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**Foreword**

ECSS is a cooperative effort of the European Space Agency, national space agencies and European industry associations for the purpose of developing and maintaining common standards. Requirements in this Standard are defined in terms of what shall be accomplished, rather than in terms of how to organize and perform the necessary work. This allows existing organizational structures and methods to be applied where they are effective, and for the structures and methods to evolve as necessary without rewriting the standards.

This Standard has been prepared by the Working Group, under the auspice of the ESCC Space Components Steering Board, reviewed by the ECSS Executive Secretariat and jointly approved by the ESCC SCSB and the ECSS Technical Authority.

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Change log

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Introduction

The objective of the EEE component selection, control, procurement and use requirements is to ensure that EEE components used in a space project enables the project to meet its mission requirements.

Important elements of EEE component requirements include:

1. component programme management,
2. component selection, evaluation and approval,
3. procurement,
4. handling and storage,
5. component quality assurance,
6. specific components, and
7. documentation.

The main tools which can be used to reach the objective are:

1. concurrent engineering,
2. standardization of component types,
3. characterization of components,
4. assessment of component manufacturers including declared competencies and processes,
5. testing, screening, lot acceptance and periodic testing,
6. procurement specifications,
7. control and inspection,
8. control of nonconforming materials,
9. assessment and use of existing component data,
10. application of specific control to mitigate risk for components with limited data or confidence, and
11. information management.

The basic approach is as follows:

* The customer of a given space project defines the EEE component requirements within the boundaries of this standard. They appear in the appropriate clauses of the project requirements as defined in ECSS-M-ST-10.
* The supplier defines a component control plan to implement those requirements into a system which enables, for instance, to control the selection, approval, procurement, handling in a schedule compatible with his requirements, and in a cost-efficient way.
* The supplier ensures that the applicable parts requirements are passed down to lower level suppliers and ensure that they are compliant to these parts requirements.

# Scope

This standard defines the requirements for selection, control, procurement and usage of EEE components for space projects.

This standard differentiates between three classes of components through three different sets of standardization requirements (clauses) to be met.

The three classes provide for three levels of trade-off between assurance and risk. The highest assurance and lowest risk is provided by class 1 and the lowest assurance and highest risk by class 3. Procurement costs are typically highest for class 1 and lowest for class 3. Mitigation and other engineering measures may decrease the total cost of ownership differences between the three classes. The project objectives, definition and constraints determine which class or classes of components are appropriate to be utilised within the system and subsystems.

1. Class 1 components are described in Clause 4.
2. Class 2 components are described in Clause 5
3. Class 3 components are described in Clause 6.

The requirements of this document apply to all parties involved at all levels in the integration of EEE components into space segment hardware and launchers.

This standard may be tailored for the specific characteristics and constraints of a space project in conformance with ECSS-S-ST-00.

# Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this ECSS Standard. For dated references, subsequent amendments to, or revision of any of these publications do not apply, However, parties to agreements based on this ECSS Standard are encouraged to investigate the possibility of applying the more recent editions of the normative documents indicated below. For undated references, the latest edition of the publication referred to applies.

|  |  |
| --- | --- |
| ECSS-S-ST-00-01 | ECSS system — Glossary of terms |
| ECSS-M-ST-10 | Space project management — Project planning and implementation |
| ECSS-Q-ST-10-09 | Space product assurance — Nonconformance control system |
| ECSS-Q-ST-20 | Space product assurance — Quality assurance |
| ECSS-Q-ST-30-11 | Space product assurance — Derating — EEE components |
| ECSS-Q-ST-60-03 | Space product assurance — ASIC, FPGA and IP Core product assurance |
| ECSS-Q-ST-60-05 | Space product assurance — Generic procurement requirements for hybrid |
| ECSS-Q-ST-60-12 | Space product assurance — Design, selection, procurement and use of die form monolithic microwave integrated circuits (MMICs) |
| ECSS-Q-ST-60-13 | Commercial electrical, electronic and electromechanical (EEE) components |
| ECSS-Q-ST-60-14 | Space product assurance – Relifing procedure – EEE components |
| ECSS-Q-ST-60-15 | Radiation hardness assurance – EEE components |
| ECSS-Q-ST-70 | Space product assurance — Materials, mechanical parts and processes |
| EN 61340-5-1 | Protection of electronic devices from electrostatic phenomena |
| ESCC 20200 | ESCC Basic Specification: Component Manufacturer Evaluation |
| ESCC 21004 | ESCC Basic Specification: Guidelines for incoming inspection of EEE components |
| ESCC 22500 | ESCC Basic Specification: Guidelines for displacement damage irradiation testing |
| ESCC 22800 | ESCC Basic Specification: ESA/SCC Non conformance Control System |
| ESCC 22900 | ESCC Basic Specification: Total Dose Steady-State Irradiation Test Method |
| ESCC 24900 | ESCC Basic Specification: Minimum requirements for controlling environmental contamination of components |
| ESCC 25500 | ESCC Basic Specification: Methodology for the detection of pure tin in the external surface finish of case and leads of EEE components |
| ESCC QPL | ESCC qualified part list (<https://escies.org>) |
| ESCC EPPL | ESCC European preferred parts list (<https://escies.org>) |
| ESCC QML | ESCC qualified manufacturers list (<https://escies.org>) |
| GEIA-STD-0005-2 (1 May 2012) | Standard for mitigating the effects of tin whiskers in aerospace and high performance electronic systems |
| MIL QPLs | MIL qualified parts lists |
| MIL QMLs | MIL qualified manufacturers lists |
| NPSL | NASA Parts Selection List |
| JAXA QPL | JAXA qualified parts list |
| JESD-201A (September 2008) | Environmental acceptance requirements for tin whisker susceptibility of tin and tin alloy surface finishes |
| JESD-22-A121A (July 2008) | Measuring whisker growth on tin and tin alloy surface finishes |
| ESCC, MIL, JAXA &CECC specifications and standards called in the document | |

# Terms, definitions and abbreviated terms

## Terms from other standards

For the purpose of this Standard, the terms and definitions from ECSS-S-ST-00-01 apply.

## Terms specific to the present standard

1. agent

organization contracted to perform the procurement of EEE components including related engineering and quality assurance tasks

1. characterization

determination of the attributes of an EEE component, in sufficient detail to allow assessment of its suitability for a particular use or application

1. commercial component

part neither designed, nor manufactured with reference to military or space standards

1. concurrent engineering

engineering activity taking place in the context of simultaneous design of the product, the production process and all associated product usages, in an integrated, multifunctional team, with external organizational constraints minimized

1. destructive physical analysis

series of inspections, tests and analyses performed on a sample of components to verify that the material, design and workmanship used for its construction, as well as the construction itself, meet the requirements of the relevant specification and are suitable for the intended application

1. franchised distributor

distributor officially and contractually authorised by the manufacturer

1. parts engineer

professional engineer with demonstratable specialisation in EEE components

1. parts procurer

supplier who procures components by himself or a parts procurement agent who procures parts for the supplier

1. qualified parts

parts belonging to QPLs or QMLs from the following normative systems: ESCC, MIL, JAXA, CECC

1. screening

tests, inspections or combination thereof, imposed on 100% of parts, to remove unsatisfactory items or those likely to exhibit early failures

1. space qualified parts

parts belonging to QPLs or QMLs from the following normative systems (ESCC, MIL) according to quality levels listed in Table 7‑1

* 1. 1 Space qualified parts are a subset of the qualified parts defined in clause 3.2.9.
  2. 2 Parts belonging to JAXA QPL are considered as space qualified provided the equivalence of the generic JAXA specification with the ESCC or MIL generic specifications has been established.

## Abbreviated terms

For the purpose of this Standard, the abbreviated terms from ECSS-S-ST-00-01 and the following apply:

|  |  |
| --- | --- |
| Abbreviation | Meaning |
| **ASIC** | Application specific integrated circuit |
| **CCD** | charge coupled device |
| **CCP** | Component control plan |
| **CDR** | critical design review |
| **CECC** | CENELEC electronic components committee |
| **CENELEC** | Comité Européen de Normalisation Electrotechnique |
| **CI** | conformance inspection |
| **CN** | change notice |
| **CoC** | certificate of conformance |
| **CPPA** | centralized parts procurement agent |
| **CR** | change request |
| **CSI** | customer source inspection |
| **CSV** | comma-separated values |
| **DCL** | declared components list |
| **DPA** | destructive physical analysis |
| **DRD** | document requirement definition |
| **EEE** | electrical, electronic, electromechanical |
| **EFR** | established failure rate |
| **EPPL** | European preferred parts list |
| **ESCC** | European space components coordination |
| **ESR** | equivalent serial resistance |
| **FPGA** | field programmable gate arrays |
| **GSE** | ground support equipment |
| **GSFC** | Goddard space flight center |
| **JAXA** | Japanese aerospace exploration agency |
| **JD** | justification document |
| **LAT** | lot acceptance test |
| **LED** | light emitting diode |
| **LVT** | lot validation testing |
| **MMIC** | microwave monolithic integrated circuit |
| **NASA** | national aeronautics and space administration |
| **NCR** | nonconformance report |
| **NPSL** | NASA parts selection list |
| **PA** | product assurance |
| **PAD** | part approval document |
| **PCB** | Parts Control Board |
| **PCN** | process change notice |
| **PDR** | preliminary design review |
| **PIND** | particle impact noise detection |
| **QCI** | quality conformance inspection |
| **QML** | qualified manufacturers list |
| **QPL** | qualified parts list |
| **RFD** | request for deviation |
| **RFW** | request for waiver |
| **RVT** | radiation verification testing |
| **SCSB** | Space Components Steering Board |
| **SEB** | single event burn‑out |
| **SEE** | single event effect |
| **SEFI** | single event functional interrupt |
| **SEGR** | single event gate rupture |
| **SEL** | single event latch‑up |
| **SET** | single event transient |
| **SEU** | single event upset |
| **TCI** | technology conformance inspection |
| **TRR** | test readiness review |
| **WFR** | Weibull failure rate |

## Conventions

1. The term “EEE component“ is synonymous with the terms "EEE Part", "Component" or just "Part".
2. The term “for approval” means that a decision of the approval authority is necessary for continuing the process.
3. The term “for review” means that raised reviewers comments are considered and dispositioned.
4. The term “for information” means that no comments are expected about the delivered item.
5. For the purpose of clear understanding of this document, hereunder is a listing of component categories which are covered by the term EEE component, encapsulated or non-encapsulated, irrespective of the quality level:
   1. Cable assemblies (high date Rate & RF, optical Fibre)
   2. Capacitors
   3. Connectors
   4. Crystals
   5. Discrete semiconductors (including diodes, transistors, microvwave)
   6. Filters
   7. Fuses
   8. Magnetic components (e.g. inductors, transformers, including in-house products)
   9. Monolithic Microcircuits (including MMICs)
   10. Oscillators
   11. Hybrid circuits
   12. Relays
   13. Resistors, heaters
   14. Surface acoustic wave devices
   15. Switches (including mechanical, thermal)
   16. Thermistors
   17. Wires and Cables
   18. Optoelectronic Devices (including opto‑couplers, LED, CCDs, displays, sensors)
   19. Passive Microwave Devices (including, for instance, mixers, couplers, isolators and switches)
6. Microwave switches consisting of multiple EEE components are considered as equipment. The requirements of this standard are applicable to the EEE parts they incorporate and to microwave switches having a simple design (single EEE part).

## Nomenclature

The following nomenclature applies throughout this document:

1. The word “shall” is used in this Standard to express requirements. All the requirements are expressed with the word “shall”.
2. The word “should” is used in this Standard to express recommendations. All the recommendations are expressed with the word “should”.

NOTE It is expected that, during tailoring, recommendations in this document are either converted into requirements or tailored out.

1. The words “may” and “need not” are used in this Standard to express positive and negative permissions, respectively. All the positive permissions are expressed with the word “may”. All the negative permissions are expressed with the words “need not”.
2. The word “can” is used in this Standard to express capabilities or possibilities, and therefore, if not accompanied by one of the previous words, it implies descriptive text.

NOTE In ECSS “may” and “can” have completely different meanings: “may” is normative (permission), and “can” is descriptive.

1. The present and past tenses are used in this Standard to express statements of fact, and therefore they imply descriptive text.

# Requirements for Class 1 components

## Component programme management

### General

ECSS-Q-ST-60\_0480001

<<deleted>>

### Components control programme

#### Organization

ECSS-Q-ST-60\_0480002

The supplier shall identify the organization responsible for the management of the component programme, and describe the organization’s approaches (including the procurement system and its rationale) and capability to efficiently implement, manage, and control the component requirements.

ECSS-Q-ST-60\_0480003

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#### Component control plan

ECSS-Q-ST-60\_0480004

The supplier shall prepare a Component Control Plan (CCP) in conformance with its DRD in Annex A.

ECSS-Q-ST-60\_0480492

The CCP may be part of the overall project PA plan.

ECSS-Q-ST-60\_0480006

The supplier shall submit the CCP to the customer for approval.

### Parts control board

ECSS-Q-ST-60\_0480007

The approval of the selection and usage of EEE parts shall be implemented through Parts Control Boards (PCBs) held between the customer and the supplier (or lower tier subcontractor).

ECSS-Q-ST-60\_0480008

At supplier's level, the Parts Control Board (PCB) shall be composed as follows:

chaired by a member of the supplier’s PA team with designated responsibility for components management,

include, as a minimum, in addition the suppliers’ parts engineer, the customer’s representative and the lower tier subcontractor parts engineers.

ECSS-Q-ST-60\_0480493

Other pertinent experts from the customer or suppliers may also participate, on request.

ECSS-Q-ST-60\_0480010

Depending on the progress of the program, the main PCB activities shall be:

To manage and control the part procurement programmes at all levels including the review and approval of the supplier’s EEE component control plan and associated documents,

To implement the Parts Approval cycle through PAD approval including review of part/manufacturer evaluation/qualification plan and test reports, status of qualification, approval of procurement specifications, quality and lot acceptance levels and procurement inspections, DPA, radiation sensitivity assessment information,

To assess parts technical issues such as Non-conformances, Waivers, Deviations and alerts and verify the implementation of mitigation measures.

1. PCB activity also includes to review the procurement status and to identify risks like U.S. parts under Export license restrictions, ITAR, all Long Lead Time Items.

### Declared components list

ECSS-Q-ST-60\_0480011

For each equipment, its supplier shall issue a DCL in an editable and sortable electronic format, as a minimum compatible with CSV, identifying all component types needed.

1. CSV is a common file format that can be used to transfer data between database or spreadsheet tables (a spreadsheet program is for example Excel®).

ECSS-Q-ST-60\_0480012

The list specified in 4.1.4a shall be kept under configuration control (issue and identification of changes).

ECSS-Q-ST-60\_0480013

The DCL shall be issued as a minimum at PDR and CDR (as designed) and before TRR (as built).

ECSS-Q-ST-60\_0480014

After equipment CDR, all modifications affecting the PAD and JD information shall be implemented, in the "as design" DCL and submitted to the customer for approval, before assembly.

ECSS-Q-ST-60\_0480015

The “as design” DCL shall be sent to the customer for approval.

ECSS-Q-ST-60\_0480016

Any change of parts during equipment manufacturing (e.g. type and manufacturer) shall be handled through RFWs submitted to the customer for approval before mounting.

ECSS-Q-ST-60\_0480017

The “as built” DCL reflecting the actual EEE parts assembled into the flight hardware and their date code, shall be provided before TRR to the customer for review and to end customer for information.

ECSS-Q-ST-60\_0480018

The content of the DCL shall be in conformance with its DRD in Annex B.

ECSS-Q-ST-60\_0480522

The supplier shall establish and update a consolidated “as design" DCL at its level and deliver it to the customer.

### Electrical and mechanical GSE

ECSS-Q-ST-60\_0480019

EEE components used in GSE, which are physically and directly interfacing to flight hardware, shall be:

Fit Form and Function compatible,

manufactured from materials identical to the flight opposite part, and

ensured to be visibly clean before each connection to flight hardware.

ECSS-Q-ST-60\_0480020

Flight hardware connector interfaces to GSE shall interface to a flight compatible connector, as per 4.1.5a.

1. This connector can be installed on the test harness or can be a saver.

### EQM components

ECSS-Q-ST-60\_0480523

EEE components used in Engineering Qualification Model (EQM) shall be fit, form and function representative of the flight components and be from the same manufacturers.

ECSS-Q-ST-60\_0480524

If thermal vacuum tests are performed on the EQM, the EEE parts shall be material representative of the FM parts.

## Component selection, evaluation and approval

### General

ECSS-Q-ST-60\_0480021

The supplier shall ensure that the following requirements are met during his selection process:

Project requirements (e.g. quality levels, component policy, manufacturing and delivery schedules and budgets, quantities),

Design requirements (e.g. component type, case, dimensions, materials),

Production requirements (e.g. packaging, thermal and storage constraints, component mounting process),

Operational requirements (e.g. electrical, mechanical, radiation, reliability, assembly, and lifetime).

1. The supplier of each product is responsible for the selection of components, which enable the performance, lifetime, environmental, material, safety, quality and reliability requirements of the product of which they form a part, to be satisfied in all respects.

ECSS-Q-ST-60\_0480491

The selection, evaluation and approval of commercial EEE components for class 1 programmes shall be performed in conformance with clause 4.2 from ECSS-Q-ST-60-13.

### Manufacturer and component selection

#### General rules

ECSS-Q-ST-60\_0480022

The supplier shall establish and maintain in his own facility, and ensure that his suppliers also establish and maintain, procedures for selecting and controlling all components intended for use in deliverable products.

ECSS-Q-ST-60\_0480023

Components shall be selected on the basis of proven qualification, characterization, and previous space experience and data, relevant with regard to the requirements for the programme, from manufacturers or sources (preferably European) employing effective Product Assurance Programmes in manufacturing and test.

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#### Parts and material restriction

ECSS-Q-ST-60\_0480028

The supplier shall ensure that non-hermetically sealed materials of components meet the requirements of ECSS-Q-ST-70 regarding off-gassing, out-gassing, flammability, toxicity and any other criteria specified for the intended use.

ECSS-Q-ST-60\_0480029

The supplier shall evaluate the robustness of selected EEE components against the stresses induced by the assembly techniques to be employed.

ECSS-Q-ST-60\_0480030

With respect to health and safety, beryllium oxide and lithium (except for the one which is identified in the procurement specification), cadmium, magnesium, mercury, zinc, radioactive material and all material which can cause safety hazards shall not be used.

ECSS-Q-ST-60\_0480031

For limited life duration, known instability, safety hazards or reliability risk reasons, the EEE components listed below shall not be used:

Hollow core resistors,

Potentiometers (except for mechanism position monitoring),

Non-metallurgically bonded diodes,

Semiconductor dice with unglassivated active area,

Wet slug tantalum capacitors other than capacitor construction using double seals and a tantalum case,

Any component whose internal construction uses metallurgic bonding with a melting temperature not compatible with the end-application mounting conditions,

TO5 relays without double welding of the mechanism to the header or with any type of integrated diodes inside,

Aluminium liquid electrolytic capacitors,

Tin coated wires and cables,

PVC insulated wires and cables,

Electromechanical parts in commercial grade,

Feedthrough filter in commercial grade,

Connectors without gold plating contact in commercial grade.

Components with bright tin plating (>97% tin) on terminations

1. Matte and bright tin definition according to JESD201.

ECSS-Q-ST-60\_0480032

For limited life duration, known instability, safety hazards or reliability risk reasons, EEE components listed below shall not be used for new designs:

RNC90 > 100 kOhm,

TO3 and DO4/DO5 packages,

Wire link fuses.

ECSS-Q-ST-60\_0480494

The use of pure tin in internal cavities may be authorized, on a case-by-case basis, based on the demonstration that there is no alternative product and there is no risk (supported by a technical justification).

ECSS-Q-ST-60\_0480034

As per 4.2.2.2f., the justification of the use of pure tin shall be presented during a PCB for customer’s approval.

ECSS-Q-ST-60\_0480035

The use of pure tin (inside or outside the part) shall be declared in the PAD or in the JD.

ECSS-Q-ST-60\_0480525

The customer shall specify either requirement 4.2.2.2j, or requirements 4.2.2.2k and 4.2.2.2l to handle risks linked with pure-tin terminations.

ECSS-Q-ST-60\_0480526

The following actions shall be performed by the supplier to control the pure-tin risk:

Collect and synthesize all information participating to the risk analysis in conformance with Clause 9.

Based on the risk analysis, elaborate a mitigation plan.

Include in the JD the risk analysis and mitigation plan for customer approval.

Before retinning of flight parts, document the hot solder dip process by a procedure to be submitted to customer for approval.

Perform evaluation tests, lot acceptance tests and screening tests of retinned components after the retinning process.

* 1. 1 The mitigation plan can include one or a combination of the following solutions:
     + Tin whisker sensitivity evaluation
     + Retinning of terminations with complementary evaluation,
     + Conformal coating,
     + Design modification.
  2. 2 Solder dip for tin whisker mitigation differs from solder dip for solderability in that for tin whisker mitigation, the termination is coated over its entire length, right up to the package surface (no stand off). As this process is critical it is good practice to evaluate it and control it well.

ECSS-Q-ST-60\_0480527

All the following conditions shall be fulfilled to use Parts with matte pure tin finish, >97% tin:

They pass the JESD-201A class 2 requirements or meet the GEIA-STD-0005-2/Level 2B requirements,

They are not used in power function, where both Voltage >15 V and Current >2 A conditions are applied at the same time,

They are not mechanically torqued on board or equipment.

ECSS-Q-ST-60\_0480528

If one of the three conditions specified in requirement 4.2.2.2k is not met, a mitigation plan shall be submitted to the customer for approval, through the JD approval process.

1. This mitigation plan can include, as an example, one of the following solutions:
   * + Conformal coating,
     + Design analysis and risk assessment versus a possible short circuit.

#### Preferred sources

ECSS-Q-ST-60\_0480036

Parts shall be chosen from the EPPL part I.

ECSS-Q-ST-60\_0480037

For parts not selected from the EPPL part I, the following sources shall be considered in the following order of precedence:

MIL QPL's and QML's, space level, and NSPL 1 when compatible with the project requirements,

EPPL part II,

NPSL level 2 or 3 when compatible with the project requirements.

