is a life limiting storage requirement and execute a maintenance plan. | Desiccants.<br>Hermetic enclosures.<br>Dry air storage for long term storage of units.<br>Advise the customer if there is a life limiting storage requirement and execute a maintenance plan. | Consider dry atmospheric storage.<br>If advised of a life limiting storage requirement, execute the maintenance plan as recommended by the plan owner. | Consider dry atmospheric storage. | |
| **Atmospheric SEU radiation** | Select components, for example memories not subject to SEU effects.<br>Select components, for example memories not subject to SEL.<br>Test components of a certain die revision or lot date code for atmospheric SEU susceptibility to IEC 62396-2 and consider one time buys.<br>Select components which do not use Boron 10.<br>Derate SEU-susceptible high voltage components. | System architecture design mitigation techniques to IEC 62396-3.<br>Conduct product SEE testing during electronic COTS assembly selection and/or plan owner's product qualification to assess suitability of the assembly for the application. | Consider system architecture design mitigation techniques to IEC 62396-3. | Select location and materials to minimize thermal neutron magnification effects. | Consider maximum altitude of operation, as the effects are harder to manage the higher the altitude is. | |

| Environmental or reliability factor | Select electronic COTS assemblies where the components used inside the assembly are mitigated as follows: | Mitigations for plan owner assembly containing the electronic COTS assembly | Mitigations for the plan owner delivered unit or product that contains the electronic COTS assembly | Aircraft, UAV or satellite bay mitigations | Aircraft, UAV, satellite or space unit mitigations | Aircraft, UAV, satellite or space unit external |
|---|---|---|---|---|---|---|
| **Total dose radiation effects for space use** | Select components immune to total dose radiation effects.<br>Select components, for example memories not subject to SEL or SEU.<br>Test components of a certain die revision or lot date code and carry out one time buys.<br>Select assemblies with no single point failures. | Consider system architecture design mitigation techniques. | Consider system architecture design mitigation. | | | |
| **Semiconductor wear-out and life time** | Derate.<br>Select older design geometry (higher than 90 nm) components which are less susceptible to these effects.<br>Operate components at lowest voltage, temperature and duty cycle temperature possible to minimise effects.<br>Request access or data from component manufacturer's reliability prediction tools. | Derate electronics COTS assemblies in the plan owner's application.<br>Use the lowest operating voltage, temperature and duty cycle possible to minimise acceleration of effects.<br>Design replacement upgrades for maintainability to be deployed when wear-out of the assemblies begins and life time can be affected. | Design replacement upgrades for maintainability to be deployed when wear-out of the assemblies begins and life time can be affected. | | Talk to the plan owner about deployment of upgrades when the electronics COTS assemblies can present semiconductor wear-out and life time concerns. | |

# Annex E
(informative)

## Requirements matrix for IEC TS 62239-2

Table E.1 provides the requirements matrix for IEC TS 62239-2.

**Table E.1 – Requirements matrix for IEC TS 62239-2**

| Requirement number | IEC TS 62239-2:2017 – clause/subclause number | Title | Abbreviated requirements extracting the 'shall' requirements only |
|---|---|---|---|
| N/A | 4 | Technical requirements | Heading |
| 1 | 4.1 | General | The plan owner shall have an electronic COTS assembly management plan (CAMP) addressing each requirement of this document, based on its existing quality management system where applicable to assure customer that electronic COTS assemblies are selected and applied in the plan owner's equipment using controlled processes (see 5.7). |
| 2 | 4.2.2 | Design assurance | The processes documented in the plan shall:<br>– provide design assurance for all applicable assemblies;<br>– assure that requirements for each assembly are identified and evaluated against the manufacturer's electronic COTS assembly specification and/or datasheet and any additional relevant data to ensure suitability in the end application;<br>– assure that, if additional performance is required (for example up-screening, uprating, additional parameters defined), the electronic COTS assembly is considered as a specific one and is uniquely identified (see 4.3.6 and 4.4.8) and that the evaluations are documented (see 4.4.10);<br>– assure that availability and level of obsolescence risk are considered as a major assembly selection criterion (see 4.4.14). |
| N/A | 4.3 | COTS assembly application | Heading |
| 6 | 4.3.2 | Functionality | The documented processes shall:<br>– verify that the allocated equipment/system electrical and functional requirements for each electronic COTS assembly are clearly specified by the plan owner;<br>– assure that the selected electronic COTS assemblies satisfy the electrical and functional requirements for each application (see 4.3.6 for integrity aspects). |

