



Space product assurance

**ASIC, FPGA and IP Core product
assurance**

**ECSS Secretariat
ESA-ESTEC
Requirements & Standards Section
Noordwijk, The Netherlands**

Foreword

This Standard is one of the series of ECSS Standards intended to be applied together for the management, engineering, product assurance and sustainability in space projects and applications. 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 ECSS-E-ST-20-40C and ECSS-Q-ST-60-03C Working Group, reviewed by the ECSS Executive Secretariat and approved by the ECSS Technical Authority.

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Change log

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Table of contents

Change log	3
1 Scope.....	7
2 Normative references	9
3 Terms, definitions and abbreviated terms.....	10
3.1 Terms from other standards.....	10
3.2 Terms specific to the present standard	11
3.3 Abbreviated terms.....	11
3.4 Conventions.....	12
3.4.1 Names of DEVICE development phases and reviews	12
3.5 Nomenclature	12
4 ASIC, FPGA and IP Core product assurance principles	14
4.1 Overview	14
4.2 Organization of this Standard	14
4.3 Tailoring.....	15
5 Product Assurance programme implementation.....	16
5.1 Organization and responsibility	16
5.1.1 Organization.....	16
5.1.2 Responsibility and authority	16
5.1.3 DEVICE product assurance responsible	16
5.2 DEVICE product assurance programme management	17
5.2.1 DEVICE product assurance planning and control.....	17
5.2.2 DEVICE product assurance reporting.....	18
5.2.3 Audits.....	18
5.2.4 Alerts.....	19
5.2.5 DEVICE problems reporting	19
5.2.6 Nonconformances	20
5.3 Risk management and critical item control.....	20
5.3.1 Risk management.....	20
5.3.2 Critical item control.....	20
5.4 Supplier selection and control.....	21
5.4.1 Supplier selection.....	21
5.4.2 Supplier requirements	21

5.4.3	Supplier monitoring	21
5.4.4	Criticality classification	22
5.5	Tools and supporting environment.....	22
5.5.1	Methods and tools.....	22
5.5.2	Development environment selection	22
6	DEVICE Process Assurance	24
6.1	DEVICE development flow.....	24
6.1.1	DEVICE development flow	24
6.2	Requirements applicable to all DEVICE engineering processes and phases	25
6.2.1	DEVICE dependability and safety	25
6.2.2	Handling of critical DEVICES.....	26
6.2.3	Reuse of existing DEVICES.....	28
6.2.4	Automatic code generation.....	30
6.2.5	Project Security Assurance	31
6.2.6	Independent Verification and Validation	32
6.3	Requirements applicable to individual DEVICE engineering processes and activities.....	32
6.3.1	DEVICE Definition Phase.....	32
6.3.2	DEVICE Design and Verification Phase	32
6.3.3	DEVICE Implementation Phase	33
6.3.4	DEVICE Design Validation, Qualification and Acceptance Phase	33
6.4	Process Assessment and improvement.....	38
6.4.1	Process assessment control	38
6.4.2	Process assessment reporting	38
6.4.3	Process improvement	38
7	DEVICE Product Quality Assurance	39
7.1	Product quality objectives and metrication	39
7.1.1	Assurance activities for product quality requirements.....	39
7.1.2	Product Metrics definition and reporting	39
7.1.3	Basic metrics.....	40
7.1.4	Reporting of metrics	40
7.2	IP Core or DEVICES intended for Reuse	40
7.2.1	Overview	40
7.2.2	Self-contained information.....	40
7.2.3	Requirements for intended reuse	40
7.2.4	Configuration management for intended reuse.....	41
7.2.5	Testing on different EEE component.....	41