1. For NPSL consider application notes.

ECSS-Q-ST-60\_0480038

Parts subject to export restrictions or regulations shall not be preferred.

ECSS-Q-ST-60\_0480024

Preference shall be given to components which necessitate the least evaluation or qualification effort.

ECSS-Q-ST-60\_0480025

Starting with the design phase of the project the supplier shall ensure maximum use of preferred and qualified components to achieve component reduction and standardization.

ECSS-Q-ST-60\_0480026

When selecting items, the supplier shall check the current data, applicability of the basis of qualification, problem notifications and alerts, and adequacy of specifications.

ECSS-Q-ST-60\_0480027

The supplier shall implement a type reduction activity.

#### Radiation hardness

ECSS-Q-ST-60\_0480039

The radiation requirements for EEE components are project specific, they shall be derived from the Mission Radiation Environment Specification defined in accordance with the DRD in Annex A of ECSS-Q-ST-60-15.

ECSS-Q-ST-60\_0480040

The supplier who is responsible for the design of the piece of hardware shall demonstrate the compliance of its components selection with the radiation constraints of the project.

ECSS-Q-ST-60\_0480041

For this demonstration, the supplier shall consider all types of radiation including cosmic (Heavy Ions), electromagnetic, trapped (charged particles – electrons, protons – in radiation belts) and solar (flares).

ECSS-Q-ST-60\_0480042

Due consideration shall be given to the mission orbit and trajectory, the duration, the associated spatial and temporal variations of the radiation environment as well as all protective factors such as shielding.

ECSS-Q-ST-60\_0480043

The supplier shall assess the actual radiation tolerance of the selected components for compliance with the radiation requirements in term of total dose, displacement damage and Single Events Effects (SEE).

ECSS-Q-ST-60\_0480044

The supplier shall identify components which are not compliant with the radiation requirements as critical radiation sensitive components.

ECSS-Q-ST-60\_0480045

The supplier shall implement a Radiation Hardness Assurance Programme, in conformance with the requirements of ECSS-Q-ST-60-15, documented by a plan to be approved by the customer, for radiation sensitive components, covering the collection of all relevant information and specifying the necessary actions in terms of evaluation and procurement testing, planning and control.

ECSS-Q-ST-60\_0480046

The supplier shall issue an Equipment Radiation Analysis document identifying all sensitive components w.r.t. the relevant radiation effects, possibly their impact and giving an adequate engineering solution (e.g. local shielding, design solution, specific test, and RVT) for the relevant equipment.

ECSS-Q-ST-60\_0480047

The Equipment Radiation Analysis document shall be submitted to the customer for approval.

1. More detailed information about the above requirements is given in ECSS-E-ST-10-12 and ECSS-Q-ST-60-15.

#### Derating

ECSS-Q-ST-60\_0480048

The supplier shall implement derating rules for components used in his designs in accordance with the requirements of ECSS-Q-ST-30-11.

ECSS-Q-ST-60\_0480049

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### Component evaluation

#### General

ECSS-Q-ST-60\_0480050

The supplier shall perform a component evaluation in absence of an approved demonstration that a component has the ability to conform to the requirements for functional performance, quality, dependability, and environmental resistance as required for the project.

ECSS-Q-ST-60\_0480051

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ECSS-Q-ST-60\_0480052

The scope and planning of the component evaluation shall be derived from the results of an assessment of the design and intended application of the component.

ECSS-Q-ST-60\_0480053

An evaluation plan shall be sent to the customer for approval, and include the following elements:

Component Manufacturer Assessment (as per clause 4.2.3.2),

Constructional Analysis (as per clause 4.2.3.3),

Evaluation Testing (as per clause 4.2.3.4),

Radiation Hardness (as per clause 4.2.3.4b.5).

ECSS-Q-ST-60\_0480054

In the definition of the evaluation programme any information including pertinent reliability, analysis and test data from the manufacturer of the component and previous use in comparable applications shall be considered and their relevance justified.

ECSS-Q-ST-60\_0480055

Omission of any of these elements, or the introduction of alternative activities, shall be justified.

ECSS-Q-ST-60\_0480056

All tests and inspections shall be carried out on representative samples of the component type from the current production of the manufacturer selected for the component procurement for the flight hardware.

ECSS-Q-ST-60\_0480057

For programmable devices, the representativeness shall include the programming hardware tools and the compatibility of the software.

ECSS-Q-ST-60\_0480058

The supplier shall review the evaluation results to determine their impact on the content of the procurement specification and amend it as necessary.

ECSS-Q-ST-60\_0480059

The supplier shall summarize the evaluation results in the evaluation report and send it to the customer for approval.

1. For guidance for the assessment of the space environmental aspects refer to ECSS-E-ST-10-04 and ECSS-E-ST-10-12.

#### Component manufacturer assessment

##### Purpose

The purpose of the manufacturer assessment is to determine its capability, to ensure the adequacy of its organization, plant and facilities, and to ascertain its fitness to supply components to the appropriate specifications for space application.

##### Requirements

ECSS-Q-ST-60\_0480060

The supplier shall perform an evaluation against the ESCC basic specification no. 20200 and the ancillary specifications for dedicated component families and shall include, but not necessarily be limited to, a survey of:

The overall manufacturing facility and its organization and management,

The manufacturer’s system for inspection and manufacturing control including all relevant specifications, procedures, and internal documents,

The production line used for the component.

ECSS-Q-ST-60\_0480061

The complete manufacturer assessment, including the survey report and the associated corrective actions, shall be part of the evaluation report.

#### Constructional analysis

ECSS-Q-ST-60\_0480062

Constructional analysis shall be carried out on representative components.

1. The primary aim is to provide an early indication of a component’s constructional suitability for meeting the specified performances of the space project application.

ECSS-Q-ST-60\_0480063

The Constructional Analysis shall comprise destructive and non-destructive inspections, analyses, and testing, to identify:

Design and construction technology,

Materials used,

Inherent reliability aspects,

Quality of workmanship,

Potential hazards.

ECSS-Q-ST-60\_0480064

The findings of the analysis shall be contained within a Constructional Analysis Report and shall be included in the Evaluation Report.

#### Evaluation testing

ECSS-Q-ST-60\_0480065

The evaluation shall determine which inspections or tests are required to provide the confidence that the component type under evaluation, when assembled and tested in accordance with the procurement specification, successfully meets the project requirements.

ECSS-Q-ST-60\_0480066

The supplier shall review the already existing data in order to adapt and minimize the content of the evaluation testing while ensuring that there are inputs and pertinent results covering the following topics:

Endurance test (operating at elevated temperature and electrical stress),

Mechanical stress (shock, vibration, constant acceleration),

Environmental stress (thermal shock, temperature cycling, high and low temperature storage, humidity),

Assembly capability testing,

Radiation testing, for total dose, displacement effects and single event effects sensitivity.

1. For guidance refer to ESCC basic specification no. 22600 and the ancillary specifications for dedicated component families and to ESCC basic specifications 22900, 22500 and 25100.

### Parts approval

ECSS-Q-ST-60\_0480067

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ECSS-Q-ST-60\_0480068

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ECSS-Q-ST-60\_0480069

The supplier shall maintain a system of traceability of the acceptance and approval of each component used in flight products.

ECSS-Q-ST-60\_0480070

The approval process by the customer depends on the part qualification status and shall be organized as follows:

Space qualified parts: Space qualified parts listed in the DCL are approved through the DCL review except in the following cases where a PAD in conformance with ECSS-Q-ST-60 Annex D is delivered for customer's approval:

additional controls are required (e.g. precap, buy-off, LAT or LVT, RVT, DPA),

used outside the specified limits,

specific tests are required during procurement as per Table 7‑1,

Other HiRel parts: A PAD in accordance with ECSS Q-ST-60 Annex D is delivered to customer for approval

Commercial parts: A Justification Document in accordance with ECSS-Q-ST-60-13 Annex F is delivered to customer for approval.

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ECSS-Q-ST-60\_0480071

In case the evaluation results are changing the procurement conditions documented in the PAD or the JD (as per clause 4.2.3.1), a new revision of PAD or the JD shall be submitted to the customer for approval.

ECSS-Q-ST-60\_0480529

The parts approval process, including PAD and JD approval, shall be completed prior to CDR, or MRR for recurring units if there is no CDR.

The previous use or approval of a part via PAD, JD in any other project shall not be included as an automatic approval for the present program.

1. The pertinence of the heritage in terms of mission profile and requirements is assessed as well as all the deviations (e.g. RFDs, RFWs, special dispositions for a specific space program) previously accepted.

All programmable devices shall be subject to PAD approval.

1. Programmable devices are considered non-standard parts.

Hybrids, ASICs and MMICs shall be covered by PAD even if included in Capability Approval List, QML, QPL.

For ASICs built on space qualified technologies, the PAD may be replaced, if agreed with the customer, by information embedded in the DCL.

## Component procurement

### General

ECSS-Q-ST-60\_0480072

The supplier shall ensure that all procured components meet the programme requirements with respect to inspection, screening and tests.

ECSS-Q-ST-60\_0480073

Class 1 components shall meet the quality levels ands supplementary conditions specified in Table 7‑1.

ECSS-Q-ST-60\_0480074

The supplier shall be responsible for manufacturer surveillance and control throughout the procurement programme.

ECSS-Q-ST-60\_0480075

For non qualified parts, the supplier shall put in place a configuration control system to ensure that any change of the product (e.g. mask, manufacturing and assembly process) affecting evaluation, performance, quality, reliability and interchangeability is communicated to him by the manufacturer (e.g. PCN).

ECSS-Q-ST-60\_0480076

The supplier shall ensure the compatibility of the change with its application and update all the related documentation.

1. For example: RFD, PAD, JD evaluation.

ECSS-Q-ST-60\_0480077

In case of documentation update, the change shall be submitted to the customer for approval.

ECSS-Q-ST-60\_0480078

To reduce the risk of procuring counterfeit components, when parts are not directly procured from the manufacturer, the supplier shall procure parts only from distributors duly franchised by the parts manufacturer.

ECSS-Q-ST-60\_0480447

The procurements of the commercial EEE components for class 1 programs shall be performed in conformance with the requirements of clause 4.3 of ECSS-Q-ST-60-13.

The supplier shall establish an attrition policy and corresponding rules which consider the specific criticality of each EEE component family.

### Procurement specification

ECSS-Q-ST-60\_0480079

The supplier shall procure EEE components according to controlled specifications.

ECSS-Q-ST-60\_0480080

International specifications systems, recognized as suitable for space applications (e.g. ESCC, MIL), shall be used by the supplier.

ECSS-Q-ST-60\_0480081

Any new specification shall be prepared and designed by the supplier as per existing international specification systems (ESCC, MIL). Preference shall be given to ESCC format when agreed by the manufacturer.

ECSS-Q-ST-60\_0480082

The content of any new specification shall be in conformance with Annex C.

ECSS-Q-ST-60\_0480083

The use of any new specification shall be submitted to the customer for approval through the PAD process (see clause 4.2.4)

ECSS-Q-ST-60\_0480084

Upon request, any new procurement specification prepared in the frame of the project, shall be delivered to the customer.

ECSS-Q-ST-60\_0480085

The supplier shall keep each procurement specification under configuration control.

### Screening requirements

ECSS-Q-ST-60\_0480086

All components to be incorporated into flight standard hardware shall be subjected to screening.

ECSS-Q-ST-60\_0480087

The screening test requirements shall be defined such that accumulated stress does not jeopardize component reliability.

ECSS-Q-ST-60\_0480088

All screening tests shall be performed at the component manufacturer’s premises or at a facility approved either by the qualification approval authority, where applicable (e.g. ESCC), or otherwise by the supplier.

ECSS-Q-ST-60\_0480089

The quality levels defined in Table 7‑1 shall apply.

ECSS-Q-ST-60\_0480090

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ECSS-Q-ST-60\_0480448

When a component is available in a qualified version according to quality level specified in Table 7‑1 it shall be selected.

ECSS-Q-ST-60\_0480449

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ECSS-Q-ST-60\_0480450

In case of X-rays or CT scan inspection, the total dose deposited and exposure time shall not deteriorate part performance or reliability.

### Initial customer source inspection (precap)

ECSS-Q-ST-60\_0480091

The procurement entity shall carry out, at the manufacturer’s premises, a customer precap inspection for non-space qualified parts listed below:

Capacitors (ceramic, mica and plastic film)

Crystals

Oscillators

Discrete semiconductors (including diodes and transistors)

Filters

Fuses (cermet)

Inductors, coils and transformers (not applicable to in-house products)

Monolithic microcircuits (including MMICs)

Hybrid circuits

Relays

Resistors (high precision, fixed, metal foil – RNC90)

Switches (including mechanical and thermal)

Optoelectronic devices (e.g. opto-couplers, LEDs, CCDs and sensors)

Cable assembly.

1. As a reminder: Precap inspection is not needed for chip components.

ECSS-Q-ST-60\_0480092

The procurement entity shall carry out, at the manufacturer’s premises, a customer precap inspection on critical space qualified parts , including as a minimum relays, oscillators and hybrids.

ECSS-Q-ST-60\_0480093

When not covered by MIL or ESCC specifications, methods and accept/reject criteria for customer’s precap inspection shall be documented by a procedure to be presented to the customer, on request, for review.

1. For guidance refer to the basic specificaton ESCC 21002.

### Lot acceptance

ECSS-Q-ST-60\_0480094

The supplier shall ensure that any lot/date code of EEE parts is submitted to a lot acceptance procedure, in line with applied normative systems, according to the following rules:

Space qualified parts:

ESCC: user’s lot acceptance on the procured lot/date code is not required due to periodic lot validation testing performed by the manufacturer.

MIL: QCI or TCI performed by the manufacturer is in accordance with the quality level of the MIL specification.

Other HiRel qualified parts:

The content of the lot acceptance is ESCC level LAT1 or level LAT2 or LVT (subgroups 1, 2 and 3) or comparable QCI.

The lot acceptance may be replaced by the review of available data less than 2 years old and provided there have been no changes to the manufacturing process and no changes to the part design and construction.

In case of partial available data, any complementary lot acceptance content is defined by the supplier subject to PCB agreement.

The PCB documents and justifies any reduced lot acceptance based on available data for customer approval.

Commercial parts:

The content of the lot acceptance is defined according to information provided by the justification document according to ECSS-Q-ST-60-13.

The proposed lot acceptance is approved through the approval process in accordance with clause 4.2.4.

1. LAT1 is required unless reliability data are available on the same package from the same manufacturer.

ECSS-Q-ST-60\_0480095

The sample size for lot acceptance which may be reduced in some cases, shall be submitted to the customer for approval through the PAD process (see clause 4.2.4).

Components from lot acceptance shall be considered as destructive as defined in ESCC or MIL specifications / test methods.

### Final customer source inspection (buy-off)

ECSS-Q-ST-60\_0480096

The procurement entity shall carry out, at the manufacturer’s premises, a final customer source inspection for non-space qualified parts, based on inspections, tests and review activities to verify that the requirements of the purchase order are met prior to shipment of the flight parts.

ECSS-Q-ST-60\_0480097

The buy-off shall include:

External visual inspection,

Witnessing electrical measurements,

Verifying mechanical dimensions,

Review and verification of the data-package.

1. For guidance refer to ESCC basic specification no. 21003.

ECSS-Q-ST-60\_0480495

The buy-off may be replaced by an incoming inspection at the procurement entity's facilities.

ECSS-Q-ST-60\_0480099

If the buy-off is replaced by an incoming inspection at the procurement entity's facilities, it shall be declared in the PAD submitted to the customer for approval.

### Incoming inspections

ECSS-Q-ST-60\_0480100

The procurement entity shall perform incoming inspection at his premises on all components to verify conformance with the purchase order requirements.

ECSS-Q-ST-60\_0480101

The incoming inspection shall be performed as follows:

For any part: the minimum inspections required in ESCC 21004.

For the non-space qualified parts, when the final customer source inspection has not been performed, the following additional items:

External visual inspection by sampling (AQL 0,65% level II or 20 parts min)

Electrical measurements at room temperature on 20 parts or 100% (if lot size < 20 parts), or a datapackage review.

ECSS-Q-ST-60\_0480102

The incoming inspection shall be documented by a procedure to be presented, on request, to the customer for review.

ECSS-Q-ST-60\_0480496

If the parts have passed successfully a final CSI (or buy-off), the incoming inspection may be reduced to the following minimum:

Verification of the manufacturer’s CoC

Packing checking,

Quantity verification.

ECSS-Q-ST-60\_0480497

In case the incoming inspection has been performed by a procurement agent, the incoming inspection performed by the end-user, may be reduced to the following minimum:

Packing checking,

Quantity verification.

### Radiation verification testing

ECSS-Q-ST-60\_0480105

Radiation sensitive components, as defined in clause 4.2.2.4, and for which applicable existing test data is insufficient shall be subjected to RVT.

ECSS-Q-ST-60\_0480106

RVT shall be performed in accordance with internationally recognized standards, such as ESCC Basic Specifications No. 22900 and 22500.

1. Additional information on test methods is given in MIL-STD-750 Test Method 1019, MIL-STD-883 Test Method 1019.

ECSS-Q-ST-60\_0480107

In such a case, a PAD in conformance with Annex D shall be issued and processed as per clause 4.2.4.

ECSS-Q-ST-60\_0480108

The results of RVT shall be documented by a report.

ECSS-Q-ST-60\_0480109

When RVT is performed in the frame of the project, the supplier shall send the related report to the customer for information.

### Destructive physical analysis

ECSS-Q-ST-60\_0480110

The DPA shall be performed on 3 samples per lot/date code for non-space qualified parts belonging to the following categories:

Capacitors (glass, ceramic, tantalum and variable)

Crystals

Oscillators

Discrete semiconductors (including diodes and transistors)

Filters

Monolithic microcircuits (including MMICs)

Hybrid circuits

Relays

Switches (including mechanical and thermal)

Optoelectronic devices (e.g. opto-couplers, LED’s, CCD’s and sensors)

Passive microwave devices (e.g. mixers, couplers, isolators and switches)

MEMS

Sensors

Other component type where DPA is necessary based on outcome from the evaluation, for validation during PCB.

ECSS-Q-ST-60\_0480111

The DPA shall be performed on 3 samples per lot/date code on critical space qualified parts, including as a minimum relays and oscillators and when required in Table 7‑1, which is validated during PCB.

1. DPA can be performed on samples submitted to either endurance or radiation tests.

ECSS-Q-ST-60\_0480498

DPA may be carried out on representative samples of the components families when the following three conditions are met:

procured from the same manufacturer and same package without major change in the process,

with a limited datecode range of 13 weeks,

approved by the customer through the PAD process.

1. In complement of above conditions, for series of integrated circuits, series of thermal switches, series of active discrete and series of passive components (e.g. 54xxxx, 1N63xx, …), representative samples can be from the same family considering technology limit and their complexity.

ECSS-Q-ST-60\_0480113

The DPA sample size may be reduced if approved by the customer through the PAD process.

ECSS-Q-ST-60\_0480114

The DPA process shall be documented by a procedure to be submitted , on request, to the customer for information.

1. For guidance refer to the basic specificaton ESCC 21001.

ECSS-Q-ST-60\_0480115

The supplier shall verify that the outcome of the DPA is satisfactory prior to the installation of the components into flight hardware.

ECSS-Q-ST-60\_0480499

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ECSS-Q-ST-60\_0480500

DPA may be performed by the manufacturer if agreed by the supplier .

ECSS-Q-ST-60\_0480118

For health and safety reasons, any test producing beryllium oxide dust shall be omitted.

ECSS-Q-ST-60\_0480119

The results of DPA shall be documented by a report sent to the customer, on request, for information.

### Relifing

ECSS-Q-ST-60\_0480451

When components from a supplier’s or parts procurement agent’s stock are used, the following criteria shall be met:

The parts are stored according to the minimum conditions given in clause 4.4,

The minimum overall requirements (including screening) are in accordance with the project requirements,

The lot/date code homogeneity and traceability can be demonstrated,

The EEE parts documentation is available and the content is acceptable in accordance with the project requirements (including radiation data, if necessary),

There are no open NCR’s and no unresolved alerts with respect to their date code.

ECSS-Q-ST-60\_0480121

For components meeting the criteria specified in requirement 4.3.10a, and which have a lot / date code exceeding the period defined in ECSS-Q-ST-60-14 clause 5, the relifing procedure ECSS-Q-ST-60-14 shall apply to the lot.

### Manufacturer’s data documentation deliveries

ECSS-Q-ST-60\_0480122

The manufacturer’s CoC shall be delivered to the parts procurer.

ECSS-Q-ST-60\_0480123

Any other data (i.e. LAT or LVT, QCI orTCI), defined in the applicable procurement documents, shall be available at the manufacturer’s facilities or delivered to the parts’ procurer in line with the purchase order, as a minimum compatible with CSV.

1. CSV is a common file format that can be used to transfer data between database or spreadsheet tables (a spreadsheet program is for example Excel®).

ECSS-Q-ST-60\_0480124

For non qualified parts, the parts procurer shall store the documentation for a minimum of 15 years after reception of the components.

1. For qualified parts, the documentation storage period is under the responsibility of the manufacturer and the qualifying authority.

## Handling and storage

ECSS-Q-ST-60\_0480125

The supplier shall establish and implement procedures for handling and storage of components in order to prevent possible degradation.

1. For guidance, refer to the basic specification ESCC 20600.

ECSS-Q-ST-60\_0480126

The procedures shall be applicable at any facility dealing with components for flight application.

ECSS-Q-ST-60\_0480127

On request, handling and storage procedures shall be sent to the customer for review.

ECSS-Q-ST-60\_0480128

As a minimum, the following areas shall be covered:

Control of the environment in accordance with ESCC Basic Specification No. 24900.

Measures and facilities to segregate and protect components during receiving inspection, storage, and delivery to manufacturing.

Control measures to ensure that electrostatic discharge susceptible components are identified and handled only by trained personnel using anti static packaging and tools.

Corrosion, moisture or process sensitive components, as classified in compliance with IPC/JEDEC J-STD-020, ECA/IPC/JEDEC J-STD-075 or other documented classification procedure, shall be handled in accordance with J-STD-033 or other documented classification procedure.

1. See IPC-1602 for further information on moisture sensitive printed boards.

An ESD Control Programme in accordance with EN 61340-5-1 shall be developed and implemented by the supplier.