| Requirement number | IEC TS 62239-2:2017 – clause/subclause number | Title | Abbreviated requirements extracting the 'shall' requirements only |
|---|---|---|---|
| 7 | 4.3.3 | COTS assembly compatibility | The processes documented in the plan shall:<br>– assure the electronic COTS assembly and integration processes are identified and are compatible throughout equipment/system integration, shipping, handling, storage, test, repair and rework conducted by the plan owner;<br>– assure that any identified effects on assemblies are addressed. |
| 8 | 4.3.4 | Assembly materials | The processes documented in the plan shall assure that the electronic COTS assembly design is assessed against applicable materials requirements, such as reduction of hazardous, restricted or banned substances (for example RoHS, REACh), foreign object debris (FOD), fungus resistance, and flammability. |
| 9 | 4.3.5 | Heat dissipation and cooling | The documented processes shall verify that each electronic COTS assembly's heat dissipation and cooling requirements are consistent with the equipment/system specification. |
| N/A | 4.3.6 | Integrity analysis | Heading |
| 10 | 4.3.6.1 | General | The documented processes shall:<br>– verify that the electronic COTS assembly is consistent with equipment/system integrity requirements (see definition in 3.1.29);<br>– determine whether the electronic COTS assembly will be used within the environmental, electrical and functional operating conditions and limits specified by the electronic COTS assembly manufacturer and will keep its whole performances (for example electrical, functional). |
| 11 | 4.3.6.2 | Electronic COTS assembly not used within its specified operating conditions and limits or those not specified | When an electronic COTS assembly is not used within the operating conditions and limits specified by the electronic COTS manufacturer, the plan owner shall:<br>– document all the instances; see Annex C with regard to potential identification risks;<br>– document either corrective action or mitigation to bring the planned usage within the specified operating conditions and limit or document justification showing that all equipment/system requirements will be met while not satisfying each criterion (all the documentation becoming part of the electronic COTS assembly data package). |
| 12 | 4.3.7 | Reliability analysis | The documented processes shall:<br>– verify that the electronic COTS assembly when integrated into the deliverable equipment/system is managed with relevant mitigations if needed to be consistent with equipment/system reliability requirements;<br>– ensure that reliability assessments are conducted, with sufficient detail to understand their uses, limitations, and uncertainties with potential mitigations as considered necessary, relevant to the application or consider potentially tailoring if agreed with the customer (see Annex A). |
| 13 | 4.3.8 | Useful life | The documented processes shall verify that the electronic COTS assembly useful life is managed using relevant mitigations if needed to be consistent with the equipment/system requirements. The plan owner can potentially consider tailoring if agreed with the customer (see Annex A). |

| Requirement number | IEC TS 62239-2:2017 – clause/subclause number | Title | Abbreviated requirements extracting the 'shall' requirements only |
|---|---|---|---|
| 14 | 4.3.9 | Storage life | The documented process shall verify that the electronic COTS assembly storage life is managed using potential mitigations if needed (see Annex D) to be consistent with the equipment/system requirements. The plan owner can potentially consider tailoring if agreed with the customer (see Annex A). |
| 15 | 4.3.10 | Failure modes and effects analysis | The documented process shall include failure modes and effects analysis (FMEA) as part of the design process integrating the electronic COTS assembly when required by the design assurance process. |
| 16 | 4.3.11 | Maintainability and testability | The documented process shall assure that the electronic COTS assembly, as incorporated in the equipment/system meets maintainability and testability requirements. |
| 17 | 4.3.12 | Markings | The documented processes shall ensure that the electronic COTS assembly markings meet the requirements for identification, warnings, traceability, etc. |
| 18 | 4.3.13 | Safety | The documented process shall assure equipment/system environmental, personnel, and equipment/system safety requirements are met. |
| 19 | 4.3.14 | Acceptance by the plan owner | The documented process shall define the plan owner's electronic assembly, equipment and system acceptance tests as applicable. |
| N/A | 4.4 | Electronic COTS assembly manufacturer selection | Heading |
| 20 | 4.4.1 | General | The plan owner shall conduct a risk assessment of potential electronic COTS assembly manufacturers to determine their suitability in order to meet the requirements of this document. |
| 21 | 4.4.2 | Electronic COTS assembly manufacturer quality system | The plan owner shall verify that the electronic COTS assembly manufacturer has a documented quality management system. Unless otherwise specified by the customer, the quality system should be assessed to an internationally recognised quality management system or equivalent. |
| 22 | 4.4.4 | Electronic COTS assembly derating and stress analysis | The documented process shall:<br>– determine the derating criteria that the electronic COTS assembly manufacturer used in its design process;<br>– consider where appropriate the derating criteria and methods if provided by the electronic COTS assembly manufacturer;<br>– document an appropriate estimate of the derating criteria and methods used by the electronic COTS assembly manufacturer if the electronic COTS assembly manufacturer does not provide this information or if it is not appropriate;<br>– ensure that these data are used to validate the reliability assessment assumptions. |
| 23 | 4.4.5 | Electronic COTS assembly qualification/characterization | The processes documented in the plan shall ensure by whatever means appropriate (for example derating, analysis, testing, and screening) that the electronic COTS assembly is qualified or characterized against the requirements of the equipment/system specification. |