7.2.6	Certificate of conformance	41
8	DEVICE Configuration Management.....	42
8.1	Configuration Management planning and control.....	42
8.1.1	Configuration Management Plan	42
8.1.2	Software tools	43
8.2	Configuration Management implementation.....	43
8.2.1	DEVICE Configuration management implementation	43
8.2.2	CIDL and ABCL	43
8.2.3	Software configuration management implementation	45
8.3	Configuration Control.....	45
9	Tailoring by DEVICE criticality	46
9.1	Device criticality categories.....	46
9.2	Applicability Matrix.....	48
Annex A (normative) DEVICE Product Assurance Plan (DPAP) - DRD.....		67
Annex B (normative) DEVICE Product Assurance Report (DPAR) - DRD..		74
Annex C (normative) DEVICE Reuse File (DRF) - DRD.....		78
Annex D (informative) DEVICE Development Expected Outputs		80
Annex E (informative) Traceability from ECSS-Q-ST-60-03 to ECSS-Q-ST-60-02		87
Bibliography.....		105

Tables

Table D-1 : ECSS-Q-ST-60-03 and ECSS-E-ST-20-40 list of Expected Outputs.....	81
Table E-1 : Traceability matrix from ECSS-Q-ST-60-03 to ECSS-Q-ST-60-02	87

1

Scope

This standard together with ECSS-E-ST-20-40 supersedes ECSS-Q-ST-60-02. All general engineering requirements from ECSS-Q-ST-60-02 have been transferred to ECSS-E-ST-20-40. All Product Assurance requirements from ECSS-Q-ST-60-02 have been transferred to this standard.

This Standard defines a set of product assurance requirements for the development, reuse and maintenance of integrated circuits such as ASICs and FPGAs, and for IP Cores as reusable building blocks of complex integrated circuits, in space systems.

This standard does not cover requirements for the selection, control, procurement or usage of Integrated Circuits for space projects nor their ESCC qualification requirements, as those requirements are covered by ECSS-Q-ST-60-02 and the ESCC generic specification No. 9000 respectively.

In the context of this standard, the special word DEVICE is used to refer to either an ASIC, an FPGA or an IP Core. Space systems include manned and unmanned spacecraft, launchers, payloads, experiments and their associated ground equipment and facilities.

This standard is written to complement ECSS-E-ST-20-40 with which it is to be used in a co-engineering approach. This standard contains Product Assurance requirements for the DEVICE engineering activities, workflow, phases and reviews defined in ECSS-E-ST-20-40. Both this standard and ECSS-E-ST-20-40 are to be used during the development of DEVICES.

This Standard applies to the development, reuse and maintenance of DEVICES which affect the quality of the deliverable product or service provided by a space system, if the service is implemented by these DEVICES.

This standard interfaces with space product assurance, engineering and management standardisation documents, which are addressed in the Product Assurance (Q), Engineering (E) and Management (M) branches of the ECSS System. This standard explains how the supporting standards relate to the DEVICE product assurance processes and phases.

This standard does not modify the generic PA requirements (ECSS-Q-ST-10), QA requirements (ECSS-Q-ST-20), Dependability requirements (ECSS-Q-ST-30), and Configuration (ECSS-M-ST-40) previously defined in ECSS-Q-ST-60-02. This standard translates the requirements of these ECSS standards and adapts them to the context of the DEVICE engineering domain defined in ECSS-E-ST-20-40.

This standard requires that the user applies the generic Project Planning and Implementation requirements (ECSS-M-ST-10). However, it is worth noting that the phases and reviews defined in ECSS-E-ST-20-40 do not follow the naming convention of processes and reviews defined in ECSS-M-ST-10.

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

Tailoring of this standard to a specific business agreement or project, when ASIC/FPGA/IP Core product assurance requirements are prepared, is also addressed in clause 4.3.