1. EN 61340-5-1 guideline can be used for editing the ESD Control Programme.

The process for the selection of new components shall include their ESD sensitivity.

If ultra-sensitive devices classified in compliance with the classes defined in EN 61340-5-1, a dedicated ESD Control Programme for ultra-sensitive devices shall be developed and implemented by the supplier.

## Component quality assurance

### General

ECSS-Q-ST-60\_0480129

The supplier shall establish and implement the requirements of this document including methods, organizations and documents used to control the selection and procurement of components in accordance with the requirements of ECSS‑Q-ST-20.

### Nonconformances or failures

ECSS-Q-ST-60\_0480130

The supplier shall establish and maintain a nonconformance control system in accordance with the general requirements in ECSS-Q-ST-10-09.

ECSS-Q-ST-60\_0480131

Any observed deviation of EEE components from requirements as laid down in applicable specifications, procedures and drawings shall be controlled by the nonconformance control system.

1. This includes failures, malfunctions, deficiencies and defects.

ECSS-Q-ST-60\_0480132

The nonconformance control system shall handle all nonconformances occurring on EEE components during:

Manufacture (if available), screening and acceptance tests,

Incoming inspection,

Integration and test of equipment,

Storage and handling.

ECSS-Q-ST-60\_0480133

For ESCC qualified components the supplier shall apply the ESCC basic specification no 22800.

### Alerts

ECSS-Q-ST-60\_0480134

The supplier shall take into account all received alerts, errata sheets from international alert systems, from manufacturers or sent by the customer and shall validate that there are no alerts related to the intended applications and the recommendations of alerts were taken into account.

ECSS-Q-ST-60\_0480135

If alerts become available at a later stage, the supplier shall analyse the alerts, analyse the project risk and propose an action plan for customer approval.

ECSS-Q-ST-60\_0480136

The supplier shall initiate and distribute within the project notifications for all major problems arising on EEE parts during procurement, incoming inspection or during all levels of equipment manufacturing or testing, which are of general concern.

### Traceability

ECSS-Q-ST-60\_0480137

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ECSS-Q-ST-60\_0480138

The traceability shall be maintained through incoming, storage, and installation at the procurer and user of the component.

ECSS-Q-ST-60\_0480139

In any case, the traceability requirements imposed by the supplier on the EEE parts manufacturer or distributor shall allow managing the adequacy of the tests performed by the supplier (i.e. evaluation, lot validation, any additional test or inspection).

ECSS-Q-ST-60\_0480140

The traceability of EEE parts during installation in equipment, shall be ensured by the supplier through maintaining the traceability to the manufacturer’s lot/date code number of the EEE parts actually mounted.

ECSS-Q-ST-60\_0480141

If the as built DCL has not yet been delivered, the supplier shall be able to provide this information (part type actually installed with its relevant lot/date code number) within one week.

### Lot homogeneity for sampling test

ECSS-Q-ST-60\_0480142

If tests are performed by sampling, the sampled parts shall be selected so that they are representative of the lot/date code distribution.

ECSS-Q-ST-60\_0480143

For radiation tests, the set of test samples shall be in accordance with ECSS-Q-ST-60-15.

## Specific components

### General

ECSS-Q-ST-60\_0480144

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### ASICs

ECSS-Q-ST-60\_0480145

For the development and re-use of ASICs ECSS-Q-ST-60-03 shall apply..

### Hybrids

ECSS-Q-ST-60\_0480146

The hybrids shall be procured in conformance with the specifications listed in Table 7‑1.

ECSS-Q-ST-60\_0480452

Selection and validation of the hybrids manufacturers shall conform to clauses 5 and 6 of ECSS-Q-ST-60-05 and design of hybrids to clause 7 of ECSS-Q-ST-60-05.

ECSS-Q-ST-60\_0480453

The list of add-on parts shall be provided to the customer..

### One time programmable and reprogrammable devices

ECSS-Q-ST-60\_0480147

For the development, re-use and maintenance of FPGAs, ECSS-Q-ST-60-03 shall apply.

ECSS-Q-ST-60\_0480148

<<deleted>>

ECSS-Q-ST-60\_0480501

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ECSS-Q-ST-60\_0480150

One time programmable components shall be submitted to a post-programming sequence.

ECSS-Q-ST-60\_0480151

For one time programmable FPGA and PROM without a clear and defined heritage, a post-programming burn-in shall be applied, in conformance with ESCC9000 subclause 8.16, for a minimum duration of 160 h.

1. FPGA and PROM with defined heritage are documented in these reports: ESCC REP 010 and ESCC REP011, available on <https://escies.org>.

ECSS-Q-ST-60\_0480152

The supplier shall prepare a post-programming procedure for customer’s approval, depending on part types.

1. This includes, if applicable:
   * + electrical test conditions,
     + programming conditions and equipment,
     + programming software version qualified by the supplier,
     + burn-in conditions,
     + additional screening tests, and
     + specific marking after programming.

ECSS-Q-ST-60\_0480153

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ECSS-Q-ST-60\_0480502

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### Microwave monolithic integrated circuits

ECSS-Q-ST-60\_0480155

Design, selection, procurement and use of the microwave monolithic integrated circuits shall be performed in conformance with the requirements from ECSS-Q-ST-60-12.

### Connectors

ECSS-Q-ST-60\_0480530

For connectors with removable contacts, contacts shall be procured from the same manufacturer as the connector in which they are mounted.

### High Voltage Application

For high voltage applications and high power microwave EEE components the compatibility with operation in vacuum and partial pressure shall be verified.

1. Refer to ECSS-E-HB-20-05 for a definition for High voltage application.

### Self Made Magnetics

Self made Magnetics parts shall be designed and screened using MIL-STD-981 or equivalent.

Minimum screening of Self made Magnetics parts on a 100 % basis shall include:

visual inspection,

electrical measurements before test,

thermal cycling,

high temperature storage (minimum 96h) (optional),

final electrical measurements.

## Documentation

ECSS-Q-ST-60\_0480156

Any result from inspection or control shall be documented (including, precap, lot acceptance, buy-off, incoming, relifing and complementary tests).

Table 4‑1: Document requirements list for Class 1 components

| Document | Clause | Customer | Comments |
| --- | --- | --- | --- |
| Component control plan | 4.1.2.2 | Approval |  |
| “as design” DCL | NOTE | Approval |  |
| RFW during equipment manufacturing  *(after “as design” DCL and before “as built” DCL)* | NOTE | Approval |  |
| “as built” DCL | NOTE | Review |  |
| Technical note for parts having pure tin in internal cavities  *(as info can go on PAD)* | 4.2.2.2 | Approval | When applicable |
| Radiation hardness assurance plan | 4.2.2.4 | Approval | to document the radiation hardness assurance programme |
| Equipment radiation analysis document | 4.2.2.4 | Approval |  |
| Evaluation plans | 4.2.3.1 | Approval |  |
| Evaluation reports | 4.2.3.1 | Approval |  |
| PAD’s | 4.2.4 | Approval |  |
| Justification Documents | 4.2.4 | Approval | applicable for commercial parts |
| Change on EEE parts | 4.3.1 | Approval |  |
| Procurement specifications prepared in the frame of the project | 4.3.2 | Approval |  |
| PIND test method for DO4, DO5 & TO3 packages | 4.3.3 | Approval | Only for old design |
| Procedure for customer precap | 4.3.4 | Review  (on request) | when not covered by ESCC or MIL specifications |
| Procedure for incoming | 4.3.7 | Review  (on request) |  |
| RVT reports when RVT is performed in the frame of the project | 4.3.8 | Information |  |
| Procedure for DPA | 4.3.9 | Information  (on request) |  |
| DPA reports | 4.3.9 | Information  (on request) |  |
| Procedure for handling and storage of EEE parts | 4.4 | Review  (on request) |  |
| Action plan for alerts | 4.5.3 | Approval |  |
| Procedure for post-programming sequence | 4.6.3c | Approval |  |

# Requirements for Class 2 components

## Component programme management

### General

ECSS-Q-ST-60\_0480157

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### Components control programme

#### Organization

ECSS-Q-ST-60\_0480158

The supplier shall identify the organization responsible for the management of the component programme, and describe the organization’s approaches (including the procurement system and its rationale) and capability to efficiently implement, manage, and control the component requirements.

#### Component control plan

ECSS-Q-ST-60\_0480159

The supplier shall prepare a compliance matrix to the clauses of this standard.

ECSS-Q-ST-60\_0480160

The supplier shall submit his compliance matrix to the customer for approval.

### Parts Control Board

ECSS-Q-ST-60\_0480161

The approval of the selection and usage of EEE parts shall be implemented through Parts Control Boards (PCBs) held between the customer and the supplier (or lower tier subcontractor).

ECSS-Q-ST-60\_0480162

At supplier's level, the Parts Control Board (PCB) shall be composed as follows:

chaired by a member of the supplier’s PA team with designated responsibility for components management,

include, as a minimum, in addition the suppliers’ parts engineer, the customer’s representative and the lower tier subcontractor parts engineers.

ECSS-Q-ST-60\_0480503

Other pertinent experts from the customer or suppliers may also participate, on request.

ECSS-Q-ST-60\_0480164

Depending on the progress of the program, the main PCB activities shall be:

To manage and control the part procurement programmes at all levels including the review and approval of the supplier’s EEE component control plan and associated documents,

To implement the Parts Approval cycle through PAD approval including review of part/manufacturer evaluation/qualification plan and test reports, status of qualification, approval of procurement specifications, quality and lot acceptance levels and procurement inspections, DPA, radiation sensitivity assessment information,

To assess parts technical issues such as Non-conformances, Waivers, Deviations and alerts and verify the implementation of mitigation measures,

Upon customer’s request, assessment activities (by sampling) including:

conformity of procurement conditions,

conformity of procurement data,

post-procurement data, and

application of alerts recommendations

* 1. 1 PCB activity also include to review the procurement status and to identify risks like U.S. parts under Export license restrictions, ITAR, all Long Lead Time Items.
  2. 2 Customer request depends on from the criticality of the equipment or supplier.
  3. 3 For (a) to (c), assessment of the procurement conditions, conformity of procurement and post-procurement data is performed versus approval document.

### Declared Components List

ECSS-Q-ST-60\_0480165

For each equipment, its supplier shall issue a DCL in an editable and sortable electronic format, as a minimum compatible with CSV, identifying all component types needed.

1. CSV is a common file format that can be used to transfer data between database or spreadsheet tables (a spreadsheet program is for example Excel®).

ECSS-Q-ST-60\_0480166

The list specified in 5.1.4a shall be kept under configuration control (issue and identification of changes).

ECSS-Q-ST-60\_0480167

The DCL shall be issued as a minimum at PDR and CDR (as designed) and before TRR (as built).

ECSS-Q-ST-60\_0480168

After equipment CDR, all modifications affecting the PAD and JD information shall be implemented in the "as design" DCL and submitted to the customer for approval, before assembly.

ECSS-Q-ST-60\_0480169

The “as design” DCL shall be sent to the customer for approval.

ECSS-Q-ST-60\_0480170

Any change of parts during equipment manufacturing (e.g. type and manufacturer) shall be handled through RFWs submitted to the customer for approval before mounting.

ECSS-Q-ST-60\_0480171

The “as built” DCL reflecting the actual EEE parts assembled into the flight hardware and their date code, shall be provided before TRR to the customer for review and to end customer for information.

ECSS-Q-ST-60\_0480172

The content of the DCL shall be in conformance with its DRD in Annex B.

ECSS-Q-ST-60\_0480531

The supplier shall establish and update a consolidated “as design" DCL at his level and deliver it to the customer.

### Electrical and mechanical GSE

ECSS-Q-ST-60\_0480173

EEE components used in GSE, which are physically and directly interfacing to flight hardware, shall be:

Fit Form and Function compatible,

manufactured from materials identical to the flight opposite part, and

ensured to be visibly clean before each connection to flight hardware.

ECSS-Q-ST-60\_0480174

Flight hardware connector interfaces to GSE shall interface to a flight compatible connector, as per 5.1.5a.2.

1. This connector can be installed on the test harness or can be a saver.

### EQM components

ECSS-Q-ST-60\_0480532

EEE components used in Engineering Qualification Model (EQM) shall be fit, form and function representative of the flight components and be from the same manufacturers.

ECSS-Q-ST-60\_0480533

If thermal vacuum tests are performed on the EQM, the EEE parts shall be material representative of the FM parts.

## Component selection, evaluation and approval

### General

ECSS-Q-ST-60\_0480175

The supplier shall ensure that the following requirements are met during his selection process:

Project requirements (e.g. quality levels, component policy, manufacturing and delivery schedules and budgets, and quantities),

Design requirements (e.g. component type, case, dimensions, and materials),

Production requirements (e.g. packaging, thermal and storage constraints, component mounting and process),

Operational requirements (e.g. electrical, mechanical, radiation, reliability, assembly, and lifetime).

1. The supplier of each product is responsible for the selection of components, which enable the performance, lifetime, environmental, material, safety, quality and reliability requirements of the product of which they form a part, to be satisfied in all respects.

ECSS-Q-ST-60\_0480454

The selection, evaluation and approval of commercial EEE components for class 2 programmes shall be performed in conformance with clause 5.2 from ECSS-Q-ST-60-13.

### Manufacturer and component selection

#### General rules

ECSS-Q-ST-60\_0480176

The supplier shall establish and maintain in his own facility, and ensure that his suppliers also establish and maintain, procedures for selecting and controlling all components intended for use in deliverable products.

ECSS-Q-ST-60\_0480177

Components shall be selected on the basis of proven qualification, characterization, and previous space experience and data, relevant with regard to the requirements for the programme, from manufacturers or sources (preferably European) employing effective Product Assurance Programmes in manufacturing and test.

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<<deleted and moved to 5.2.2.3b>>

#### Parts and material restriction

ECSS-Q-ST-60\_0480180

The supplier shall ensure that non-hermetically sealed materials of components meet the requirements of ECSS-Q-ST-70 regarding off-gassing, out-gassing, flammability, toxicity and any other criteria specified for the intended use.

ECSS-Q-ST-60\_0480181

The supplier shall evaluate the robustness of selected EEE components against the stresses induced by the assembly techniques to be employed.

ECSS-Q-ST-60\_0480182

With respect to health and safety, beryllium oxide and lithium (except for the one which is identified in the procurement specification), cadmium, magnesium, mercury, zinc, radioactive material and all material which can cause safety hazard shall not be used.

ECSS-Q-ST-60\_0480183

For limited life duration, known instability, safety hazard or reliability risk reasons, the EEE components listed below shall not be used:

Hollow core resistors,

Potentiometers (except for mechanism position monitoring),

Non-metallurgically bonded diodes,

Semiconductor dice with unglassivated on active area,

Wet slug tantalum capacitors other than capacitor construction using double seals and a tantalum case,

Any component whose internal construction uses metallurgic bonding with a melting temperature not compatible with the end-application mounting conditions,

TO5 relays without double welding of the mechanism to the header or with any type of integrated diodes inside.

Aluminium liquid electrolytic capacitors,

Tin coated wires and cables,

PVC insulated wires and cables,

Electromechanical parts in commercial grade,

Feedthrough filter in commercial grade,

Connectors without gold plating contact in commercial grade,

Components with bright tin plating (>97% tin) on terminations.

1. Matte and bright tin definition according to JESD201.

ECSS-Q-ST-60\_0480184

For limited life duration, known instability, safety hazards or reliability risk reasons, EEE components listed below shall not be used for new designs:

RNC90 > 100 kOhm,

TO3 and DO4/DO5 packages,

Wire link fuses.

ECSS-Q-ST-60\_0480504

The use of pure tin in internal cavities may be authorized, on a case-by-case basis, based on the demonstration that there is no alternative product and there is no risk (supported by a technical justification).

ECSS-Q-ST-60\_0480186

As per 5.2.2.2f., the justification of the use of pure tin shall be presented during a PCB for customer’s approval,

ECSS-Q-ST-60\_0480187

The use of pure tin (inside or outside the part) shall be declared in the PAD or in the JD.

ECSS-Q-ST-60\_0480534

The customer shall specify either requirement 5.2.2.2j, or requirements 5.2.2.2k and 5.2.2.2l to handle risks linked with pure-tin terminations.

ECSS-Q-ST-60\_0480535

The following actions shall be performed by the supplier to control the pure-tin risk:

Collect and synthesize all information participating to the risk analysis in conformance with Clause 9.

Based on the risk analysis, elaborate a mitigation plan.

Include in the JD the risk analysis and mitigation plan for customer approval.

Before retinning of flight parts, document the hot solder dip process by a procedure to be submitted to customer for approval.

Perform evaluation tests, lot acceptance tests and screening tests of retinned components after the retinning process.

* 1. 1 The mitigation plan can include one or a combination of the following solutions:
     + Tin whisker sensitivity evaluation
     + Retinning of terminations with complementary evaluation,
     + Conformal coating,
     + Design modification.
  2. 2 Solder dip for tin whisker mitigation differs from solder dip for solderability in that for tin whisker mitigation, the termination is coated over its entire length, right up to the package surface (no stand off). As this process is critical it is good practice to evaluate it and control it well.

ECSS-Q-ST-60\_0480536

All the following conditions shall be fulfilled to use Parts with matte pure tin finish, >97% tin:

They pass the JESD-201A class 2 requirements or meet the GEIA-STD-0005-2/Level 2B requirements,

They are not used in power function, where both Voltage >15 V and Current >2 A conditions are applied at the same time,

They are not mechanically torqued on board or equipment.

ECSS-Q-ST-60\_0480537

If one of the three conditions specified in requirement 5.2.2.2k is not met, a mitigation plan shall be submitted to the customer for approval, through the JD approval process.

1. This mitigation plan can include, as an example, one of the following solutions:
   * + Conformal coating,
     + Design analysis and risk assessment versus a possible short circuit.

#### 

1. Refer to EPPL Part I or II to find these components.

Parts subject to export restrictions or regulations shall not be preferred.

#### Radiation hardness

The radiation requirements for EEE components are project specific, they shall be derived from the Mission Radiation Environment Specification defined in accordance with the DRD in Annex A of ECSS-Q-ST-60-15.

ECSS-Q-ST-60\_0480189

The supplier who is responsible for the design of the piece of hardware shall demonstrate the compliance of its components selection with the radiation constraints of the project.

ECSS-Q-ST-60\_0480190

For this demonstration, the supplier shall consider all types of radiation including cosmic (Heavy Ions), electromagnetic, trapped (charged particles – electrons, protons – in radiation belts) and solar (flares).

ECSS-Q-ST-60\_0480191

Due consideration shall be given to the mission orbit and trajectory, the duration, the associated spatial and temporal variations of the radiation environment as well as all protective factors such as shielding.

ECSS-Q-ST-60\_0480192

The supplier shall assess the actual radiation tolerance of the selected components for compliance with the radiation requirements in term of total dose, displacement damage and Single Events Effects (SEE).

ECSS-Q-ST-60\_0480193

The supplier shall identify components which are not compliant with the radiation requirements as critical radiation sensitive components.

ECSS-Q-ST-60\_0480194

The supplier shall implement a Radiation Hardness Assurance Programme, in conformance with the requirements of ECSS-Q-ST-60-15, documented by a plan to be approved by the customer, for radiation sensitive components, covering the collection of all relevant information and specifying the necessary actions in terms of evaluation and procurement testing, planning and control.

ECSS-Q-ST-60\_0480195

The supplier shall issue an Equipment Radiation Analysis document identifying all sensitive components w.r.t. the relevant radiation effects, possibly their impact and giving an adequate engineering solution (e.g. local shielding, design solution, specific test, RVT) for the relevant equipment.

ECSS-Q-ST-60\_0480196

The Equipment Radiation Analysis document shall be submitted to the customer for approval.

1. More detailed information about the above requirements is given in ECSS-E-ST-10-12 and ECSS-Q-ST-60-15.

#### Derating

ECSS-Q-ST-60\_0480197

The supplier shall implement derating rules for components used in his designs in accordance with the requirements of ECSS-Q-ST-30-11.

ECSS-Q-ST-60\_0480198

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### Component evaluation

#### General

ECSS-Q-ST-60\_0480199

The supplier shall perform a component evaluation in absence of an approved demonstration that a component has the ability to conform to the requirements for functional performance, quality, dependability, and environmental resistance as required for the project.

ECSS-Q-ST-60\_0480200

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ECSS-Q-ST-60\_0480201

The scope and planning of the component evaluation actions shall be derived from the results of an assessment of the design and intended application of the component.

ECSS-Q-ST-60\_0480202

An evaluation plan shall be sent to the customer for approval, and include the following elements:

Constructional Analysis (as per clause 5.2.3.3),

Evaluation Testing (as per clause 5.2.3.4),

Radiation Hardness (as per clause 5.2.3.4b.5).

ECSS-Q-ST-60\_0480203

In the definition of the evaluation programme any information including pertinent reliability, analysis and test data from the manufacturer of the component and previous use in comparable application shall be considered and their relevance justified.

ECSS-Q-ST-60\_0480204

Omission of any of these elements, or the introduction of alternative activities, shall be justified.

ECSS-Q-ST-60\_0480205

All tests and inspections shall be carried out on representative samples of the component type from the current production of the manufacturer selected for the component procurement for the flight hardware.

ECSS-Q-ST-60\_0480206

For programmable devices, the representativeness shall include the programming hardware tools and the compatibility of the software.

ECSS-Q-ST-60\_0480207

The supplier shall review the evaluation results to determine their impact on the content of the procurement specification and amend it as necessary.

ECSS-Q-ST-60\_0480208

The supplier shall summarize the evaluation results in the evaluation report and send it to the customer for approval.

1. For guidance for the assessment of the space environmental aspects refer to ECSS-E-ST-10-04 and ECSS-E-ST-10-12.

#### Component manufacturer assessment

1. A component manufacturer assessment is not required.

#### Constructional analysis

ECSS-Q-ST-60\_0480210

Constructional analysis shall be carried out on representative components.

1. The primary aim is to provide an early indication of a component’s constructional suitability for meeting the specified performances of the space project application.

ECSS-Q-ST-60\_0480211

The Constructional Analysis shall comprise destructive and non-destructive inspections, analyses, and testing, to identify:

Design and construction technology,

Materials used,

Inherent reliability aspects,

Quality of workmanship,

Potential hazards.