| Requirement number | IEC TS 62239-2:2017 – clause/subclause number | Title | Abbreviated requirements extracting the 'shall' requirements only |
|---|---|---|---|
| 24 | 4.4.6 | Electronic components used in electronics COTS assembly: Selection/qualification and acceptance | The plan owner shall:<br>– document and assess the electronic COTS assembly manufacturer's electronic components selection/qualification and acceptance process;<br>– otherwise provide an alternate assurance based on an assessment of the adequacy of the electronic COTS assembly manufacturers' selection/qualification and acceptance effort and description of any additional effort required to assure that the electronic COTS assembly will meet all specified requirements. |
| 25 | 4.4.7 | Electronic COTS assembly manufacturing and handling | The processes documented in the plan shall verify that the electronic COTS assembly manufacturer has process capability utilizing manufacturing and handling technologies which are repeatable and sufficient to meet equipment/system requirements. |
| 26 | 4.4.8 | Electronic COTS assembly qualification approval | The processes documented in the plan shall:<br>– assure that the electronic COTS manufacturer's qualification processes for the electronic COTS assembly are documented and assessed;<br>– otherwise assure that alternative assurance is provided that the electronic COTS assembly will perform as required in the application specified usage. |
| 27 | 4.4.9 | Electronic COTS assembly final acceptance | The plan owner shall:<br>– document and assess the electronic COTS assembly manufacturer's final acceptance process (for example acceptance test procedure);<br>– otherwise provide alternative assurance that the electronic COTS assembly will perform as required in the application specified usage. |
| 28 | 4.4.10 | Configuration management and documentation | The process documented in the plan shall:<br>– include a configuration management process appropriate to the electronic COTS assembly;<br>– verify that the equipment/system configuration is maintained relative to the electronic COTS assembly usage in the application;<br>– verify that tools used for design and verification are under configuration control and included with the design control and design changes;<br>– propose, when the configuration management of the electronic COTS assembly cannot be guaranteed (for example not appropriate, missing in whole or in part), an alternative approach to assure that contract requirements are met and that the electronic COTS assembly will perform as required in the specified application usage.<br>In the last case and despite the potential dispositions, the use of the electronic COTS assembly is at risk, is discouraged and considered as an exception when no reasonable alternative is available. |
| 29 | 4.4.11 | Plan owner documentation | The processes documented in the plan shall ensure that a system exists at the plan owner that collects, stores, provides retrieval, analysis and reporting capability, for all relevant data from the electronic COTS assembly, equipment/system integration and equipment/system use in service, and for keeping the data per customer or regulatory requirements. |

| Requirement number | IEC TS 62239-2:2017 – clause/subclause number | Title | Abbreviated requirements extracting the 'shall' requirements only |
|---|---|---|---|
| 30 | 4.4.12 | Electronic COTS assembly manufacturer documentation | The process documented in the plan shall:<br>– include a process to request electronic COTS assembly data according to 4.4.11 when available from the electronic COTS assembly manufacturers to assure dependability and to facilitate related analyses (for example integrity, reliability);<br>– identify an adequate engineering link between the electronic COTS assembly user and the electronic COTS assembly manufacturer with access to the related information/process for each electronic COTS assembly type/manufacturer;<br>– ensure that, in the event that the plan owner is unable to document the electronic COTS assembly's configuration in adequate detail to assure dependability, then the plan owner shall provide alternate assurance that the assembly will perform as required in the specified application usage, see 4.4.10. |
| 31 | 4.4.13 | Life cycle management | The documented processes shall ensure that the life cycle objectives are met and activities have been completed as outlined in plans or that deviations have been addressed. |
| 32 | 4.4.14 | COTS assembly availability risk management | The documented processes shall:<br>– ensure that risks associated with availability of the electronic COTS assembly and technology changes are identified, evaluated using appropriate metrics, and that methods to mitigate those risks are identified;<br>– assure tracking and reporting of the status of risk mitigation efforts when required by customer or business needs;<br>– document the processes used by the plan owner to resolve obsolete electronic COTS assembly occurrences to assure continued production and support of the equipment/systems in which the electronic COTS assembly is integrated as required, including logistics supportability and life cycle management issues when required by customer or business needs. |
| 33 | 4.4.15 | Equipment/system corrective action and product (electronics COTS assembly) change notices | The plan shall document the process used by the plan owner or systems in place for:<br>– data collection and analysis;<br>– use of factory data, customer reject data, and in-service data if available to improve the equipment/system (for example performance, operating, etc.) in which the electronic COTS assembly is integrated;<br>– receipt of manufacturer product change notices (PCNs) that affect the electronic COTS assembly and those that are not DMSMS or obsolescence related (for example, a GIDEP or safety alert on the product, manufacturing assembly process change, factory location change, etc.), and evaluation of the potential effects on the equipment/system. |
| N/A | 4.4.16 | Electronic COTS assembly substitution or alternative source | Heading |

| Requirement number | IEC TS 62239-2:2017 – clause/subclause number | Title | Abbreviated requirements extracting the 'shall' requirements only |
|---|---|---|---|
| 34 | 4.4.16.1 | Approach for acceptability | Any substitute or alternative source of an electronic COTS assembly shall be form, fit and function alternatives which are identified and documented in the plan owner's equipment/system assembly database.<br>This is to reduce potential risks of electronic COTS assembly procurement or to solve an obsolescence or unavailability problem of the previous source or sources. |
| 35 | 4.4.16.2 | Customer notifications and approvals | Customer notifications and approvals shall be defined between plan owner and customer, if required.<br>Since the customer notification and approval process is likely to be unique to each customer-supplier (generally the plan owner) relationship, related requirements are beyond the scope of the baseline electronic COTS assembly management process described in this document, and should be documented in the contractual agreements between the plan owner and the customer. |
| N/A | 5 | Plan administration | Heading |
| 36 | 5.1 | Plan content and organization | The plan shall be organized in such a manner that each of the requirements of Clause 4 is addressed clearly, concisely and unambiguously.<br>The plan shall state clearly, concisely, and unambiguously:<br>– what the plan owner does to accomplish each of the objectives;<br>– how compliance to the plan is demonstrated;<br>– that the evidence is available to show that the objectives have been accomplished; and<br>– where the plan owner obtains electronic COTS assemblies (from the manufacturer itself, or a distributor or other source and that the relevant requirements of this document apply to that source.<br>All the requirements given in Clause 5 apply to deliverable equipment and/or systems as stated in Clause 4. These requirements may be accomplished by either the plan owner including potential support service under its authority or the electronic COTS assembly manufacturer in whole or in part according to the contract terms. In either case, the plan owner has the responsibility for ensuring all objectives and requirements are met. |
| 37 | 5.2 | Plan terms, definitions and abbreviated terms | The terms, definitions and abbreviated terms used in the plan shall be those of Clause 3 of this document, unless they are clearly defined otherwise in the plan. |
| 38 | 5.3 | Plan focal point | The plan shall<br>– identify an authority or an organization to serve as the primary interface between the plan owner and outside parties (for example customer, electronic COTS manufacturer) in matters pertaining to the plan;<br>– assure that it is reviewed and updated as necessary. |
| 39 | 5.4 | Plan references | The plan shall include a list of references to all the documents necessary to accomplish the electronic COTS assembly management, including this document, other industry and government documents, and the plan owner's internal documents. |

| Requirement number | IEC TS 62239-2:2017 – clause/subclause number | Title | Abbreviated requirements extracting the 'shall' requirements only |
|---|---|---|---|
| 40 | 5.5 | Plan applicability | The plan shall document all the electronic COTS assembly types including potential tailoring details agreed with the customer (see Annex A) for the range of equipment and/or systems manufactured and/or integrated by the plan owner to which the plan applies. |
| 41 | 5.6 | Plan implementation | The plan owner shall<br>– implement and follow the processes documented in the plan, within its range of applicability;<br>– provide objective evidence that the provisions of this document are met, and that the plan has been implemented. |
| 42 | 5.7 | Plan acceptance | The plan shall be accepted when the plan owner and the customer agree that the plan is acceptable. Certification by an assessment body may be used as evidence that the plan satisfies the requirements of this document. |