ECSS-Q-ST-60\_0480212

The findings of the analysis shall be contained within a Constructional Analysis Report and shall be included in the Evaluation Report.

#### Evaluation testing

ECSS-Q-ST-60\_0480213

The evaluation shall determine which inspections or tests are required to provide the confidence that the component type under evaluation, when assembled and tested in accordance with the procurement specification, successfully meets the project requirements.

ECSS-Q-ST-60\_0480214

The supplier shall review the already existing data in order to adapt and minimize the content of the evaluation testing while ensuring that there are inputs and pertinent results covering the following topics:

Endurance test (operating at elevated temperature and electrical stress),

Mechanical stress (shock, vibration, constant acceleration),

Environmental stress (thermal shock, temperature cycling, high and low temperature storage, humidity),

Assembly capability testing,

Radiation testing, for total dose, displacement effects and single event effects sensitivity.

1. For guidance refer to ESCC basic specification no. 22600 and the ancillary specifications for dedicated component families and to ESCC basic specifications 22900, 22500 and 25100.

### Parts approval

ECSS-Q-ST-60\_0480215

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ECSS-Q-ST-60\_0480216

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ECSS-Q-ST-60\_0480217

The supplier shall maintain a system of traceability of the acceptance and approval of each component used in flight products.

ECSS-Q-ST-60\_0480218

The approval process by the customer depends on the part qualification status and shall be organized as follows:

Space qualified parts : Space qualified parts listed in the DCL are approved through the DCL review except in the following cases where a PAD in conformance with ECSS-Q-ST-60 Annex D is delivered for customer's approval:

additional controls are required (e.g. precap, buy-off, LAT or LVT, RVT, DPA),

used outside the specified limits,

specific tests are required during procurement as per Table 7‑2,

Other HiRel parts: A PAD in accordance with ECSS-Q-ST-60 Annex D is delivered to customer for approval.

Commercial parts: A Justification Document in accordance with ECSS-Q-ST-60-13 Annex F is delivered to customer for approval.

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ECSS-Q-ST-60\_0480219

In case the evaluation results (as per clause 5.2.3.1) are changing the procurement conditions documented in the PAD or the JD, a new revision of PAD or the JD shall be submitted to the customer for approval.

ECSS-Q-ST-60\_0480538

The parts approval process, including PAD and JD approval, shall be completed prior to CDR, or MRR for recurring units if there is no CDR.

The previous use or approval of a part, via PAD or JD, in any other project shall not be considered as an automatic approval for the present program.

1. The pertinence of the heritage in terms of mission profile and requirements can be assessed as well as all the deviations (e.g. RFDs, RFWs, special dispositions for a specific space program) previously accepted.

All programmable devices shall be subject to PAD approval.

1. Programmable devices are considered are non-standard parts.

## Component procurement

### General

ECSS-Q-ST-60\_0480220

The supplier shall ensure that all procured components meet the programme requirements with respect to inspection, screening and tests.

ECSS-Q-ST-60\_0480221

Class 2 components shall meet the quality levels and supplementary conditions specified in Table 7‑2.

ECSS-Q-ST-60\_0480222

The supplier shall be responsible for manufacturer surveillance and control throughout the procurement programme.

ECSS-Q-ST-60\_0480223

For non qualified parts, the supplier shall put in place a configuration control system to ensure that any change of the product (e.g. mask, manufacturing and assembly process) affecting evaluation, performance, quality, reliability and interchangeability is communicated to him by the manufacturer (e.g. PCN).

ECSS-Q-ST-60\_0480224

The supplier shall ensure the compatibility of the change with its application and update all the related documentation.

1. For example: RFD, PAD, JD evaluation.

ECSS-Q-ST-60\_0480225

In case of documentation update, the change shall be submitted to the customer for approval.

ECSS-Q-ST-60\_0480226

To reduce the risk of procuring counterfeit components, when parts are not directly procured from the manufacturer, the supplier shall procure parts only from distributors duly franchised by the parts manufacturer.

ECSS-Q-ST-60\_0480455

The procurement of commercial EEE components for class 2 programmes shall be performed in conformance with the requirements of clause 5.3 of ECSS-Q-ST-60-13.

The supplier shall establish an attrition policy and corresponding rules which consider the specific criticality of each EEE component family.

### Procurement specification

ECSS-Q-ST-60\_0480227

The supplier shall procure EEE components according to controlled specifications.

ECSS-Q-ST-60\_0480228

International specifications systems, new specifications or manufacturer’s datasheets under configuration shall be used by the supplier.

ECSS-Q-ST-60\_0480229

Any new specification shall be prepared and designed by the supplier as per existing international specification systems (ESCC, MIL). Preference shall be given to ESCC format when agreed by the manufacturer.

ECSS-Q-ST-60\_0480230

The content of any new specification shall be in conformance with Annex C.

ECSS-Q-ST-60\_0480231

The use of any new specification or datasheet shall be submitted to the customer for approval through the PAD process (see clause 5.2.4).

ECSS-Q-ST-60\_0480232

Upon request, any new procurement specification prepared in the frame of the project, shall be delivered to the customer.

ECSS-Q-ST-60\_0480233

The supplier shall keep each procurement specification or manufacturer’s datasheet under configuration control.

### Screening requirements

ECSS-Q-ST-60\_0480234

All components to be incorporated into flight standard hardware shall be subjected to screening.

ECSS-Q-ST-60\_0480235

The screening test requirements shall be defined such that accumulated stress does not jeopardize component reliability.

ECSS-Q-ST-60\_0480236

All screening tests shall be performed at the component manufacturer’s premises or at facility approved either by the qualification approval authority, where applicable (e.g. ESCC), or otherwise by the supplier.

ECSS-Q-ST-60\_0480237

The quality levels defined in Table 7‑2 shall apply.

ECSS-Q-ST-60\_0480238

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ECSS-Q-ST-60\_0480456

When a component is available in a qualified version according to quality level specified in Table 7‑2 it shall be selected.

ECSS-Q-ST-60\_0480457

In case a component is not available in a qualified version according to quality level specified in Table 7‑2, the screening of the component shall meet the screening flow defined by the generic specifications listed in Table 7‑2.

ECSS-Q-ST-60\_0480458

In case of X-rays or CT scan inspection, the total dose deposited and exposure time shall not deteriorate part performance or reliability.

### Initial Customer Source Inspection (precap)

ECSS-Q-ST-60\_0480239

The procurement entity shall carry out, at the manufacturer’s premises, a customer precap inspection for the following non-space qualified parts types: relays, crystals, oscillators and hybrids.

ECSS-Q-ST-60\_0480240

When not covered by MIL or ESCC specifications, methods and accept/reject criteria for customer’s precap inspection shall be documented by a procedure to be presented to the customer, on request, for review.

1. For guidance refer to the basic specificaton ESCC 21002.

### Lot acceptance

ECSS-Q-ST-60\_0480241

The supplier shall ensure that any lot/date code of EEE parts is submitted to a lot acceptance procedure, in line with applied normative systems, according to the following rules:

Space qualified parts:

ESCC: user’s lot/date code acceptance on the procured lot is not required due to periodic lot validation testing performed by the manufacturer.

MIL: QCI or TCI performed by the manufacturer is in accordance with the quality level of the MIL specification.

Other HiRel qualified parts:

The content of the lot acceptance is defined according to the available data.

The proposed lot acceptance is approved through the approval process (see clause 5.2.4).

Commercial parts:

The content of the lot acceptance is defined according to information provided by the justification document according to ECSS-Q-ST-60-13.

The proposed lot acceptance is approved through the approval process in accordance with clause 5.2.4.

ECSS-Q-ST-60\_0480459

The sample size for lot acceptance which may be reduced in some cases, shall be submitted to the customer for approval through the PAD process (see clause 5.2.4).

Components from lot acceptance shall be considered as destructive as defined in ESCC or MIL specifications / test methods.

### Final customer source inspection (buy-off)

ECSS-Q-ST-60\_0480243

The procurement entity shall carry out, at the manufacturer’s premises, a final customer source inspection for non-space qualified parts based on inspections, tests and review activities to verify that the requirements of the purchase order are met prior to shipment of the flight parts.

ECSS-Q-ST-60\_0480244

The buy-off shall include:

External visual inspection,

Witnessing electrical measurements,

Verifying mechanical dimensions,

Review and verification of the data-package.

1. For guidance refer to ESCC basic specification no. 21003.

ECSS-Q-ST-60\_0480505

The buy-off may be replaced by an incoming inspection at the procurement entity's facilities;

ECSS-Q-ST-60\_0480246

If the buy-off is replaced by an incoming inspection at the procurement entity's facilities; it shall be declared in the PAD submitted to the customer for approval.

### Incoming inspections

ECSS-Q-ST-60\_0480247

The procurement entity shall perform incoming inspection at his premises on all components to verify conformance with the purchase order requirements.

ECSS-Q-ST-60\_0480248

The incoming inspection shall include the following items:

For any part: the minimum inspections required in ESCC 21004.

For the non-space qualified parts, when the final customer source inspection has not been performed, the following additional items:

External visual inspection by sampling (AQL 0,65% level II or 20 parts min)

Electrical measurements at room temperature on 20 parts or 100% (if lot size < 20 parts), or a datapackage review.

ECSS-Q-ST-60\_0480249

The incoming inspection shall be documented by a procedure to be presented, on request, to the customer for review.

ECSS-Q-ST-60\_0480506

If the parts have passed successfully a final CSI (or buy-off), the incoming inspection may be reduced to the following minimum:

Verification of the manufacturer’s CoC,

Packing checking,

Quantity verification.

ECSS-Q-ST-60\_0480507

In case the incoming inspection has been performed by a procurement agent, the incoming inspection performed by the end-user, may be reduced to the following minimum:

Packing checking,

Quantity verification

### Radiation verification testing

ECSS-Q-ST-60\_0480252

Radiation sensitive components, as defined in clause 5.2.2.4 and for which applicable existing test data is insufficient shall be subjected to RVT.

ECSS-Q-ST-60\_0480253

RVT shall be performed in accordance with internationally recognized standards, such as ESCC Basic Specifications No. 22900 and 22500.

1. Additional information on test methods is given in MIL-STD-750 Test Method 1019, MIL-STD-883 Test Method 1019.

ECSS-Q-ST-60\_0480254

In such a case, a PAD in conformance with Annex D shall be issued and processed as per clause 5.2.4.

ECSS-Q-ST-60\_0480255

The results of RVT shall be documented by a report.

ECSS-Q-ST-60\_0480256

When RVT is performed in the frame of the project, the supplier shall send the related report to the customer for information.

### Destructive physical analysis

ECSS-Q-ST-60\_0480257

The DPA shall be performed on 3 samples per lot/date code for the following non-space qualified parts types: as a minimum relays, oscillators and hybrids and for space qualified parts when requested in Table 7‑2, which is valided during PCB.

1. DPA can be performed on samples submitted to either endurance or radiation tests.

ECSS-Q-ST-60\_0480508

DPA may be carried out on representative samples of the components families when the following three conditions are met:

procured from the same manufacturer and same package without major change in the process,

with a limited datecode range of 13 weeks,

approved by the customer through the PAD (or Justification document) process.

1. In complement of above conditions, for series of integrated circuits, series of thermal switches, series of active discrete and series of passive components (e.g. 54xxxx, 1N63xx, …), representative samples can be from the same family considering technology limit and their complexity.

ECSS-Q-ST-60\_0480259

The DPA sample size may be reduced if approved by the customer through the PAD process.

ECSS-Q-ST-60\_0480260

The DPA process shall be documented by a procedure to be submitted, on request, to the customer for information.

1. For guidance, refer to the basic specification ESCC 21001.

ECSS-Q-ST-60\_0480261

The supplier shall verify that the outcome of the DPA is satisfactory prior to the installation of the components into flight hardware.

ECSS-Q-ST-60\_0480509

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ECSS-Q-ST-60\_0480510

DPA may be performed by the manufacturer if agreed by the supplier.

ECSS-Q-ST-60\_0480264

For health and safety reasons, any test producing beryllium oxide dust shall be omitted.

ECSS-Q-ST-60\_0480265

The results of DPA shall be documented by a report sent to the customer, on request, for information.

### Relifing

ECSS-Q-ST-60\_0480460

When components from a supplier’s or parts procurement agent’s stock are used, the following criteria shall be met:

The parts are stored according to the minimum conditions given in clause 5.4,

The minimum overall requirements (including screening) are in accordance with the project requirements,

The lot/date code homogeneity and traceability can be demonstrated,

The EEE parts documentation is available and the content is acceptable in accordance with the project requirements (including radiation data, if necessary),

There are no open NCR’s and no unresolved alerts with respect to their date code.

ECSS-Q-ST-60\_0480267

For components meeting the criteria specified in requirement 5.3.10a, and which have a lot / date code exceeding the period defined in ECSS-Q-ST-60-14 clause 5, the relifing procedure ECSS-Q-ST-60-14 shall apply to the lot.

### Manufacturer’s data documentation deliveries

ECSS-Q-ST-60\_0480268

The manufacturer’s CoC shall be delivered to the parts procurer.

ECSS-Q-ST-60\_0480269

Any other data (i.e. LAT or LVT, QCI or TCI), defined in the applicable procurement documents, shall be available at the manufacturer’s facilities or delivered to the parts’ procurer in line with the purchase order, as a minimum compatible with CSV.

1. CSV is a common file format that can be used to transfer data between database or spreadsheet tables (a spreadsheet program is for example Excel®).

ECSS-Q-ST-60\_0480270

For non qualified parts, the parts procurer shall store the documentation for a minimum of 15 years after reception of the components.

1. For qualified parts, the documentation storage period is under the responsibility of the manufacturer and the qualifying authority.

## Handling and storage

ECSS-Q-ST-60\_0480271

The supplier shall establish and implement procedures for handling and storage of components in order to prevent possible degradation.

1. For quidance, refer to the basic specification ESCC 20600.

ECSS-Q-ST-60\_0480272

The procedures shall be applicable at any facility dealing with components for flight application.

ECSS-Q-ST-60\_0480273

On request, handling and storage procedures shall be sent to the customer for review.

ECSS-Q-ST-60\_0480274

As a minimum, the following areas shall be covered:

Control of the environment in accordance with ESCC Basic Specification No. 24900.

Measures and facilities to segregate and protect components during receiving inspection, storage, and delivery to manufacturing.

Control measures to ensure that electrostatic discharge susceptible components are identified and handled only by trained personnel using anti static packaging and tools.

Corrosion, moisture or process sensitive components as classified in compliance with IPC/JEDEC J-STD-020, ECA/IPC/JEDEC J-STD-075 or other documented classification procedure, shall be handled in accordance with J-STD-033 or other documented classification procedure.

1. See IPC-1602 for further information on moisture sensitive printed boards.

An ESD Control Programme in accordance with EN 61340-5-1 shall be developed and implemented by the supplier.

1. EN 61340-5-1 guideline can be used for editing the ESD Control Programme.

The process for the selection of new components shall include their ESD sensitivity

If ultra-sensitive devices classified in compliance with the classes defined in EN 61340-5-1, a dedicated ESD Control Programme for ultra-sensitive devices shall be developed and implemented by the supplier

## Component quality assurance

### General

ECSS-Q-ST-60\_0480275

The supplier shall establish and implement the requirements of this document including methods, organizations and documents used to control the selection and procurement of components in accordance with the requirements of ECSS‑Q-ST-20.

### Nonconformances or failures

ECSS-Q-ST-60\_0480276

The supplier shall establish and maintain a nonconformance control system in accordance with the general requirements in ECSS-Q-ST-10-09.

ECSS-Q-ST-60\_0480277

Any observed deviation of EEE components from requirements as laid down in applicable specifications, procedures and drawings shall be controlled by the nonconformance control system.

1. This includes failures, malfunctions, deficiencies and defects.

ECSS-Q-ST-60\_0480278

The nonconformance control system shall handle all nonconformances occurring on EEE components during:

Manufacture (if available), screening and acceptance tests,

Incoming inspection,

Integration and test of equipment,

Storage and handling.

ECSS-Q-ST-60\_0480279

For ESCC qualified components the supplier shall apply the ESCC basic specification no 22800.

### Alerts

ECSS-Q-ST-60\_0480280

The supplier shall take into account all received alerts, errata sheets from international alert systems, from manufacturers or sent by the customer and shall validate that there are no alerts related to the intended applications and the recommendations of alerts were taken into account.

ECSS-Q-ST-60\_0480281

If alerts become available at a later stage, the supplier shall analyse the alerts, analyse the project risk and propose an action plan for customer approval.

### Traceability

ECSS-Q-ST-60\_0480282

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ECSS-Q-ST-60\_0480283

The traceability shall be maintained through incoming, storage, and installation at the procurer and user of the component.

ECSS-Q-ST-60\_0480284

In any case, the traceability requirements imposed by the supplier on the EEE parts manufacturer or distributor shall allow managing the adequacy of the tests performed by the supplier (i.e. evaluation, lot validation, any additional test or inspection).

ECSS-Q-ST-60\_0480285

The traceability of EEE parts during installation in equipment, shall be ensured by the supplier through maintaining the traceability to the manufacturer’s lot/date code number of the EEE parts actually mounted.

ECSS-Q-ST-60\_0480286

If the as built DCL has not yet been delivered, the supplier shall be able to provide this information (part type actually installed with its relevant lot/date code number) within one week.

### Lot homogeneity for sampling test

ECSS-Q-ST-60\_0480287

For radiation tests, the set of test samples shall be in accordance with ECSS-Q-ST-60-15.

If tests are performed by sampling, the sampled parts shall be selected so that they are representative of the lot/date code distribution.

## Specific components

### General

ECSS-Q-ST-60\_0480288

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### ASICs

ECSS-Q-ST-60\_0480289

For the development and re-use of ASICs ECSS-Q-ST-60-03 shall apply.

### Hybrids

ECSS-Q-ST-60\_0480290

The hybrids shall be procured in conformance with the specifications listed in Table 7‑2.

ECSS-Q-ST-60\_0480462

Selection and validation of the hybrids manufacturers shall conform to clauses 5 and 6 of ECSS-Q-ST-60-05 and design of hybrids to clause 7 of ECSS-Q-ST-60-05.

ECSS-Q-ST-60\_0480463

The list of add-on parts shall be provided to the customer.

### One time programmable and reprogrammable devices

ECSS-Q-ST-60\_0480291

For the development, re-use and maintenance of FPGAs, ECSS-Q-ST-60-03 shall apply..

ECSS-Q-ST-60\_0480292

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ECSS-Q-ST-60\_0480511

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ECSS-Q-ST-60\_0480294

One time programmable components shall be submitted to a post-programming sequence.

ECSS-Q-ST-60\_0480295

For one time programmable FPGA and PROM without a clear and defined heritage, a post-programming burn-in shall be applied, in conformance with ESCC9000 subclause 8.16, for a minimum duration of 160 h.

1. FPGA and PROM with defined heritage are documented in these reports: ESCC REP 010 and ESCC REP011, available on <https://escies.org>.

ECSS-Q-ST-60\_0480296

The supplier shall prepare a post-programming procedure for customer’s approval, depending on part types.

1. This includes, if applicable:
   * + electrical test conditions,
     + programming conditions and equipment,
     + programming software version qualified by the supplier,
     + burn-in conditions,
     + additional screening tests, and
     + specific marking after programming.

ECSS-Q-ST-60\_0480297

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ECSS-Q-ST-60\_0480512

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### Microwave monolithic integrated circuits

ECSS-Q-ST-60\_0480299

Design, selection, procurement and use of the microwave monolithic integrated circuits shall be performed in conformance with the requirements from ECSS-Q-ST-60-12.

### Connectors

ECSS-Q-ST-60\_0480539

For connectors with removable contacts, contacts shall be procured from the same manufacturer as the connector in which they are mounted.

### High Voltage Application

For high voltage applications and high power microwave EEE components the compatibility with operation in vacuum and partial pressure shall be verified.

1. Refer to ECSS-E-HB-20-05 for a definition for High voltage application.

### Self Made Magnetics

Self made magnetics parts shall be designed and screened using MIL-STD-981 or equivalent.

Minimum screening of Self made magnetics parts on a 100 % basis shall include :

visual inspection,

electrical measurements before test,

thermal cycling,

high temperature storage (minimum 96h) (optional),

final electrical measurements.

## Documentation

ECSS-Q-ST-60\_0480300

Any result from inspection or control shall be documented (including, precap, lot acceptance, buy-off, incoming, relifing and complementary tests).

Table 5‑1: Document requirements list for Class 2 components

| Document | Clause | Customer | Comments |
| --- | --- | --- | --- |
| Compliance matrix | 5.1.2.2 | Approval |  |
| “as design” DCL | 5.1.4 | Approval |  |
| RFW during equipment manufacturing  *(after “as design” DCL and before “as built” DCL)* | 5.1.4 | Approval |  |
| “as built” DCL | 5.1.4 | Review |  |
| Technical note for parts having pure tin in internal cavities *(as info can go on PAD)* | 5.2.2.2 | Approval | When applicable |
| Radiation hardness assurance plan | 5.2.2.4 | Approval | to document the radiation hardness assurance programme |
| Equipment radiation analysis document | 5.2.2.4 | Approval |  |
| Evaluation plans | 5.2.3.1 | Approval |  |
| Evaluation reports | 5.2.3.1 | Approval |  |
| PAD’s | 5.2.4 | Approval |  |
| Justification documents | 5.2.4 | Approval | applicable for commercial parts |
| Change on EEE parts | 5.3.1 | Approval |  |
| Procurement specifications prepared in the frame of the project | 5.3.1h | Approval |  |
| PIND test method for DO4, DO5 & TO3 packages | 5.3.3 | Review | Only for old design |
| Procedure for customer precap | 5.3.4 | Review (on request) | When not covered by ESCC or MIL specifications |
| Procedure for incoming | 5.3.7 | Review (on request) |  |
| RVT reports when RVT is performed in the frame of the project | 5.3.8 | Information |  |
| Procedure for DPA | 5.3.9 | Information (on request) |  |
| DPA reports | 5.3.9 | Information (on request) |  |
| Procedure for handling and storage of EEE parts | 5.4 | Review (on request) |  |
| Action plan for alerts | 5.5.3 | Approval |  |
| Procedure for post-programming sequence | 5.6.4 | Approval |  |

# Requirements for Class 3 components

## Component programme management

### General

ECSS-Q-ST-60\_0480301

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### Components control programme

#### Organization

ECSS-Q-ST-60\_0480302

The supplier shall identify the organization responsible for the management of the component programme, and describe the organization’s approaches (including the procurement system and its rationale) and capability to efficiently implement, manage, and control the component requirements.