# Bibliography

IEC 60300 (all parts), *Dependability management*

IEC 60300-1, *Dependability management – Part 1: Guidance for management and application*

IEC 61340-5-1, *Electrostatics – Part 5-1: Protection of electronic devices from electrostatic phenomena – General requirements*

IEC TR 61340-5-2, *Electrostatics – Part 5-2: Protection of electronic devices from electrostatic phenomena – User guide*

IEC TS 62239-1:2015, *Process management for avionics – Management plan – Part 1: Preparation and maintenance of an electronic components management plan*

IEC TR 62240-1, *Process management for avionics – Electronic components capability in operation – Part 1: Temperature uprating*

IEC 62396 (all parts), *Process management for avionics – Atmospheric radiation effects*

IEC 62396-1:2016, *Process management for avionics – Atmospheric radiation effects – Part 1: Accommodation of atmospheric radiation effects via single event effects within avionics electronic equipment*

IEC 62396-2, *Process management for avionics – Atmospheric radiation effects – Part 2: Guidelines for single event effects testing for avionics systems*

IEC 62396-3, *Process management for avionics – Atmospheric radiation effects – Part 3: System design optimization to accommodate the single event effects (SEE) of atmospheric radiation*

IEC 62402, *Obsolescence management –Application guide*

IEC 62435-1, *Electronic components – Long-term storage of electronic semiconductor devices – Part 1: General*

IEC 62435-2, *Electronic components – Long-term storage of electronic semiconductor devices – Part 2: Deterioration mechanisms*

IEC 62435-5, *Electronic components – Long-term storage of electronic semiconductor devices – Part 5: Die and wafer devices*

IEC 62647 (all parts), *Process management for avionics – Aerospace and defence electronic systems containing lead-free solder*

IEC TS 62647-1, *Process management for avionics – Aerospace and defence electronic systems containing lead-free solder – Part 1: Preparation for a lead-free control plan*

IEC 62668 (all parts), *Process management for avionics – Counterfeit prevention*

IEC TS 62668-1:2016, *Process management for avionics – Counterfeit prevention – Part 1: Avoiding the use of counterfeit, fraudulent and recycled electronic components*

IEC/ISO 31010, *Risk management – Risk assessment techniques*

ISO 9001, *Quality management systems – Requirements*

ISO 10007, *Quality management systems — Guidelines for configuration management*

ISO TS 16949, *Quality management systems – Particular requirements for the application of ISO 9001:2008 for automotive production and relevant service part organizations*

ISO 31000, *Risk management – Principles and guidelines*

ISO Guide 73*, Risk management – Vocabulary*

ANSI/VITA 47, *Environments, Design and Construction, Safety, and Quality for Plug-In Units*

ANSI/VITA 51, *Reliability Prediction*

ANSI/VITA 53, *Commercial Technology Market Surveillance*

AS/EN/JISQ 9100, *Quality Management systems – Requirements for aviation, Space and defense organisations*

AS/EN/JISQ 9120, *Quality Management systems – Requirements for aviation, Space and defense organisations*

ASTM E1678-15, *Standard Test Method for Measuring Smoke Toxicity for Use in Fire Hazard Analysis*

BS EN 100015, *Basic Specification. Protection of Electrostatic Sensitive Devices*

Defence Standard 05-135, *Avoidance of Counterfeit Materiel*

DFAR 252.246.7007, *Contractor Counterfeit Electronics Part Detection and avoidance System*

EUROCAE ED-80, *Design Assurance for Airborne Electronic Hardware*

EIA GEB1, – *Diminishing Manufacturing Sources and Material Shortages (DMSMS) Management Practices*

EIA SSB-1, – *Guidelines for Using Plastic Encapsulated Microcircuits and Semiconductors in Military, Aerospace and Other Rugged Applications*

EIA-724, – *Product Life Cycle Data Model*

EASA CM – SWCEH – 001, *Certification Memorandum, Development Assurance of Airborne Electronic Hardware*

JEDEC JESD22-A110, *Highly-Accelerated Temperature and Humidity Stress Test (HAST)*

IPC/JEDEC J-STD-033, *Handling, Packing, Shipping and Use of Moisture/Relfow Sensitive Surface Mount Devices*

MIL-HDBK-217F, *Military Handbook: Reliability Prediction of Electronic Equipment*

MIL-HDBK-263, *Electrostatic Discharge (ESD) Control Handbook for Protection of Electrical and Electronic Parts, Assemblies, and Equipment (Excluding Electrically Initiated Explosive Devices) (Metric)*

MIL-STD-810, *Environmental Engineering Considerations and Laboratory Tests.*

MIL-STD-882, *Standard Practice – System Safety*

MIL-STD-883, *Test Method Standard – Microcircuits*

MIL-STD-1521, *Technical Reviews and Audits for Systems, Equipments and Computer Software*

RTCA DO-160, *Environmental Conditions and Test Procedures for Airborne Equipment*

RTCA DO-254, *Design Assurance Guidance for Airborne Electronic Hardware*

SAE ARP 6338[1], *Process for Assessment and Mitigation of Early Wearout of Life limited Microcircuits*

SAE AS5553[2], *Counterfeit Electronic Parts; Avoidance, Detection, Mitigation, and Disposition*

SAE AS6174[3], *Counterfeit Materiel; Assuring Acquisition of Authentic and Conforming Materiel*

SAE AS 6496[4], *Fraudulent/Counterfeit Electronic Parts: Avoidance, Detection, Mitigation and Disposition – Authorised/Franchised Distribution*

SAE ARP 4761[5], *Guidelines and Methods for Conducting the Safety Assessment Process on Civil Airborne Systems and Equipment*

SAE ARP 5890[6], *Guidelines for Preparing Reliability Assessment Plans for Electronic Engine Controls*

SAE EIA-649[7], *Configuration Management Standard*

SAE EIA-933B[8], *Requirements for a COTS Assembly Management Plan*

---

[1] Reprinted with permission from the published version of SAE document SAE ARP 6338 (c) 2016 SAE International.

[2] Reprinted with permission from the published version of SAE document SAE AS5553 (c) 2016 SAE International.

[3] Reprinted with permission from the published version of SAE document SAE AS6174 (c) 2016 SAE International.

[4] Reprinted with permission from the published version of SAE document SAE AS6496 (c) 2016 SAE International.

[5] Reprinted with permission from the published version of SAE document SAE ARP 4761 (c) 2016 SAE International.

[6] Reprinted with permission from the published version of SAE document SAE ARP 5890 (c) 2016 SAE International.

[7] Reprinted with permission from the published version of SAE document SAE EIA-649 (c) 2016 SAE International.

[8] Reprinted with permission from the published version of SAE document SAE EIA-933 (c) 2016 SAE International.

SAE EIA-STD-4899[9], *Requirements for an Electronic Component Management Plan*

SAE GEIA-STD-0003[10], *Long Term Storage of Electronic Devices*

SAE GEIA-STD-0005-1[11], *Performance Standard for Aerospace and High Performance Electronic Systems Containing Lead-Free Solder*

SAE GEIA-STD-0008[12], D*erating of Electronic Components*

SAE GEIA-STD-0010[13], *Standard Best Practices for System Safety Program Development and Execution*

SAE STD-0016[14], S*tandard for Preparing a DMSMS Management Plan*

RoHS Directive, *Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (commonly known as the RoHS or Restriction of Hazardous Substances Directive).*
*http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:037:0019:0023:en:PDF*

RoHS Directive, *Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment ((commonly known as the RoHS 2).*
*http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:174:0088:0110:en:PDF*

REACh Regulation, *Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC.*
*http://www.hse.gov.uk/reach/reachtext.pdf*

_____

9 Reprinted with permission from the published version of SAE document SAE EIA-STD-4899 (c) 2016 SAE International.

10 Reprinted with permission from the published version of SAE document SAE GEIA-STD-0003 (c) 2016 SAE International. Document under development.

11 Reprinted with permission from the published version of SAE document SAE GEIA-STD-0005 (c) 2016 SAE International.

12 Reprinted with permission from the published version of SAE document SAE GEIA-STD-0008 (c) 2016 SAE International.

13 Reprinted with permission from the published version of SAE document SAE GEIA-STD-0010 (c) 2016 SAE International.

14 Reprinted with permission from the published version of SAE document SAE STD-0016 (c) 2016 SAE International.

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

3, rue de Varembé
PO Box 131
CH-1211 Geneva 20
Switzerland

Tel: + 41 22 919 02 11
Fax: + 41 22 919 03 00
info@iec.ch
www.iec.ch