#### Component control plan

ECSS-Q-ST-60\_0480303

The supplier shall prepare a compliance matrix to the clauses of this standard.

ECSS-Q-ST-60\_0480304

The supplier shall submit his compliance matrix to the customer for approval.

### Parts control board

When required by the customer or agreed by both parties, the approval of the selection and usage of EEE parts shall be implemented through Parts Control Boards (PCBs) held between the customer and the supplier or lower tier subcontractor.

1. In absence of customer decision, the PCB is not required.

At supplier's level, the Parts Control Board (PCB), when required, shall be composed as follows:

chaired by a member of the supplier’s team with designated responsibility for components management,

include, as a minimum, in addition the suppliers’ parts engineer, the customer’s representative and the lower tier subcontractor parts engineers.

Other pertinent experts from the customer or suppliers may also participate, on request.

Depending on the progress of the program, the main PCB activities shall be:

Review and approval of the supplier's compliance matrix to the requirements of clause 6 of this standard and any associated documents,

Parts approval including evaluation activities,

Problem assessment.

1. Examples of problem assessments are: alerts, nonconformances, RFD, RFW and delivery delays).

### Declared components list

ECSS-Q-ST-60\_0480306

For each equipment, its supplier shall issue a DCL in an editable and sortable electronic format, as a minimum compatible with CSV, identifying all component types needed.

1. CSV is a common file format that can be used to transfer data between database or spreadsheet tables (a spreadsheet program is for example Excel®).

ECSS-Q-ST-60\_0480307

The list specified in 6.1.4a shall be kept under configuration control (issue and identification of changes).

ECSS-Q-ST-60\_0480308

The DCL shall be issued as a minimum at PDR and CDR (as designed) .

ECSS-Q-ST-60\_0480309

After equipment CDR, all modifications affecting the PAD and JD information shall be implemented, in the "as design" DCL and submitted to the customer for approval, before assembly.

ECSS-Q-ST-60\_0480310

The “as design” DCL shall be sent to the customer for approval.

ECSS-Q-ST-60\_0480311

Any change of parts during equipment manufacturing (e.g. type and manufacturer) shall be handled through RFWs submitted to the customer for approval before mounting.

ECSS-Q-ST-60\_0480312

The content of the DCL shall be in conformance with the DRD in Annex B.

ECSS-Q-ST-60\_0480540

The supplier shall establish and update a consolidated “as design" DCL at his level and deliver it to the customer.

### Electrical and mechanical GSE

ECSS-Q-ST-60\_0480313

EEE components used in GSE, which are physically and directly interfacing to flight hardware, shall be:

Fit Form and Function compatible,

manufactured from materials identical to the flight opposite part,

ensured to be visibly clean before each connection to flight hardware.

ECSS-Q-ST-60\_0480314

Flight hardware connectors interfaces to GSE shall interface to a flight compatible connector, as per 6.1.5a.

1. This connector can be installed on the test harness or can be a saver.

### EQM components

ECSS-Q-ST-60\_0480541

EEE components used in Engineering Qualification Model (EQM) shall be fit, form and function representative of the flight components and be from the same manufacturers.

ECSS-Q-ST-60\_0480542

If thermal vacuum tests are performed on the EQM, the EEE parts shall be material representative of the FM parts.

## Component selection, evaluation and approval

### General

ECSS-Q-ST-60\_0480315

The supplier shall ensure that the following requirements are met during his selection process:

Project requirements (e.g. quality levels, component policy, manufacturing and delivery schedules and budgets, quantities),

Design requirements (e.g. component type, case, dimensions, materials),

Production requirements (e.g. packaging, thermal and storage constraints, component mounting process),

Operational requirements (e.g. electrical, mechanical, radiation, reliability, assembly, lifetime).

1. The supplier of each product is responsible for the selection of components, which enable the performance, lifetime, environmental, material, safety, quality and reliability requirements of the product of which they form a part, to be satisfied in all respects.

ECSS-Q-ST-60\_0480464

The selection, evaluation and approval of commercial EEE components for class 3 programmes shall be performed in conformance with clause 6.2 from ECSS-Q-ST-60-13 standard.

### Manufacturer and component selection

#### General rules

ECSS-Q-ST-60\_0480316

The supplier shall establish and maintain in his own facility, and ensure that his suppliers also establish and maintain, procedures for selecting and controlling all components intended for use in deliverable products.

ECSS-Q-ST-60\_0480317

Components shall be selected on the basis of proven qualification, characterization, and previous space experience and data, relevant with regard to the requirements for the programme, from manufacturers or sources (preferably European) employing effective Product Assurance Programmes in manufacturing and test.

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<<deleted and moved to 6.2.2.3b>>

#### Parts and material restriction

ECSS-Q-ST-60\_0480320

The supplier shall ensure that non-hermetically sealed materials of components meet the requirements of ECSS‑Q-ST-70 regarding off-gassing, out-gassing, flammability, toxicity and any other criteria specified for the intended use.

ECSS-Q-ST-60\_0480321

The supplier shall evaluate the robustness of selected EEE components against the stresses induced by the assembly techniques to be employed.

ECSS-Q-ST-60\_0480322

With respect to health and safety, beryllium oxide and lithium (except for the one which is identified in the procurement specification), cadmium, magnesium, mercury, zinc, radioactive material and all material which can cause safety hazard shall not be used.

ECSS-Q-ST-60\_0480323

For limited life duration , known instability, safety hazard or reliability risk reasons, the EEE components listed below shall not be used:

Hollow core resistors,

Potentiometers (except for mechanism position monitoring),

Non-metallurgically bonded diodes,

Semiconductor dice with unglassivated active area,

Wet slug tantalum capacitors other than capacitor construction using double seals and a tantalum case,

Any component whose internal construction uses metallurgic bonding with a melting temperature not compatible with the end-application mounting conditions,

TO5 relays without double welding of the mechanism to the header or with any type of integrated diodes inside.

Aluminium liquid electrolytic capacitors,

Tin coated wires and cables,

PVC insulated wires and cables,

Electromechanical parts in commercial grade,

Feedthrough filter in commercial grade,

Connectors without gold plating contact in commercial grade,

Components with bright tin plating (>97% tin) on terminations.

1. Matte and bright tin definition according to JESD201.

ECSS-Q-ST-60\_0480324

For limited life duration, known instability, safety hazard or reliability risk reasons, the use of EEE components listed below shall not be used for new designs:

RNC90 > 100 kOhm,

TO3 and DO4/DO5 packages,

Wire link fuses.

ECSS-Q-ST-60\_0480513

The use of pure tin in internal cavities may be authorized, on a case-by-case basis, based on the demonstration that there is no alternative product and there is no risk (supported by a technical justification).

ECSS-Q-ST-60\_0480326

As per 6.2.2.2f, the justification of the use of pure tin shall be sent to the customer for approval.

ECSS-Q-ST-60\_0480327

The use of pure tin (inside or outside the part) shall be declared in the PAD or in the JD.

ECSS-Q-ST-60\_0480543

The customer shall specify either requirement 6.2.2.2j, or requirements 6.2.2.2k and 6.2.2.2l to handle risks linked with pure-tin terminations.

ECSS-Q-ST-60\_0480544

The following actions shall be performed by the supplier to control the pure-tin risk:

Collect and synthesize all information participating to the risk analysis in conformance with Clause 9.

Based on the risk analysis, elaborate a mitigation plan.

Include in the JD the risk analysis and mitigation plan for customer approval.

Before retinning of flight parts, document the hot solder dip process by a procedure to be submitted to customer for approval.

Perform evaluation tests, lot acceptance tests and screening tests of retinned components after the retinning process.

* 1. 1 The mitigation plan can include one or a combination of the following solutions:
     + Tin whisker sensitivity evaluation
     + Retinning of terminations with complementary evaluation,
     + Conformal coating,
     + Design modification.
  2. 2 Solder dip for tin whisker mitigation differs from solder dip for solderability in that for tin whisker mitigation, the termination is coated over its entire length, right up to the package surface (no stand off). As this process is critical it is good practice to evaluate it and control it well.

ECSS-Q-ST-60\_0480545

All the following conditions shall be fulfilled to use Parts with matte pure tin finish, >97% tin:

They pass the JESD-201A class 2 requirements or meet the GEIA-STD-0005-2/Level 2B requirements,

They are not used in power function, where both Voltage >15 V and Current >2 A conditions are applied at the same time,

They are not mechanically torqued on board or equipment.

ECSS-Q-ST-60\_0480546

If one of the three conditions specified in requirement 6.2.2.2k is not met, a mitigation plan shall be submitted to the customer for approval, through the JD approval process.

1. This mitigation plan can include, as an example, one of the following solutions:
   * + Conformal coating,
     + Design analysis and risk assessment versus a possible short circuit.

#### Preferred sources

ECSS-Q-ST-60\_0480318

Preference shall be given to components which necessitate the least evaluation or qualification effort.

1. Refer to EPPL Part I or II to find these components.

ECSS-Q-ST-60\_0480319

When selecting items, the supplier shall check the current data, applicability of the basis of qualification, problem notifications and alerts, and adequacy of specifications.

Parts subject to export restrictions or regulations shall not be preferred.

#### Radiation hardness

The radiation requirements for EEE components are project specific, they shall be derived from the Mission Radiation Environment Specification defined in accordance with the DRD in Annex A of ECSS-Q-ST-60-15.

ECSS-Q-ST-60\_0480330

The supplier who is responsible for the design of the piece of hardware shall demonstrate the compliance of its components selection with the radiation constraints of the project.

ECSS-Q-ST-60\_0480331

For this demonstration, the supplier shall consider all types of radiation including cosmic (Heavy Ions), electromagnetic, trapped (charged particles – electrons, protons – in radiation belts) and solar (flares).

ECSS-Q-ST-60\_0480332

Due consideration shall be given to the mission orbit and trajectory, the duration, the associated spatial and temporal variations of the radiation environment as well as all protective factors such as shielding.

ECSS-Q-ST-60\_0480333

The supplier shall assess the actual radiation tolerance of the selected components for compliance with the radiation requirements in term of total dose, displacement damage and Single Events Effects (SEE).

ECSS-Q-ST-60\_0480334

The supplier shall identify components which are not compliant with the radiation requirements as critical radiation sensitive components.

ECSS-Q-ST-60\_0480335

The supplier shall implement a Radiation Hardness Assurance Programme, in conformance with the requirements of the ECSS-Q-ST-60-15, documented by a plan to be approved by the customer, for radiation sensitive components, covering the collection of all relevant information and specifying the necessary actions in terms of evaluation and procurement testing, planning and control.

ECSS-Q-ST-60\_0480336

The supplier shall issue an Equipment Radiation Analysis document identifying all sensitive components w.r.t. the relevant radiation effects, possibly their impact and giving an adequate engineering solution (e.g. shielding, design solution, specific test, and RVT) or the relevant equipment.

ECSS-Q-ST-60\_0480337

The Equipment Radiation Analysis document shall be submitted to the customer for approval.

1. More detailed information about the above requirements is given in ECSS-E-ST-10-12 and ECSS-Q-ST-60-15.

#### Derating

ECSS-Q-ST-60\_0480338

The supplier shall implement derating rules for components used in his designs in accordance with the requirements of ECSS-Q-ST-30-11.

ECSS-Q-ST-60\_0480339

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### Component evaluation

#### General

ECSS-Q-ST-60\_0480340

The supplier shall perform a component evaluation in absence of an approved demonstration that a component has the ability to conform to the requirements for functional performance, quality, dependability, and environmental resistance as required for the project.

ECSS-Q-ST-60\_0480341

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ECSS-Q-ST-60\_0480342

The scope and planning of the component evaluation actions shall be derived from the results of an assessment of the design and intended application of the needed component.

ECSS-Q-ST-60\_0480343

An evaluation plan shall be sent to the customer for approval, and include the following elements:

Constructional Analysis (as per clause 6.2.3.3),

Evaluation Testing (as per clause 6.2.3.4),

Radiation Hardness (as per clause 6.2.3.4b.5).

ECSS-Q-ST-60\_0480344

In the definition of the evaluation programme any information including pertinent reliability, analysis and test data from the manufacturer of the component and previous use in comparable application shall be considered and their relevance justified.

ECSS-Q-ST-60\_0480345

Omission of any of these elements, or the introduction of alternative activities, shall be justified.

ECSS-Q-ST-60\_0480346

All tests and inspections shall be carried out on representative samples of the component type from the current production of the manufacturer selected for the component procurement for the flight hardware.

ECSS-Q-ST-60\_0480347

For programmable devices, the representativeness shall include the programming hardware tools and the compatibility of the software.

ECSS-Q-ST-60\_0480348

The supplier shall review the evaluation results to determine their impact on the content of the procurement specification and amend it as necessary.

ECSS-Q-ST-60\_0480349

The supplier shall summarize the evaluation results in the evaluation report and send it to the customer for approval.

1. For guidance for the assessment of the space environmental aspects refer to ECSS-E-ST-10-04 and ECSS E-ST-10-12.

ECSS-Q-ST-60\_0480350

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#### Component manufacturer assessment

1. A component manufacturer assessment is not required.

#### Constructional analysis

ECSS-Q-ST-60\_0480352

Constructional analysis shall be carried out on representative components.

1. The primary aim is to provide an early indication of a component’s constructional suitability for meeting the specified performances of the space project application.

ECSS-Q-ST-60\_0480353

The Constructional Analysis shall comprise destructive and non-destructive inspections, analyses, and testing, to identify:

Design and construction technology,

Materials used,

Inherent reliability aspects,

Quality of workmanship,

Potential hazards.

ECSS-Q-ST-60\_0480354

The findings of the analysis shall be contained within a Constructional Analysis Report and shall be included in the Evaluation Report.

#### Evaluation testing

ECSS-Q-ST-60\_0480355

The evaluation shall determine which inspections or tests are required to provide the confidence that the component type under evaluation, when assembled and tested in accordance with the procurement specification, successfully meets the project requirements.

ECSS-Q-ST-60\_0480356

The supplier shall review the already existing data in order to adapt and minimize the content of the evaluation testing while ensuring that there are inputs and pertinent results covering the following topics:

Endurance test (operating at elevated temperature and electrical stress),

Mechanical stress (shock, vibration, constant acceleration),

Environmental stress (thermal shock, temperature cycling, high and low temperature storage, humidity),

Assembly capability testing,

Radiation testing, for total dose, displacement effects and single event effects sensitivity.

1. For guidance refer to ESCC basic specification no. 22600 and the ancillary specifications for dedicated component families and to ESCC basic specifications 22900, 22500 and 25100.

### Parts approval

ECSS-Q-ST-60\_0480357

When required by the customer or agreed by both parties, all components shall be reviewed and approved by the customer through the Parts Control Board (PCB).

ECSS-Q-ST-60\_0480358

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ECSS-Q-ST-60\_0480359

The supplier shall maintain a system of traceability of the acceptance and approval of each component used in flight products.

ECSS-Q-ST-60\_0480360

The approval process by the customer depends on the part qualification status and shall be organized as follows:

Space qualified parts: Space qualified parts listed in the DCL are approved through the DCL review except in the following cases where a PAD in conformance with ECSS-Q-ST-60 Annex D is delivered for customer's approval:

additional controls are required (e.g. precap, buy-off, LAT or LVT, RVT, DPA),

used outside the specified limits,

specific tests are required during procurement as per Table 7‑3,

Other HiRel parts: A PAD in accordance with ECSS-Q-ST-60 Annex D is delivered to customer for approval.

Commercial parts: A Justification Document in accordance with ECSS-Q-ST-60-13 Annex F is delivered to customer for approval.

ECSS-Q-ST-60\_0480361

In case the evaluation results (as per clause 6.2.3.1) are changing the procurement conditions documented in the PAD or the JD, a new revision of the PAD or the JD shall be submitted to the customer for approval.

ECSS-Q-ST-60\_0480547

The parts approval process, including PAD and JD approval, shall be completed prior to CDR, or MRR for recurring units if there is no CDR.

The previous use or approval of a part, via PAD, JD or otherwise, in any other project shall not be considered as an automatic approval for the present program.

1. The pertinence of the heritage in terms of mission profile and requirements shall be assessed as well as all the deviations (e.g. RFDs, RFWs, special dispositions for a specific space program) previously accepted.

Hybrids, ASICs and MMICs shall be covered by PAD even if included in Capability Approval List, QML, QPL.

## Component procurement

### General

ECSS-Q-ST-60\_0480362

The supplier shall ensure that all procured components meet the programme requirements with respect to inspection, screening and tests.

ECSS-Q-ST-60\_0480363

Class 3 components shall meet the quality levels and supplementary conditions specified in Table 7‑3.

ECSS-Q-ST-60\_0480364

The supplier shall be responsible for manufacturer surveillance and control throughout the procurement programme.

ECSS-Q-ST-60\_0480365

To reduce the risk of procuring counterfeit components, when parts are not directly procured from the manufacturer, the supplier shall procure parts only from distributors duly franchised by the parts manufacturer.

ECSS-Q-ST-60\_0480465

The procurement of commercial EEE components for class 3 programmes shall be in conformance with the requirements of clause 6.3 of ECSS-Q-ST-60-13.

In case of documentation update, the change shall be submitted to the customer for approval.

The supplier shall establish an attrition policy and corresponding rules which consider the specific criticality of each EEE component family.

### Procurement specification

ECSS-Q-ST-60\_0480366

The supplier shall procure EEE components according to controlled specifications.

ECSS-Q-ST-60\_0480367

International specifications systems, new specifications or manufacturer’s datasheets under configuration shall be used by the supplier.

ECSS-Q-ST-60\_0480368

Any new specification shall be prepared and designed by the supplier as per existing international specification systems (ESCC, MIL) and preference be given to ESCC format when agreed by the manufacturer.

ECSS-Q-ST-60\_0480369

The content of any new specification shall be in conformance with the procurement specification DRD in Annex C.

ECSS-Q-ST-60\_0480370

The use of any new specification or datasheet shall be submitted to the customer for review through the approval process (see clause 6.2.4).

ECSS-Q-ST-60\_0480371

Upon request, any new procurement specification prepared in the frame of the project, shall be delivered to the customer.

ECSS-Q-ST-60\_0480372

The supplier shall keep each procurement specification or manufacturer’s datasheet under configuration control.

### Screening requirements

ECSS-Q-ST-60\_0480373

All components to be incorporated into flight standard hardware shall be subjected to screening.

ECSS-Q-ST-60\_0480374

The screening test requirements shall defined such that accumulated stress does not jeopardize component reliability.

ECSS-Q-ST-60\_0480375

All screening tests shall be performed at the component manufacturer’s premises or at a facility approved either by the qualification approval authority, where applicable (e.g. ESCC), or otherwise by the supplier .

ECSS-Q-ST-60\_0480376

The applicable quality levels defined in Table 7‑3 shall apply.

ECSS-Q-ST-60\_0480377

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ECSS-Q-ST-60\_0480466

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ECSS-Q-ST-60\_0480467

In case a component is not available in a qualified version according to quality level specified in Table 7‑3, the screening of the component shall meet the screening flow defined by the generic specifications listed in Table 7‑3.

ECSS-Q-ST-60\_0480468

In case of X-rays or CT scan inspection, the total dose deposited and exposure time shall not deteriorate part performance or reliability.

### Initial customer source inspection (precap)

1. A customer precap is not required.

### Lot acceptance

ECSS-Q-ST-60\_0480379

The supplier shall ensure that any lot/date code of EEE parts is submitted to a lot acceptance procedure, in line with applied normative systems, according to the following rules:

Space qualified parts:

ESCC: user’s lot acceptance on the procured lot/date code is not required due to periodic lot validation testing performed by the manufacturer.

MIL: QCI or TCI performed by the manufacturer is in accordance with the quality level of the MIL specification.

Other HiRel qualified parts:

The content of the lot acceptance is defined according to the available data.

The proposed lot acceptance is approved through the approval process (see clause 6.2.4).

Commercial parts:

The content of the lot acceptance is defined according to information provided by the justification document according to ECSS-Q-ST-60-13.

The proposed lot acceptance is approved through the approval process in accordance with clause 6.2.4.

ECSS-Q-ST-60\_0480380

The sample size for lot acceptance which may be reduced in some cases, shall be submitted to the customer approval through the PAD process (see clause 6.2.4).

Components from lot acceptance shall be considered as destructive as defined in ESCC or MIL specifications / test methods.

### Final customer source inspection (buy-off)

1. A buy-off is not required.

### Incoming inspections

ECSS-Q-ST-60\_0480382

The procurement entity shall perform incoming inspection at his premises on all components to verify conformance with the purchase order requirements.

ECSS-Q-ST-60\_0480383

The incoming inspection shall include the following items:

For any part: the minimum inspections required in ESCC 21004.

ECSS-Q-ST-60\_0480384

The incoming inspection shall be documented by a procedure to be presented, on request, to the customer for review.

ECSS-Q-ST-60\_0480514

If the parts have passed successfully a final CSI (or buy-off), the incoming inspection may be reduced to the following minimum:

Verification of the manufacturer’s CoC,

Packing checking,

Quantity verification.

ECSS-Q-ST-60\_0480515

In case the incoming inspection has been performed by a procurement agent, the incoming inspection performed by the end-user, may be reduced to the following minimum:

Packing checking,

Quantity verification.

### Radiation verification testing

ECSS-Q-ST-60\_0480387

Radiation sensitive components, as defined in clause 6.2.2.4 and for which applicable existing test data is insufficient shall be subjected to RVT.

ECSS-Q-ST-60\_0480388

RVT shall be performed in accordance with internationally recognized standards, such as ESCC Basic Specifications No. 22900 and 22500.

1. Additional information on test methods is given in MIL-STD-750 Test Method 1019, MIL-STD-883 Test Method 1019.

ECSS-Q-ST-60\_0480389

In such a case, a PAD in conformance with Annex D shall be issued and processed as per clause 6.2.4.

ECSS-Q-ST-60\_0480390

The results of RVT shall be documented by a report.

ECSS-Q-ST-60\_0480391

When RVT is performed in the frame of the project, the supplier shall send the related report to the customer for information.

### Destructive physical analysis

ECSS-Q-ST-60\_0480392

The DPA shall be performed on 3 samples per lot/date code for the following non-space qualified part types, as a minimum relays, oscillators and commercial parts, which is validated during PCB if that was agreed between both parties.

1. DPA can be performed on samples submitted to either endurance or radiation tests.

ECSS-Q-ST-60\_0480516

DPA may be carried out on representative samples of the components families when the following three conditions are met:

procured from the same manufacturer and same package without major change in the process,

with a limited datecode range of 13 weeks,

approved by the customer through the PAD (or Justification document) process.

1. In complement of above conditions, for series of integrated circuits, series of thermal switches, series of active discrete and series of passive components (e.g. 54xxxx, 1N63xx, …), representative samples can be from the same family considering technology limit and their complexity.

ECSS-Q-ST-60\_0480394

The DPA sample size may be reduced iif approved by the customer through the PAD process.

ECSS-Q-ST-60\_0480395

The DPA process shall be documented by a procedure to be submitted, on request, to the customer for information.

1. For guidance refer to the basic specificaton ESCC 21001.

ECSS-Q-ST-60\_0480396

The supplier shall verify that the outcome of the DPA is satisfactory prior to the installation of the components into flight hardware.

ECSS-Q-ST-60\_0480517

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ECSS-Q-ST-60\_0480518

DPA may be performed by the manufacturer if agreed by the supplier.

ECSS-Q-ST-60\_0480400

For health and safety reasons, any test producing beryllium oxide dust shall be omitted.

ECSS-Q-ST-60\_0480401

The results of DPA shall be documented by a report sent to the customer, on request, for information.

### Relifing

ECSS-Q-ST-60\_0480490

When components from a supplier’s or parts procurement agent’s stock are used, the following criteria shall be met:

The parts are stored according to the minimum conditions given in clause 6.4,

The minimum overall requirements (including screening) are in accordance with the project requirements,

The lot homogeneity and traceability can be demonstrated,

The EEE parts documentation is available and the content is acceptable in accordance with the project requirements (including radiation data, if necessary),

There are no open NCR’s and no unresolved alerts with respect to their date code.

ECSS-Q-ST-60\_0480403

For components meeting the criteria specified in requirement 6.3.10a, and which have a lot / date code exceeding the period defined in ECSS-Q-ST-60-14 clause 5, the relifing procedure ECSS-Q-ST-60-14 shall apply to the lot.

### Manufacturer’s data documentation deliveries

ECSS-Q-ST-60\_0480404

The manufacturer’s CoC shall be delivered to the parts procurer.

ECSS-Q-ST-60\_0480405

Any other data (i.e. LAT or LVT, QCI or TCI), defined in the applicable procurement documents, shall be available at the manufacturer’s facilities or delivered to the parts’ procurer in line with the purchase order, as a minimum compatible with CSV.

1. CSV is a common file format that can be used to transfer data between database or spreadsheet tables (a spreadsheet program is for example Excel®).

ECSS-Q-ST-60\_0480406

For non qualified parts, the parts procurer shall store the documentation for a minimum of 15 years after reception of the components.

1. For qualified parts, the documentation storage period is under the responsibility of the manufacturer and the qualifying authority.

## Handling and storage

ECSS-Q-ST-60\_0480407

The supplier shall establish and implement procedures for handling and storage of components in order to prevent possible degradation.

1. For guidance, refer to the basic specification ESCC 20600.

ECSS-Q-ST-60\_0480408

The procedures shall be applicable at any facility dealing with components for flight application.

ECSS-Q-ST-60\_0480409

On request, handling and storage procedures shall be sent to the customer for review.

ECSS-Q-ST-60\_0480410

As a minimum, the following areas shall be covered:

Control of the environment in accordance with ESCC Basic Specification No. 24900.

Measures and facilities to segregate and protect components during receiving inspection, storage, and delivery to manufacturing.

Control measures to ensure that electrostatic discharge susceptible components are identified and handled only by trained personnel using anti static packaging and tools.

Corrosion, moisture or process sensitive components, as classified in compliance with IPC/JEDEC J-STD-020, ECA/IPC/JEDEC J-STD-075 or other documented classification procedure, shall be handled in accordance with J-STD-033 or other documented classification procedure.

1. See IPC-1602 for further information on moisture sensitive printed boards.

An ESD Control Programme in accordance with EN 61340-5-1 shall be developed and implemented by the supplier.

1. EN 61340-5-1 guideline can be used for editing the ESD Control Programme.

The process for the selection of new components shall include their ESD sensitivity

If ultra-sensitive devices classified in compliance with the classes defined in EN 61340-5-1, a dedicated ESD Control Programme for ultra-sensitive devices shall be developed and implemented by the supplier.

## Component quality assurance

### General

ECSS-Q-ST-60\_0480411

The supplier shall establish and implement the requirements of this document including methods, organizations and documents used to control the selection and procurement of components in accordance with the requirements of ECSS-Q-ST-20.

### Nonconformances or failures

ECSS-Q-ST-60\_0480412

The supplier shall establish and maintain a nonconformance control system in accordance with the general requirements in ECSS-Q-ST-10-09.

ECSS-Q-ST-60\_0480413

Any observed deviation of EEE components from requirements as laid down in applicable specifications, procedures and drawings shall be controlled by the nonconformance control system.

1. This includes failures, malfunctions, deficiencies and defects.

ECSS-Q-ST-60\_0480414

The nonconformance control system shall handle all nonconformances occurring on EEE components during:

Manufacture (if available), screening and acceptance tests,

Incoming inspection,

Integration and test of equipment,

Storage and handling.

ECSS-Q-ST-60\_0480415

For ESCC qualified components the supplier shall apply the ESCC basic specification no 22800.

### Alerts

ECSS-Q-ST-60\_0480416

The supplier shall take into account all received alerts, errata sheets from international alert systems, from manufacturers or sent by the customer and shall validate that there are no alerts related to the intended applications and the recommendations of alerts were taken into account.

ECSS-Q-ST-60\_0480417

If alerts become available at a later stage, the supplier shall analyse the alerts, analyse the project risk and propose an action plan for customer approval.

### Traceability

ECSS-Q-ST-60\_0480418

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ECSS-Q-ST-60\_0480419

The traceability shall be maintained through incoming, storage, and installation at the procurer and user of the component.

ECSS-Q-ST-60\_0480420

In any case, the traceability requirements imposed by the supplier on the EEE parts manufacturer or distributor shall allow managing the adequacy of the tests performed by the supplier (i.e. evaluation, lot validation, any additional test or inspection).

ECSS-Q-ST-60\_0480421

The traceability of EEE parts during installation in equipment, shall be ensured by the supplier through maintaining the traceability to the manufacturer’s lot/date code number of the EEE parts actually mounted.

ECSS-Q-ST-60\_0480422

The supplier shall be able to provide these information (part type actually installed with its relevant lot/date code number) within one working day (when the flight system is on launch pad) or within one week (in the other cases).

### Lot homogeneity for sampling test

ECSS-Q-ST-60\_0480423

For radiation tests, the set of test samples shall be in accordance with ECSS-Q-ST-60-15.

If tests are performed by sampling, the sampled parts shall be selected so that they are representative of the lot/date code distribution.

## Specific components

### Overview

ECSS-Q-ST-60\_0480424

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### ASICs

ECSS-Q-ST-60\_0480425

For the development and re-use of ASICs, ECSS-Q-ST-60-03 shall apply.

### Hybrids

ECSS-Q-ST-60\_0480426

The hybrids shall be procured in conformance with the specifications listed in Table 7‑3.

ECSS-Q-ST-60\_0480470

Selection and validation of the hybrids manufacturers shall conform to clauses 5 and 6 of ECSS-Q-ST-60-05 and design of hybrids to clause 7 of ECSS-Q-ST-60-05.

ECSS-Q-ST-60\_0480471

The list of add-on parts shall be provided to the customer..

### One time programmable and reprogrammable devices

ECSS-Q-ST-60\_0480427

For the development, re-use and maintenance of FPGAs, ECSS-Q-ST-60-03 shall apply.

ECSS-Q-ST-60\_0480428

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ECSS-Q-ST-60\_0480519

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ECSS-Q-ST-60\_0480430

One time programmable components shall be submitted to a post-programming sequence.

ECSS-Q-ST-60\_0480431

For one time programmable FPGA and PROM without a clear and defined heritage, a post-programming burn-in shall be applied, in conformance with ESCC9000 subclause 8.16, for a minimum duration of 160 h.

1. FPGA and PROM with defined heritage are documented in these reports: ESCC REP 010 and ESCC REP011, available on <https://escies.org>.

ECSS-Q-ST-60\_0480432

The supplier shall prepare a post-programming procedure for customer’s approval, depending on part types

1. This includes, if applicable:
   * + electrical test conditions,
     + programming conditions and equipment,
     + programming software version qualified by the supplier,
     + burn-in conditions,
     + additional screening tests, and
     + specific marking after programming.

ECSS-Q-ST-60\_0480433

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ECSS-Q-ST-60\_0480520

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### Microwave monolithic integrated circuits

ECSS-Q-ST-60\_0480435

Design, selection, procurement and use of the microwave monolithic integrated circuits shall be performed in conformance with the requirements from ECSS-Q-ST-60-12.

### Connectors

ECSS-Q-ST-60\_0480548

For connectors with removable contacts, contacts shall be procured from the same manufacturer as the connector in which they are mounted.

### High Voltage Application

For high voltage applications and high power microwave EEE components the compatibility with operation in vacuum and partial pressure shall be verified.

1. Refer to ECSS-E-HB-20-05 for a definition for High voltage application.

### Self Made Magnetics

Self made magnetics parts shall be designed and screened using MIL-STD-981 or equivalent.

Minimum screening of Self made magnetics parts on a 100 % basis shall include:

visual inspection,

electrical measurements before test,

thermal cycling,

high temperature storage (minimum 96h) (optional),

final electrical measurements.

## Documentation

ECSS-Q-ST-60\_0480436

Any result from inspection or control shall be documented (including, precap, lot acceptance, buy-off, incoming, relifing and complementary tests).

Table 6‑1:Document requirements list for Class 3 components

| Document | Clause | Customer | Comments |
| --- | --- | --- | --- |
| Compliance matrix | 6.1.2.2 | Approval |  |
| “as design” DCL | 6.1.4 | Approval |  |
| RFW during equipment manufacturing  *(after “as design” DCL)* | 6.1.4 | Approval |  |
| Technical note for parts having pure in internal cavities  *(as info can go on PAD)* | 6.2.2.2 | Approval | When applicable |
| Radiation hardness assurance plan | 6.2.2.4 | Approval | to document the radiation hardness assurance programme |
| Equipment radiation analysis document | 6.2.2.4 | Approval |  |
| Evaluation plans | 6.2.3.1 | Approval |  |
| Evaluation reports | 6.2.3.1 | Approval |  |
| PAD’s | 6.2.4 | Approval |  |
| Justification documents | 6.2.4 | Approval | applicable for commercial parts |
| Procurement specifications prepared in the frame of the project | 6.3.2 | Review |  |
| PIND test method for DO4, DO5 & TO3 packages | 6.3.3 | Review | Only for old design |
| Procedure for incoming | 6.3.7 | Review (on request) |  |
| RVT reports when RVT is performed in the frame of the project | 6.3.8 | Information |  |
| Procedure for DPA | 6.3.9 | Information (on request) |  |
| DPA reports | 6.3.9 | Information (on request) |  |
| Procedure for handling and storage of EEE parts | 6.4 | Review (on request) |  |
| Action plan for alerts | 6.5.3 | Approval |  |
| Procedure for post-programming sequence | 6.6.3c | Approval |  |

# Quality levels

ECSS-Q-ST-60\_0480442

Table 7‑1: Quality levels for Class 1 components

| **EEE part family** | **Quality level** | | | **Supplementary** |
| --- | --- | --- | --- | --- |
| **ESCC** | **MIL** | **Other** | **Conditions** |
| Capacitors, chip, ceramic (PME and BME) | ESCC 3009 | MIL-PRF-55681 | JAXA-QTS-2040 Appendix C |  |
|  | EFR level R min | JAXA-QTS-2040 Appendix L |
|  | MIL-PRF-123 | JAXA-QTS-2040 Appendix M |
|  | MIL-PRF-32535 Level T |  |
| single layer ceramic chip capacitors |  | MIL-PRF-49464 |  |  |
|  | EFR level R min |  |  |
| high voltage ceramic capacitors | ESCC 3001 | MIL-PRF-49467 |  |  |
| ESCC 3009 | EFR level R min |  |  |
| Capacitors, molded, ceramic | ESCC 3001 | MIL-PRF-39014 | JAXA-QTS-2040 Appendix A | CKR06 (1µF - 50V) procured acc. to MIL-PRF-39014 is forbidden, it's recommended instead to procure |
|  | EFR level R min |  | space grade CKS06 according to MIL-PRF-123 |
|  | MIL-PRF-20 |  | For ceramic capacitors procured acc. to MIL-PRF-39014/2, additional LAT is required: |
|  | EFR level R min |  | . Thermal shock with additional cycles (total 100 cycles as per MIL-PRF-123 on 20 pieces) |
|  | MIL-PRF-123 |  | . Humidity steady state low voltage test on 20 pieces  (cf ESCC 3009) for any  capacitance and voltage values. |
|  | MIL-PRF-49470 |  | . DPA is required on 3 pieces |
|  | EFR level T |  |  |
| Capacitors, chip, solid tantalum (e.g. TAJ, T495, CWR11) | ESCC 3012 | MIL-PRF-55365 WFR level C min | JAXA-QTS-2040 Appendix K | All capacitors shall be surge current tested according to MIL-PRF-55365 surge current option B or C |
|  |
| Capacitors, non-solid tantalum, electrolytic (CLR79/80/90/91) | ESCC 3003 | MIL-PRF-39006 EFR level R min |  | 39006 / 22, 25, 30, 31 and "H“ dash number designated devices are recommended |
|  |
| Capacitors, solid tantalum, electrolytic (CSR and CSS type) | ESCC3002 | MIL-PRF-39003 WFR level C min | JAXA-QTS-2040 Appendix H | Surge current test mandatory according to MIL-PRF-39003/10 . |
| Capacitors, super metallized plastic film, (CRH type) | ESCC 3006 | MIL-PRF-83421 EFR level R min | JAXA-QTS-2040 Appendix G |  |
|  |  |
| Capacitors, metallized film, (HTP86, KM94S, PM94S, PM90SR2, MKT, …) | ESCC 3006 |  |  |  |
| Capacitors, variable | ESCC 3010 |  |  |  |
| Connectors, non filtered, D-sub rectangular | ESCC 3401 | MIL-DTL-83513 class M, Ni plated + outgassing | GSFC-311-P | for MIL-DTL-83513 additional requirements: - Processing for outgassing according to ESCC3401 |
|  |  | JAXA-QTS-2060 Appendix C |  |
|  |  | JAXA-QTS-2060 Appendix D |  |
|  |  | JAXA-QTS-2060 Appendix G |  |
| Connectors, filtered, D-sub rectangular | ESCC 3405 | MIL-DTL-24308 class M and D (Ni plated + outgassing) |  | Lifetest 1000h / 125°C / 1,5Ur on each tubular ceramic lot. |
|  |  |  | By default, assured for ESCC products. |
|  |  |  | for MIL-DTL-24308 additional requirements: - Screening acc. to MIL on 100% of the parts (instead of sample base) - Processing for outgassing according to ESCC3405 - Minimum 1.27µm gold plating thickness required |
| Connectors, printed circuit board | ESCC 3401 |  |  |  |
| Connectors, RF coaxial | ESCC 3402 | MIL-PRF-39012 | JAXA-QTS-2060 Appendix H |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Connectors, microminiature rectangular | ESCC 3401 |  | JAXA-QTS-2060 Appendix F |  |
| Connectors, non filtered, circular | ESCC 3401 | MIL-DTL-26482 Class L |  | for MIL-DTL-26482 additional requirements: - Screening acc. to MIL on 100% of the parts (instead of sample base) - Processing for outgassing according to ESCC3401 - Minimum 1.27µm gold plating thickness required |
|  | MIL-DTL-38999 class G or H |
| Connectors, filtered, circular | ESCC 3405 |  |  | Lifetest 1000h / 125°C / 1,5Ur on each tubular ceramic lot. |
|  | By default, assured for ESCC products. |
|  |  |
| Crystals | ESCC 3501 |  | JAXA-QTS-2070 |  |
| Diodes | ESCC 5000 | MIL-PRF-19500 JANS | JAXA-QTS-2030 |  |
| Diodes microwave | ESCC 5010 | MIL-PRF-19500 JANS |  |  |
| Filters | ESCC 3008 | MIL-PRF-28861 acc. to class S |  | MIL-PRF-28861/6 filters not recommended |
|  |  |  | For M28861 filters not class S qualified, group B is required on every lot/date code |
| Fuses (wire link ≥ 5A) | ESCC 4008 | MIL-PRF-23419/08 |  | Burn-in (168h – 85°C – rated current specified @85°C) is mandatory on each lot/date code  (see NOTE) |
| Fuses (CERMET) | ESCC 4008 | MIL-PRF-23419/12 | JAXA-QTS-2210 |  |
| Heaters flexible | ESCC 4009 |  | GSFC-S-311-P79 |  |
| Inductors, coils, (molded) | ESCC 3201 | MIL-STD-981 class S | JAXA-QTS-2110 |  |
| Inductors, coils (non molded) | ESCC 3201 | MIL-STD-981 class S |  |  |
| Integrated circuits (Hermetic) | ESCC 9000 | MIL-PRF-38535 class V | JAXA-QTS-2010 |  |
| Integrated circuits (non-hermetic) | ESCC9030 | MIL-PRF-38535 Class Y  (for flip-chip) | JAXA-QTS-2010 |  |
|  | Class P |  |
| Integrated circuits microwave (MMIC, hermetic) | ESCC 9010 level B | MIL-PRF-38535 class V |  |  |
| Integrated circuits microwave (MMIC, non-hermetic) |  | MIL-PRF-38535 Class Y |  |  |
| Class P |  |  |
| |  | | --- | | Microwave passive parts (circulators, isolators) | | ESCC 3202 |  |  |  |
| Microwave passive parts (coupler, power dividers) | ESCC 3404 | MIL-DTL-23971 (dividers)  “space flight” |  |  |
| Microwave passive parts (attenuators, loads) | ESCC 3403 | MIL-DTL-39030 (loads)  S letter (screened parts) |  |  |
|  |  | MIL-DTL-3933 |  |  |
|  |  | (attenuators)  S letter (screened parts) |  |  |
| Microwave switches | ESCC3603 | MIL-DTL-3928 |  |  |
| Oscillators (hybrids) | ECSS Q-ST-60-05  level 1 for OCXO | MIL-PRF-55310 (class 2) level S |  |  |
| ESCC 3503 for XO, VCXO, TCXO, or a mix of these types |  |  |  |
| Relays, electromagnetic, latching and nonlatching | ESCC 3601 |  |  |  |
| ESCC 3602 |  |  |  |
| Resistors, fixed, film, (RNC, MB x xxxx type, except RNC90) | ESCC 4001 | MIL-PRF-55182  EFR level R min | JAXA-QTS-2050 Appendix A |  |
|  | MIL-PRF-39017  EFR level R min | JAXA-QTS-2050 Appendix E |  |
|  |  | JAXA-QTS-2050 Appendix J |  |
| Resistors, high precision, fixed, metal foil (RNC90) | ESCC 4001 | MIL-PRF-55182/9 EFR level R min | JAXA-QTS-2050 Appendix B | 100 kΩ max allowed. |
|  |  |
| Resistors, network, thick film |  | MIL-PRF-914 |  |  |
|  |  | MIL-PRF-83401  Level M |
| Resistors, current sensing (RLV type) |  | MIL-PRF-49465 |  |  |
| Resistors, power, fixed, wirewound (RWR type) |  | MIL-PRF-39007  EFR level R min |  |  |
| Resistors, power, fixed, wirewound, chassis mounted (RER type) |  | MIL-PRF-39009  EFR level R min |  |  |
| Resistors, precision, fixed, wirewound (RBR type) |  | MIL-PRF-39005  EFR level R min |  | Diameter of wire shall be greater than 0,03 mm. |
| Resistors, fixed, film, high voltage | ESCC 4001 |  | GSFC S-311-P-683 & S-311-P-741 |  |
| Resistors, fixed, thick and thin film chip | ESCC 4001 | MIL-PRF-55342 EFR level R min |  |  |
| ESCC 4001  EFR level R min |  |  |  |
| Resistor, chip, fixed film, zero ohm | ESCC 4001 | MIL-PRF-32159 |  |  |
|  |  | level T |  |  |
| Switches, electromechanical |  | MIL-PRF-8805 |  |  |
| Switches, thermostatic | ESCC 3702 | MIL-PRF-24236 |  | (b) Products based on MILPRF-24236 are allowed with |
|  | (b) |  | ESCC screening: Run-in (500 cycles 60/100mA) |
|  |  |  | Elect. test per ESCC table 2 |
|  |  |  | External visual insp. 100 % |
| Thermistors | ESCC 4006 |  | GSFC-S-311-P18 |  |
|  |  | JAXA-QTS-2160 Appendix A |  |
|  |  | JAXA-QTS-2160 Appendix B |  |
|  |  | JAXA-QTS-2180 |  |
| Transformers | ESCC 3201 | MIL-STD-981 class S |  |  |
| Transistors | ESCC 5000 | MIL-PRF-19500 JANS | JAXA-QTS-2030 |  |
| Transistors microwave | ESCC 5010 | MIL-PRF-19500 JANS |  |  |
| Cables & wires, low frequency | ESCC 3901 | MIL-DTL-16878 MIL-DTL-81381 (polymide) and SAE AS22759 (PTFE)   SAE-AS81044 NEMA WC 27500 NEMA HP 7-2011 | JAXA-QTS-2120 Appendix C |  |
| Cables, coaxial, radio frequency | ESCC 3902 | MIL-DTL-17 |  |  |
| Hybrids | ECSS-Q-ST-60-05  level 1 | MIL-PRF-38534 class K | JAXA-QTS-2020 |  |
|  | ESCC 6001 |  |  |  |
| Surface Acoustic Waves (SAW) | ESCC 3502 | MIL-PRF-38534 class K |  |  |
| Photosensitive Charge  Coupled Devices (CCDs) and CMOS Imaging Sensors | ESCC 9020 |  |  |  |
| Opto discrete devices Photodiodes, LED | ESCC 5000 | MIL-PRF-19500 JANS |  | For pigtailed i/o testing should incorporate specific testing from the ESCC 23201 or ESCC 3420 |
| Phototransistors |  |  |  |  |
| Opto -couplers |  |  |  |  |
| Photoreceiver |  |  |  |  |
| Laser diodes | ESCC 23202 |  |  |  |
| Optic fibers |  | MIL-PRF-49291 |  |  |
| Cables, Optic fibers |  | MIL-PRF-85045 |  |  |
| RF cable assemblies | ESCC 3408 |  |  |  |
| Optical cable assemblies | ESCC 3420 |  |  |  |
| High data rate cable assemblies | ESCC3409 |  |  |  |
| NOTE For fuses, rated current at 85°C is the current a fuse can withstand @ +85°C during an unlimited time | | | | |



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Table 7‑2: Quality levels for Class 2 components

| **EEE part family** | **Quality level** | | | **Supplementary** |
| --- | --- | --- | --- | --- |
| **ESCC** | **MIL** | **Other** | **Conditions** |
| Capacitors, chip, ceramic (PME and BME) | ESCC 3009 | MIL-PRF-55681 | CECC 32101  (qualified parts) + burn-in |  |
|  | EFR level R min | JAXA-QTS-2040 Appendix C |
|  | MIL-PRF-123 | JAXA-QTS-2040 Appendix L |
|  | MIL-PRF-32535 Level T | JAXA-QTS-2040 Appendix M |
| single layer ceramic chip capacitors |  | MIL-PRF-49464 |  |  |
|  | EFR level R min |  |  |
| high voltage ceramic capacitors | ESCC 3001 | MIL-PRF-49467 |  |  |
| ESCC 3009 | EFR level R min |  |  |
| Capacitors, molded, ceramic | ESCC 3001 | MIL-PRF-39014 | JAXA-QTS-2040 Appendix A | CKR06 (1µF - 50V) procured acc. to MIL-PRF-39014 is forbidden, it's recommended instead to procure |
|  | EFR level R min | CECC 30601 | space grade CKS06 according to MIL-PRF-123 |
|  | MIL-PRF-20 | (type 1) | For ceramic capacitors procured acc. to MIL-PRF-39014/2, additional LAT is required: |
|  | EFR level R min | CECC 30602 | . Thermal shock with additional cycles (total 100 cycles as per MIL-PRF-123 on 20 pieces) |
|  | MIL-PRF-123 | (type 2) | . Humidity steady state low voltage test on 20 pieces  (cf ESCC 3009) for any  capacitance and voltage values. |
|  | MIL-PRF-49470 | (qualified parts) + burn-in | . DPA is required on 3 pieces |
|  | EFR level T |  |  |
| Capacitors, chip, solid tantalum (e.g. TAJ, T495, CWR11) | ESCC 3012 | MIL-PRF-55365  WFR level C min | JAXA-QTS-2040 Appendix K | All capacitors shall be surge current tested according to MIL-PRF-55365 surge current option B or C |
|  |
| Capacitors, non-solid tantalum, electrolytic (CLR79/80/90/91) | ESCC 3003 | MIL-PRF-39006  EFR level R min |  | 39006 / 22, 25, 30, 31 and "H“ dash number designated devices are recommended |
|  |
| Capacitors, solid tantalum, electrolytic (CSR and CSS type) | ESCC3002 | MIL-PRF-39003  WFR level C min | JAXA-QTS-2040 Appendix H | Surge current test mandatory according to MIL-PRF-39003/10 . |
| Capacitors, super metallized plastic film, (CRH type) | ESCC 3006 | MIL-PRF-83421  EFR level R min | JAXA-QTS-2040 Appendix G |  |
|  |  |
| Capacitors, metallized film, (HTP86, KM94S, PM94S, PM90SR2, MKT, …) | ESCC 3006 |  |  |  |
| Capacitors, variable | ESCC 3010 |  |  |  |
| Connectors, non filtered, D-sub rectangular | ESCC 3401 | MIL-DTL-83513 class M, Ni plated + outgassing | GSFC-311-P | for MIL-DTL-83513 additional requirements: - Processing for outgassing according to ESCC3401 |
|  |  | JAXA-QTS-2060 Appendix C |  |
|  |  | JAXA-QTS-2060 Appendix D |  |
|  |  | JAXA-QTS-2060 Appendix G |  |
| Connectors, filtered, D-sub rectangular | ESCC 3405 | MIL-DTL-24308 class M and D (Ni plated + outgassing) |  | Lifetest 1000h / 125°C / 1,5Ur on each tubular ceramic lot. |
|  |  |  | By default, assured for ESCC products. |
|  |  |  | for MIL-DTL-24308 additional requirements: - Screening acc. to MIL on 100% of the parts (instead of sample base) - Processing for outgassing according to ESCC3405 - Minimum 1.27µm gold plating thickness required |
| Connectors, printed circuit board | ESCC 3401 |  |  |  |
| Connectors, RF coaxial | ESCC 3402 | MIL-PRF-39012 | JAXA-QTS-2060 Appendix H |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Connectors, microminiature rectangular | ESCC 3401 |  | JAXA-QTS-2060 Appendix F |  |
| Connectors, non filtered, circular | ESCC 3401 | MIL-DTL-26482 Class L |  | for MIL-DTL-26482 additional requirements: - Screening acc. to MIL on 100% of the parts (instead of sample base) - Processing for outgassing according to ESCC3401 - Minimum 1.27µm gold plating thickness required |
|  | MIL-DTL-38999 class G or H |
| Connectors, filtered, circular | ESCC 3405 |  |  | Lifetest 1000h / 125°C / 1,5Ur on each tubular ceramic lot. |
|  | By default, assured for ESCC products. |
|  |  |
| Crystals | ESCC 3501 |  | JAXA-QTS-2070 |  |
| Diodes | ESCC 5000 | MIL-PRF-19500 JANTXV + PIND test | JAXA-QTS-2030 | PIND test (see notes 1, 2 and 3). |
|  | JANPTXV |  |  |
| Diodes microwave | ESCC 5010 | MIL-PRF-19500 JANTXV + PIND test |  | PIND test (see notes 1, 2 and 3). |
|  | JANPTXV |  |  |
| Filters | ESCC 3008 | MIL-PRF-28861 acc. to class S |  | MIL-PRF-28861/6 filters not recommended |
|  |  |  | For M28861 filters not class S qualified, group B is required on every lot/date code |
| Fuses (wire link ≥ 5A) | ESCC 4008 | MIL-PRF-23419/08 |  | Burn-in (168h – 85°C – rated current specified @85°C) is mandatory on each lot/date code  (see Note 5) |
| Fuses (CERMET) | ESCC 4008 | MIL-PRF-23419/12 | JAXA-QTS-2210 |  |
| Heaters flexible | ESCC 4009 |  | GSFC-S-311-P79 |  |
| Inductors, coils, (molded) | ESCC 3201 | MIL-STD-981 class S | JAXA-QTS-2110 |  |
| Inductors, coils (non molded) | ESCC 3201 | MIL-STD-981 class S |  |  |
| Integrated circuits (Hermetic) | ESCC 9000 | MIL-PRF-38535 class Q or M + PIND   test | JAXA-QTS-2010 | PIND test (see notes 1, 2 and 4). |
| Integrated circuits (non-hermetic) | ESCC9030 | MIL-PRF-38535 Class Y  (for flip-chip) | JAXA-QTS-2010 |  |
|  | Class P |  |
| Integrated circuits microwave (MMIC, hermetic) | ESCC 9010 level B | MIL-PRF-38535 class Q or M + PIND test | - | PIND test (see notes 1, 2 and 4). |
| Integrated circuits microwave (MMIC, non-hermetic) |  | MIL-PRF-38535 Class Y |  |  |
| Class P |  |  |
| |  | | --- | | Microwave passive parts (circulators, isolators) | | ESCC 3202 |  |  |  |
| Microwave passive parts (coupler, power dividers) | ESCC 3404 | MIL-DTL-23971 (dividers)  “space flight” |  |  |
| Microwave passive parts (attenuators, loads) | ESCC 3403 | MIL-DTL-39030 (loads)  S letter (screened parts) |  |  |
|  |  | MIL-DTL-3933 |  |  |
|  |  | (attenuators)  S letter (screened parts) |  |  |
| Microwave switches | ESCC3603 | MIL-DTL-3928 |  |  |
| Oscillators (hybrids) | ECSS Q-ST-60-05  level 1 for OCXO | MIL-PRF-55310 (class 2) level S |  |  |
| ESCC 3503 for XO, VCXO, TCXO, or a mix of these types |  |  |  |
| Relays, electromagnetic, latching and nonlatching | ESCC 3601 | MIL-PRF-39016  EFR level R min |  |  |
| ESCC 3602 | + ESCC screening according to chart 3 |  |  |
| Resistors, fixed, film, (RNC, MB x xxxx type, except RNC90) | ESCC 4001 | MIL-PRF-55182  EFR level R min | JAXA-QTS-2050 Appendix A |  |
|  | MIL-PRF-39017  EFR level R min | JAXA-QTS-2050 Appendix E |  |
|  |  | JAXA-QTS-2050 Appendix J |  |
|  |  | CECC 40101 + burn-in (qualified parts) CECC 40401  + burn-in  (qualified parts) |  |
| Resistors, high precision, fixed, metal foil (RNC90) | ESCC 4001 | MIL-PRF-55182/9 EFR level R min | JAXA-QTS-2050 Appendix B | 100 kΩ max allowed. |
|  |  |
| Resistors, network, thick film |  | MIL-PRF-914 |  |  |
|  |  | MIL-PRF-83401  Level M |
| Resistors, current sensing (RLV type) |  | MIL-PRF-49465 |  |  |
| Resistors, power, fixed, wirewound (RWR type) |  | MIL-PRF-39007  EFR level R min | CECC 40201  + burn-in  (qualified parts) |  |
| Resistors, power, fixed, wirewound, chassis mounted (RER type) |  | MIL-PRF-39009  EFR level R min | CECC 40201  + burn-in  (qualified parts) |  |
| Resistors, precision, fixed, wirewound (RBR type) |  | MIL-PRF-39005  EFR level R min |  | Diameter of wire shall be greater than 0,03 mm. |
| Resistors, fixed, film, high voltage | ESCC 4001 |  | GSFC S-311-P-683 & S-311-P-741 |  |
| Resistors, fixed, thick and thin film chip | ESCC 4001 | MIL-PRF-55342 EFR level R min | CECC 40401  + burn-in  (qualified parts) |  |
| ESCC 4001  EFR level R min |  |  |  |
| Resistor, chip, fixed film, zero ohm | ESCC 4001 | MIL-PRF-32159 |  |  |
|  |  | level T |  |  |
| Switches, electromechanical |  | MIL-PRF-8805 |  |  |
| Switches, thermostatic | ESCC 3702 | MIL-PRF-24236 |  | (b) Products based on MILPRF-24236 are allowed with |
|  | (b) |  | ESCC screening: Run-in (500 cycles 60/100mA) |
|  |  |  | Elect. test per ESCC table 2 |
|  |  |  | External visual insp. 100 % |
| Thermistors | ESCC 4006 |  | GSFC-S-311-P18 |  |
|  |  | JAXA-QTS-2160 Appendix A |  |
|  |  | JAXA-QTS-2160 Appendix B |  |
|  |  | JAXA-QTS-2180 |  |
| Transformers | ESCC 3201 | MIL-STD-981 class S |  |  |
| Transistors | ESCC 5000 | MIL-PRF-19500, JANTXV + PIND test | JAXA-QTS-2030 | PIND test (see notes 1, 2 and 3). |
|  | JANPTXV |  |  |
| Transistors microwave | ESCC 5010 | MIL-PRF-19500, JANTXV + PIND test | JAXA-QTS-2030 | PIND test (see notes 1, 2 and 3). |
|  | JANPTXV |  |  |
| Cables & wires, low frequency | ESCC 3901 | MIL-DTL-16878 MIL-DTL-81381 (polymide) and SAE AS22759 (PTFE)   SAE-AS81044 NEMA WC 27500 NEMA HP 7-2011 | JAXA-QTS-2120 Appendix C |  |
| Cables, coaxial, radio frequency | ESCC 3902 | MIL-DTL-17 |  |  |
| Hybrids | ECSS-Q-ST-60-05  level 1 | MIL-PRF-38534 class K | JAXA-QTS-2020 |  |
|  | ESCC 6001 |  |  |  |
| Surface Acoustic Waves (SAW) | ESCC 3502 | MIL-PRF-38534 class K |  |  |
| Photosensitive Charge  Coupled Devices (CCDs) and CMOS Imaging Sensors | ESCC 9020 |  |  |  |
| Opto discrete devices Photodiodes, LED | ESCC 5000 | MIL-PRF-19500 JANS |  | PIND test (see notes 1, 2 and 3). |
| Phototransistors |  | JANTXV + PIND Test |  | For pigtailed i/o testing should incorporate specific testing from the ESCC 23201 or ESCC 3420 |
| Opto -couplers |  |  |  |  |
| Photoreceiver |  |  |  |  |
| Laser diodes | ESCC 23202 |  |  |  |
| Optic fibers |  | MIL-PRF-49291 |  |  |
| Cables, Optic fibers |  | MIL-PRF-85045 |  |  |
| RF cable assemblies | ESCC 3408 |  |  |  |
| Optical cable assemblies | ESCC 3420 |  |  |  |
| High data rate cable assemblies | ESCC3409 |  |  |  |
| NOTE 1 Particle Impact Noise Detection (PIND) test is applicable to all cavity packages of active components.   NOTE 2 By default, PIND test is assured for ESCC products.   NOTE 3 For semiconductor devices the JANS criteria is applicable per MIL-PRF-19500.  The lot/date code is submitted to 100 % PIND testing according to test condition A (per test method 2052 of MIL-STD-750).   NOTE 4 For integrated circuits the Class V criteria is applicable per MIL-PRF-38535.  The lot/date code is submitted to 100 % PIND testing according to test condition A (per test method 2020 of MIL-STD-883)  NOTE 5 For fuses, rated current at 85°C is the current a fuse can withstand @ +85°C during an unlimited time | | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | |  |
|  |  |  |  |

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Table 7‑3: Quality levels for Class 3 components

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **EEE part family** | **Quality level** | | | **Supplementary** |
| **ESCC** | **MIL** | **Other** | **Conditions** |
| Capacitors, chip, ceramic (PME and BME) | ESCC 3009 | MIL-PRF-55681 | CECC 32101  (qualified parts) + burn-in |  |
|  | EFR level R min | JAXA-QTS-2040 Appendix C |
|  | MIL-PRF-123 | JAXA-QTS-2040 Appendix L |
|  | MIL-PRF-32535  Level M min | JAXA-QTS-2040 Appendix M |
| single layer ceramic chip capacitors |  | MIL-PRF-49464 |  |  |
|  | EFR level R min |  |  |
| high voltage ceramic capacitors | ESCC 3001 | MIL-PRF-49467 |  |  |
| ESCC 3009 | EFR level R min |  |  |
| Capacitors, molded, ceramic | ESCC 3001 | MIL-PRF-39014 | JAXA-QTS-2040 Appendix A | CKR06 (1µF - 50V) procured acc. to MIL-PRF-39014 is forbidden, it's recommended |
|  | EFR level R min | CECC 30601 | instead to procure space grade CKS06 according to MIL-PRF-123 |
|  | MIL-PRF-20 | (type 1) |  |
|  | EFR level R min | CECC 30602 |  |
|  | MIL-PRF-123 | (type 2) |  |
|  | MIL-PRF-49470 | (qualified parts) + burn-in |  |
|  | EFR level B |  |  |
| Capacitors, chip, solid tantalum (e.g. TAJ, T495, CWR11) | ESCC 3012 | MIL-PRF-55365  WFR level C min | JAXA-QTS-2040 Appendix K | All capacitors shall be surge current tested according to MIL-PRF-55365 surge current option B or C |
|  |
| Capacitors, non-solid tantalum, electrolytic (CLR79/80/90/91) | ESCC 3003 | MIL-PRF-39006  EFR level R min |  | 39006 / 22, 25, 30, 31 and "H“ dash number designated devices are recommended |
|  |
| Capacitors, solid tantalum, electrolytic (CSR and CSS type) | ESCC3002 | MIL-PRF-39003  WFR level C min | JAXA-QTS-2040 Appendix H | Surge current test mandatory according to MIL-PRF-39003/10 . |
| Capacitors, super metallized plastic film, (CRH type) | ESCC 3006 | MIL-PRF-83421  EFR level R min | JAXA-QTS-2040 Appendix G |  |
|  |  |
| Capacitors, metallized film, (HTP86, KM94S, PM94S, PM90SR2, MKT, …) | ESCC 3006 |  |  |  |
| Capacitors, variable | ESCC 3010 |  |  |  |
| Connectors, non filtered, D-sub rectangular | ESCC 3401 | MIL-DTL-83513 class M, Ni plated + outgassing | GSFC-311-P | for MIL-DTL-83513 additional requirements: - Processing for outgassing according to ESCC3401 |
| Connectors with same material, construction, design and processes as from qualified ESCC3401 line (for instance FR022) |  | JAXA-QTS-2060 Appendix C |  |
|  |  | JAXA-QTS-2060 Appendix D |  |
|  |  | JAXA-QTS-2060 Appendix G |  |
| Connectors, filtered, D-sub rectangular | ESCC 3405 | MIL-DTL-24308 class M and D (Ni plated + outgassing) |  | Lifetest 1000h / 125°C / 1,5Ur on each tubular ceramic lot. |
|  |  |  | By default, assured for ESCC products. |
|  |  |  | for MIL-DTL-24308 additional requirements: - Processing for outgassing according to ESCC3405 |
| Connectors, printed circuit board | ESCC 3401 |  |  |  |
| Connectors, RF coaxial | ESCC 3402 | MIL-PRF-39012 | JAXA-QTS-2060 Appendix H |  |
|  | MIL-DTL-83517 |  |  |
|  | MIL-PRF-55339 |  |  |
|  |  |  |  |
| Connectors, microminiature rectangular | ESCC 3401 |  | JAXA-QTS-2060 Appendix F |  |
| Connectors with same material, construction, design and processes as from qualified ESCC3401 line (for instance MDA or FR029, FR077, FR022) |  |  |  |
| Connectors, non filtered, circular | ESCC 3401 | MIL-DTL-26482 Class L |  |  |
|  | MIL-DTL-38999 class G or H |
| Connectors, filtered, circular | ESCC 3405 |  |  | Lifetest 1000h / 125°C / 1,5Ur on each tubular ceramic lot. |
|  | By default, assured for ESCC products. |
|  |  |
| Crystals | ESCC 3501 |  | JAXA-QTS-2070 |  |
| Diodes | ESCC 5000 | MIL-PRF-19500 JANTXV + PIND test | JAXA-QTS-2030 | PIND test (see notes 1, 2 and 3). |
|  | JANPTXV |  |  |
| Diodes microwave | ESCC 5010 | MIL-PRF-19500 JANTXV + PIND test |  | PIND test (see notes 1, 2 and 3). |
|  | JANPTXV |  |  |
| Filters | ESCC 3008 | MIL-PRF-28861 acc. to class B min |  | MIL-PRF-28861/6 filters not recommended |
|  |  |  | For M28861 filters not class S qualified, group B is required on every lot/date code |
| Fuses (wire link ≥ 5A) | ESCC 4008 | MIL-PRF-23419/08 |  | Burn-in (168h – 85°C – rated current specified @85°C) is mandatory on each lot/date code  (see note 5) |
| Fuses (CERMET) | ESCC 4008 | MIL-PRF-23419/12 | JAXA-QTS-2210 |  |
| Heaters flexible | ESCC 4009 |  | GSFC-S-311-P79 |  |
| Inductors, coils, (molded) | ESCC 3201 | MIL-STD-981 class B | JAXA-QTS-2110 |  |
| Inductors, coils (non molded) | ESCC 3201 | MIL-STD-981 class B |  |  |
| Integrated circuits (Hermetic) | ESCC 9000 | MIL-PRF-38535  TM 5004 class  level B + PIND  test  class Q or M + PIND test | JAXA-QTS-2010 | PIND test (see notes 1, 2 and 4). |
| Integrated circuits (non-hermetic) | ESCC9030 | MIL-PRF-38535  Class Y  (for flip-chip) | JAXA-QTS-2010 |  |
|  | Class N |  |
| Integrated circuits microwave (MMIC, hermetic) | ESCC 9010 level B | MIL-PRF-38535  TM 5004 class  level B + PIND test  class Q or M + PIND test | - | PIND test (see notes 1, 2 and 4). |
| Integrated circuits microwave (MMIC, non-hermetic) |  | MIL-PRF-38535  Class Y  (for flip-chip) |  |  |
| Class N |  |  |
| Microwave passive parts (circulators, isolators) | ESCC 3202 |  |  |  |
| Microwave passive parts (coupler, power dividers) | ESCC 3404 | MIL-DTL-23971 (dividers)  “space flight” |  |  |
| Microwave passive parts (attenuators, loads) | ESCC 3403 | MIL-DTL-39030 (loads)  S letter (screened parts) |  |  |
|  |  | MIL-DTL-3933 |  |  |
|  |  | (attenuators)  S letter (screened parts) |  |  |
| Microwave switches | ESCC3603 | MIL-DTL-3928 |  |  |
| Oscillators (hybrids) | ECSS Q-ST-60-05  level 1 for OCXO | MIL-PRF-55310 (class 2) level B |  |  |
| ESCC 3503 for XO, VCXO, TCXO, or a mix of these types |  |  |  |
| Relays, electromagnetic, latching and nonlatching | ESCC 3601 | MIL-PRF-39016  EFR level R min |  |  |
| ESCC 3602 | + ESCC screening according to chart 3 |  |  |
| Resistors, fixed, film, (RNC, MB x xxxx type, except RNC90) | ESCC 4001 | MIL-PRF-55182  EFR level R min | JAXA-QTS-2050 Appendix A |  |
|  | MIL-PRF-39017  EFR level R min | JAXA-QTS-2050 Appendix E |  |
|  |  | JAXA-QTS-2050 Appendix J |  |
|  |  | CECC 40101 + burn-in (qualified parts) CECC 40401  + burn-in  (qualified parts) |  |
| Resistors, high precision, fixed, metal foil (RNC90) | ESCC 4001 | MIL-PRF-55182/9 EFR level R min | JAXA-QTS-2050 Appendix B | 100 kΩ max allowed. |
|  |  |
| Resistors, network, thick film |  | MIL-PRF-914 |  |  |
|  |  | MIL-PRF-83401  Level M |
| Resistors, current sensing (RLV type) |  | MIL-PRF-49465 |  |  |
| Resistors, power, fixed, wirewound (RWR type) |  | MIL-PRF-39007  EFR level R min | CECC 40201  + burn-in  (qualified parts) |  |
| Resistors, power, fixed, wirewound, chassis mounted (RER type) |  | MIL-PRF-39009  EFR level R min | CECC 40201  + burn-in  (qualified parts) |  |
| Resistors, precision, fixed, wirewound (RBR type) |  | MIL-PRF-39005  EFR level R min |  | Diameter of wire shall be greater than 0,03 mm. |
| Resistors, fixed, film, high voltage | ESCC 4001 |  | GSFC S-311-P-683 & S-311-P-741 |  |
| Resistors, fixed, thick and thin film chip | ESCC 4001 | MIL-PRF-55342 EFR level R min | CECC 40401  + burn-in  (qualified parts) |  |
| ESCC 4001  EFR level R min |  |  |  |
| Resistor, chip, fixed film, zero ohm | ESCC 4001 | MIL-PRF-32159 |  |  |
|  |  | level M |  |  |
| Switches, electromechanical |  | MIL-PRF-8805 |  |  |
| Switches, thermostatic | ESCC 3702 | MIL-PRF-24236 |  | (b) Products based on MILPRF-24236 are allowed with |
|  | (b) |  | ESCC screening: Run-in (500 cycles 60/100mA) |
|  |  |  | Elect. test per ESCC table 2 |
|  |  |  | External visual insp. 100 % |
| Thermistors | ESCC 4006 |  | GSFC-S-311-P18 |  |
|  |  | JAXA-QTS-2160 Appendix A |  |
|  |  | JAXA-QTS-2160 Appendix B |  |
|  |  | JAXA-QTS-2180 |  |
| Transformers | ESCC 3201 | MIL-STD-981 class B |  |  |
| Transistors | ESCC 5000 | MIL-PRF-19500, JANTXV + PIND test | JAXA-QTS-2030 | PIND test (see notes 1, 2 and 3). |
|  | JANPTXV |  |  |
| Transistors microwave | ESCC 5010 | MIL-PRF-19500, JANTXV + PIND test | JAXA-QTS-2030 | PIND test (see notes 1, 2 and 3). |
|  | JANPTXV |  |  |
| Cables & wires, low frequency | ESCC 3901 | MIL-DTL-16878 MIL-DTL-81381 (polymide) and SAE AS22759 (PTFE)   SAE-AS81044 NEMA WC 27500 NEMA HP 7-2011 | JAXA-QTS-2120 Appendix C |  |
| Cables, coaxial, radio frequency | ESCC 3902 | MIL-DTL-17 |  |  |
| Hybrids | ECSS-Q-ST-60-05  level 1 | MIL-PRF-38534 class H + PIND Test | JAXA-QTS-2020 | PIND test (see notes 1 and 2). |
|  | ESCC 6001 |  |  |  |
| Surface Acoustic Waves (SAW) | ESCC 3502 | MIL-PRF-38534 class H + PIND Test |  | PIND test (see notes 1 and 2). |
| Photosensitive Charge  Coupled Devices (CCDs) and CMOS Imaging Sensors | ESCC 9020 |  |  |  |
| Opto discrete devices Photodiodes, LED | ESCC 5000 | MIL-PRF-19500 JANS |  | PIND test (see notes 1, 2 and 3). |
| Phototransistors |  | JANTXV + PIND Test |  | For pigtailed i/o testing should incorporate specific testing from the ESCC 23201 or ESCC 3420 |
| Opto -couplers |  |  |  |  |
| Photoreceiver |  |  |  |  |
| Laser diodes | ESCC 23202 |  |  |  |
| Optic fibers |  | MIL-PRF-49291 |  |  |
| Cables, Optic fibers |  | MIL-PRF-85045 |  |  |
| RF cable assemblies | ESCC 3408 |  |  |  |
| Optical cable assemblies | ESCC 3420 |  |  |  |
| High data rate cable assemblies | ESCC3409 |  |  |  |
| NOTE 1 Particle Impact Noise Detection (PIND) test is applicable to all cavity packages of active components.   NOTE 2 By default, PIND test is assured for ESCC products.   NOTE 3 For semiconductor devices the JANS criteria is applicable per MIL-PRF-19500.  The lot/date code is submitted to 100 % PIND testing according to test condition A (per test method 2052 of MIL-STD-750).   NOTE 4 For integrated circuits the Class V criteria is applicable per MIL-PRF-38535.  The lot/date code is submitted to 100 % PIND testing according to test condition A (per test method 2020 of MIL-STD-883)  NOTE 5 For fuses, rated current at 85°C is the current a fuse can withstand @ +85°C during an unlimited time | | | | |

|  |  | | |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |

# Evaluation and lot acceptance for retinned parts

This topic is covered in ECSS-Q-ST-60-13 only.

# Pure tin lead finish – risk analysis

## Overview

Pure tin finish has a propensity to generate whiskers. Tin whiskers are highly conductive ‘‘hair-like’’ protrusions of tin that can grow from the surface of pure tin plated parts due in part to compressive stress from the tin plating process or from other sources of compressive stress (e.g., tightening of a fastener) and can induce failures as:

* Electrical instantaneous or permanent short circuit
* Metal vapour arc in reduced atmospheric pressure conditions and for application with high levels of current and voltage (more than 12V)
* Contamination: a free floating whisker can interfere with the movement of mechanical parts or induce contamination of optical surfaces

Many parameters can have an impact on whisker growth. The purpose of the risk analysis is to evaluate those parameters.

## Requirements

ECSS-Q-ST-60\_0480549

A pure tin lead finish risk analysis facing whiskers shall include, as a minimum, the following:

Lead material

Underlayer material and thickness

Plating chemistry and thickness.

Heat treatment by manufacturer

Procedure for SnPb dipping of the parts

Conformal coating presence and characteristics: material and thickness

Design criticality, shorter distances between 2 connections or between a connection and an area at another potential

Supply voltage and current

Tin whisker sensitivity results as per JESD-201A and JESD22-A121A

Mission profile: storage, mission duration, thermal cycling

Previous experiences

Impact of failure at unit/system level

* 1. 1 For requirement 9.2a.1 examples of lead material are alloy 42 and copper
  2. 2 For requirement 9.2a.2 examples of underlayer material and thickness are Ni underlayer, silver underlayer.
  3. 3 For requirement 9.2a.3 examples of plating chemistry and thickness are matte or bright tin, tin thickness
  4. 4 For requirement 9.2a.4 examples of heat treatment by manufacturer are 1hour at 150 °C for Cu based lead frame
  5. 5 For requirement 9.2a.5: The risk to degrade the reliability of components during the retinning can be higher than the risk to generate an anomaly with tin whiskers. This risk has to be assessed.
  6. 6 The Annex A of GEIA STD-0005-02 can be used as guideline

1. (normative)  
   Component control plan (CCP) - DRD
   1. DRD identification
      1. Requirement identification and source document

This DRD is called up from ECSS-Q-ST-60 requirement 4.1.2.2a.

* + 1. Purpose and objective

The purpose of the component control plan (CCP) is to define and structure the activities to be implemented to ensure that the management of a CLASS 1 component programme meets the project objectives. This includes achieving the specified project cost, appropriate quality (including function and performance) and minimising schedule and overall risk.

* 1. Expected response
     1. Scope and content

ECSS-Q-ST-60\_0480437

The CCP shall include or refer to the following information:

A description of the purpose, content and the reason prompting its preparation,

A list of the applicable and reference documents,

Any additional terms, definitions and abbreviations,

The organizational breakdown structure, responsibility descriptions, management approach and concurrent engineering,

Control of lower level suppliers, procurement agents (if any) and manufacturers,

Procurement system,

Radiation control programme,

Component selection and standardization,

Component data acquisition and assessment,

Component evaluation and related testing approach,

Component approval,

Component testing, inspection and storage,

Component quality assurance activities,

Assessment of problem notifications and alerts,

Programme planning with schedule of tasks linked to programme milestones,

Specific components control and back-up plans whenever there is evidence of possible schedule, quality or technical problems,

Reporting and deliverables,

Compliance matrix to the clauses of this standard.

* + 1. Special remarks

ECSS-Q-ST-60\_0480521

The CCP may be part of the overall project PA plan (see clause 4.1.2.2b).

1. (normative)  
   Declared component list (DCL) - DRD
   1. DRD identification
      1. Requirement identification and source document

This DRD is called up from ECSS-Q-ST-60 requirements 4.1.4h, 5.1.4h and 6.1.4g.

* + 1. Purpose and objective

The purpose of the Declared Components List (DCL) is to provide a status list of all the EEE components intended to be used or actually used as dictated by the phases of the project.

* 1. Expected response
     1. Scope and content

ECSS-Q-ST-60\_0480439

The DCL shall include or refer to the following information:

A description of the purpose, content and the reason prompting its preparation,

A list of the applicable and reference documents,

Any additional terms, definitions or abbreviations,

Component number (commercial equivalent designation),

Family (ESCC group code),

Package,

Value or range of values with tolerance for non qualified parts,

Component manufacturer (name, country),

Generic procurement specification,

Detail procurement specification (with issue and revision for non qualified parts),

Specification amendment (including issue and revision),

Name of the procurement agents (CPPA, supplier, distributor),

Quality level and lot test (ESCC LAT or LVT, MIL TCI or QCI or CI),

Space qualified status (yes or no),

RVT (yes or no),

Reference of the PAD or Justification Document, where required,

Approval status of the part,

Change identification between each DCL issue,

Date-code (only for “as built” DCL).

All EEE parts that are intended to be used in the project shall be listed in the DCL.

1. A list of EEE parts is listed in clause 3.4.
   * 1. Special remarks

None.

1. (normative)  
   Procurement specification - DRD
   1. DRD identification
      1. Requirement identification and source document

This DRD is called up from ECSS-Q-ST-60 requirements 4.3.2d, 5.3.2d and 6.3.2d.

* + 1. Purpose and objective

The purpose of the Procurement Specification is to establish the component technical specification baseline.

* 1. Expected response
     1. Scope and content

ECSS-Q-ST-60\_0480440

The procurement specification shall include or refer to the following information:

A description of the purpose, content and the reason prompting its preparation,

A list of the applicable and reference documents,

Any additional terms, definitions or abbreviations,

Absolute maximum ratings,

Electrical and mechanical parameters and limits,

Screening, burn-in, and acceptance requirements,

Package material and lead finish,

Documentation/data requirements,

Delta limits when applicable,

Criteria for percent defective allowable,

LAT or LVT, QCI or TCI,

Marking,

Storage requirements,

Requirements for lot homogeneity,

Serialization (when applicable),

Protective packaging and handling requirements,

Radiation Verification Testing requirements, when applicable.

* + 1. Special remarks

None.

1. (normative)  
   Part approval document (PAD) - DRD
   1. DRD identification 
      1. Requirement identification and source document

This DRD is called up from ECSS-Q-ST-60 requirements 4.2.4d, 4.3.8c, 5.2.4d, 5.3.8c, 6.2.4d and 6.3.8c.

* + 1. Purpose and objective

The PAD is a control document the objective of which is to identify the component and to provide information about its evaluation and its acceptability w.r.t.:

* approval status,
* evaluation tests,
* procurement inspections and tests,
* lot acceptance or lot verification tests,
* radiation hardness data and RVT
  1. Expected response

ECSS-Q-ST-60\_0480441

The information given in Table D-1 shall be provided.

ECSS-Q-ST-60\_0480445

: PAD sheet

|  |
| --- |
| **PROJECT**:……………. Doc n°:………………. Prepared by: …………….  Issue:………………….. Date:……………….. |
| Approval requested by:………………………….  Family:……………….. Fcode [ ] Group:……………… Gcode [ ]  Component Number:……………………………………..  Commercial Equivalent Designation:………………….  Manufacturer/ Country:……………………………  Technology/Characteristics (value or range of values with tolerance, voltage, package etc): ……………………………..  Pure tin free (Y/N) [ ]  Generic specification:………………... Issue:….. Rev.:…..  Detail specification:……………..…… Issue:….. Rev.:….. variant:…….  Specification amendment: …………. Issue:….. Rev.:….. variant:..…..  Quality level:…………………….. Procurement by:……………………….. |
| **APPROVAL STATUS**  EPPL Part 1/2 listed (1/2/N) [ ]  ESCC QPL or EQML listed. (Y/N) [ ]  MIL QPL or QML listed (Y/N) [ ] If yes: QPL/QML Reference:………………………….  Other approvals/former usage ……………………………………….  Evaluation programme required (Y/N) [ ]  If yes reference of the Evaluation Programme:………………………… |
| **PROCUREMENT INSPECTIONS and TESTS**  Precap (Y/N) [ ]  Lot acceptance:  ESCC LAT/LVT level or subgroup [ ]  MIL QCI/TCI group [ ]  Buy-off (Y/N) [ ]  DPA (Y/N) [ ] if yes: sample size …………………………  Complementary tests ………………………………………… |
| **RADIATION HARDNESS DATA**  Radiation Hardness Assurance Plan applicable (Y/N)[ ]  Doc. Ref.: .....................................................  Total Dose Effects:  Evaluation Test Data (report) reference: ....……………..  Single Event Effects: SEL/SEU/SET/SEFI/SEB/SEGR/others: *(cross out when non applicable)*  Evaluation Test Data (report) reference: ....……………..  RVT required (Y/N)[ ] |
| **REMARKS** |
| Approval customer ........................................................................ Date ......................  Approval first-level supplier ........................................................ Date ...................... |

**GUIDANCE NOTE FOR COMPLETION OF PART APPROVAL DOCUMENT**

with justification a single PAD may be generic to cover different ranges of parts

|  |  |
| --- | --- |
| Doc No: | Unique sequential number |
| Issue: | Issue of document |
| Date: | Date of issue |
| Project: | Name of project using the component |
| Prepared by | Name of the person submitting the PAD |
| Approval requested by: | Name of the company submitting the PAD |
| Family: | Capacitor, resistor, etc. (Refer ECSS Family Code) |
| Group: | Ceramic, tantalum, etc. (Refer ECSS Group Code) |
| Component Number: | In accordance with the procurement specification  May be generic to cover different range of parts (with justification): e.g. range of resistors or capacitors or variants for connectors & accessories |
| Commercial Equivalent Designation | Self explanatory |
| Technology/Characteristics: | Additional details of the components covered by the PAD |
| Pure tin free (Y/N) | When tin ≥ 97% (inside the component and terminations) |
| Generic specification: | Relevant specification with issue and revisions |
| Detail specification: | Relevant specification with issue and revisions  only required for non qualified parts |
| Specification Amendment | Relevant specification with issue and revisions |
| Quality level: | As defined in 7 |
| Procurement by: | Identify the name of the company procuring the part. E.g. This can be self, CPPA, distributor, manufacturer or a combination thereof. |
| Manufacturer/Country: | Self-explanatory. |
| Approval status: | Information about known approvals (EPPL, ESCC, ESCC/QML, MIL, MIL/QML or other approvals/former usage.) |
| Evaluation programme required: | Y/N as applicable |
| Procurement inspections and test: | Y/N as applicable |
| DPA sample size: | Number |
| Complementary tests | Testing/Inspection in addition to that defined in the procurement specification shall be identified, e.g. PIND, upscreening, … |
| Lot Acceptance: | Identify level and subgroups |
| Radiation Hardness Data | Self-explanatory. |
| SEL/SEU/SET/SEFI/SEB/SEGR/others:  Evaluation Test Data (report) reference | Reference of the test report for SingleEvent Latchup/ SingleEvent Upset/ Single Event Transient/Single Event Functional Interrupt/Single Event Burn out/Single Event Gate Rupture |
| RVT | Radiation Verification Test Y/N as applicable |
| REMARKS | Any additional information |
| Approval customer: | Signature signifies acceptance |
| Approval first-level supplier: | Signature signifies acceptance |

1. (informative)  
   EEE documents delivery per review

Scope of the Table E-1 is to present relation of documents associated to EEE components activities to support project review objectives as specified in ECSS-M-ST-10.

1. This table constitutes a first indication for the data package content at various reviews. The full content of such data package is established as part of the business agreement, which also defines the delivery of the document between reviews.

The table lists the documents necessary for the project reviews (identified by “+”).

The various crosses in a row indicate the increased levels of maturity progressively expected versus reviews. The last cross in a row indicates that at that review the document is expected to be completed and finalized.

1. All documents, even when not marked as deliverables in Table E-1, are expected to be available and maintained under configuration management as per ECSS-M-ST-40 (e.g. to allow for backtracking in case of changes).

Documents listed in Table E-1 are either ECSS-Q-ST-60 DRDs, or DRDs to other ECSS-Q-ST-60-XX, or defined within the referenced DRDs.

For better understanding of the Phase Review during which the relevant document has to be provided, the following assumptions are given:

* Phase Reviews relevant to Documents recalled in Q-ST-60, Q-ST-60-05, Q-ST-60-12 and Q-ST-60-14 have to be considered as “Equipment Level Reviews”.
* Phase Reviews relevant to Documents recalled in Q-ST-60-02 have to be considered as “ASIC or FPGA Level Reviews”.
* All document deliveries are given for equipment under development, while for other types of equipment the table content could be different and tailored consequently.

: EEE delivery documents

| Document or DRD title | Reviews | | | | | | | | | | | | | DRD ref. |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| MDR | PRR | SRR | PDR | CDR | QR | AR | ORR | FRR | LRR | CRR | ELR | MCR |
| Component control plan (CCP) |  |  | + | + |  |  |  |  |  |  |  |  |  | ECSS-Q-ST-60 |
| Declared component list (DCL) |  |  |  | + | + | + | + |  |  |  |  |  |  | ECSS-Q-ST-60 |
| Procurement specification |  |  |  | + | + |  |  |  |  |  |  |  |  | ECSS-Q-ST-60 |
| Part approval document (PAD) |  |  |  | + | + |  |  |  |  |  |  |  |  | ECSS-Q-ST-60 |
| Radiation hardness assurance plan |  |  |  | + |  |  |  |  |  |  |  |  |  | ECSS-Q-ST-60 |
| Evaluation plans |  |  |  | + |  |  |  |  |  |  |  |  |  | ECSS-Q-ST-60 |
| Evaluation reports |  |  |  |  | + |  |  |  |  |  |  |  |  | ECSS-Q-ST-60 |
| ASIC and FPGA control plan (ACP) |  |  | + | + |  |  |  |  |  |  |  |  |  | ECSS-Q-ST-60-02 |
| ASIC and FPGA development plan (ADP) |  |  | + | + | + |  |  |  |  |  |  |  |  | ECSS-Q-ST-60-02 |
| ASIC and FPGA requirements specification (ARS) |  |  | + | + | + |  |  |  |  |  |  |  |  | ECSS-Q-ST-60-02 |
| Feasibility and risk assessment report (FRA) |  |  | + | + |  |  |  |  |  |  |  |  |  | ECSS-Q-ST-60-02 |
| Verification Plan (VP) |  |  |  | + | + | + |  |  |  |  |  |  |  | ECSS-Q-ST-60-02 |
| Design validation plan (DVP) |  |  |  |  | + | + |  |  |  |  |  |  |  | ECSS-Q-ST-60-02 |
| Data sheet |  |  |  | + | + | + |  |  |  |  |  |  |  | ECSS-Q-ST-60-02 |
| Detailed specification (DS) |  |  |  |  | + | + |  |  |  |  |  |  |  | ECSS-Q-ST-60-02 |
| Experience summary report |  |  |  |  |  | + |  |  |  |  |  |  |  | ECSS-Q-ST-60-02 |
| Hybrid circuit technology identification (HTIF) |  |  |  | + | + |  |  |  |  |  |  |  |  | ECSS-Q-ST-60-05 |
| Format of the detail specification of a hybrid circuit |  |  |  | + | + |  |  |  |  |  |  |  |  | ECSS-Q-ST-60-05 |
| Similarity form |  |  |  | + | + |  |  |  |  |  |  |  |  | ECSS-Q-ST-60-05 |
| MMIC electrical design specification |  |  | + | + | + |  |  |  |  |  |  |  |  | ECSS-Q-ST-60-12 |
| Compliance matrix for custom MMIC design |  |  | + | + | + |  |  |  |  |  |  |  |  | ECSS-Q-ST-60-12 |
| Design package document |  |  |  | + | + |  |  |  |  |  |  |  |  | ECSS-Q-ST-60-12 |
| MMIC summary design data sheet |  |  |  | + | + |  |  |  |  |  |  |  |  | ECSS-Q-ST-60-12 |
| MMIC procurement specification |  |  |  | + | + |  |  |  |  |  |  |  |  | ECSS-Q-ST-60-12 |
| MMIC lot acceptance specification for user LAT |  |  |  | + | + |  |  |  |  |  |  |  |  | ECSS-Q-ST-60-12 |
| MMIC visual inspection summary sheet |  |  |  |  | + |  |  |  |  |  |  |  |  | ECSS-Q-ST-60-12 |
| Internal supplier’s specification |  |  |  | + | + |  |  |  |  |  |  |  |  | ECSS-Q-ST-60-13 |
| Justification document |  |  |  | + | + |  |  |  |  |  |  |  |  | ECSS-Q-ST-60-13 |
| Relifing report |  |  |  |  | + |  |  |  |  |  |  |  |  | ECSS-Q-ST-60-14 |
| Mission radiation environment specification |  |  |  | + |  |  |  |  |  |  |  |  |  | ECSS-Q-ST-60-15 |
| Radiation analysis report |  |  |  | + | + |  |  |  |  |  |  |  |  | ECSS-Q-ST-60-15 |

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