2

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 revisions 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 most 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-E-ST-10-02	Space engineering – Verification
ECSS-E-ST-20-40	Space engineering – ASIC, FPGA and IP Core engineering
ECSS-Q-ST-10	Space product assurance – Product assurance management
ECSS-Q-ST-10-04	Space product assurance – Critical item control
ECSS-Q-ST-10-09	Space product assurance – Nonconformance control system
ECSS-Q-ST-20	Space product assurance – Quality assurance
ECSS-Q-ST-30	Space product assurance – Dependability
ECSS-M-ST-10	Space project management – Project planning and implementation
ECSS-M-ST-10-01	Space project management – Organization and conduct of reviews
ECSS-M-ST-40	Space project management – Configuration and information management
ECSS-M-ST-80	Space project management – Risk management

Terms, definitions and abbreviated terms

3.1 Terms from other standards

- a. For the purpose of this Standard, the terms and definitions from ECSS-ST-00-01 apply, in particular for the following terms:

1. acceptance
2. critical
3. critical item
4. dependability
5. lot
6. maintainability
7. maintenance
8. nonconformance
9. process
10. product
11. product assurance
12. project
13. quality
14. quality assurance
15. flight operations
16. qualification

NOTE The term “firmware” is defined in ECSS-S-ST-00-01C, and it is not used in the context of this standard because it is ambiguous and unnecessary. It is important not to confuse terms like “FPGA”, “FPGA programming file” or “FPGA programming bit stream” with “firmware”.

- b. For the purpose of this Standard, the terms and definitions from ECSS-E-ST-20-40 apply, in particular for the following terms:

1. Application specific integrated circuit (ASIC)
2. Building Block
3. code
4. DEVICE
5. DEVICE development flow

6. Field Programmable Gate Array (FPGA)
7. IP Core
8. phase
9. software
10. system requirement
11. validation
12. verification

3.2 Terms specific to the present standard

3.2.1 **DEVICE deactivated function**

function incorporated through correct design and coding, and intended to be executed in certain DEVICE product configurations only, or in none of them

3.2.2 **unreachable function**

function that cannot be executed due to design error or coding error

3.3 Abbreviated terms

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

Abbreviation	Meaning
ADR	DEVICE Architecture Definition Phase Review
ASIC	Application Specific Integrated Circuit
DDP	DEVICE Development plan
DDR	DEVICE Detailed Design Review
DFRAR	DEVICE Feasibility And Risk Assessment Report
DPR	DEVICE Definition Phase Review
DRS	DEVICE Requirements Specification
DSMP	DEVICE Support and Maintenance Plan
DVaP	DEVICE Validation Plan
DVeP	DEVICE Verification Plan
DVR	DEVICE Design and Verification Phase Review
DPAP	DEVICE Product Assurance Plan
DPAR	DEVICE Product Assurance Report
DRF	DEVICE Reuse File
DVP	Design Validation Plan
EIDP	End Item Data Package

Abbreviation	Meaning
ESCC	European Space Components Coordination
FM	Flight Model
FPGA	Field-Programmable Gate Array
IEEE	Institute of Electrical and Electronics Engineers
IC	Integrated Circuit
IP	Intellectual Property
IPR	DEVICE Implementation Phase Review
IVV	Independent Verification and Validation
LPR	DEVICE Layout Phase Review
MoM	Minutes of Meeting
NCR	Nonconformance Record
NRB	Nonconformance Review Board
OTS	Off-The-Shelf
QSL	Qualification Status List
VQAR	DEVICE Validation, Qualification and Acceptance Phase Review
VHDL	Very High Speed Integrated Circuit hardware description language

3.4 Conventions

3.4.1 Names of DEVICE development phases and reviews

ECSS-Q-ST-60-03 follows the names of DEVICE development phases and reviews defined in ECSS-E-ST-20-40. These do not follow the naming conventions defined in ECSS-M-ST-10 in an effort to use widely established ASIC, FPGA and IP Core engineering terminology which is self-explanatory and commonly used by IC engineers. In order to facilitate collaboration between IC and PA engineers ECSS-E-ST-20-40 Annex L provides a comparison between the ECSS-E-ST-20-40 phases and ECSS-M-ST-10 phases and key names.

3.5 Nomenclature

The following nomenclature applies throughout this document:

- The word “shall” is used in this Standard to express requirements. All the requirements are expressed with the word “shall”.
- 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.

- c. 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”.
- d. 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.

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

4

ASIC, FPGA and IP Core product assurance principles

4.1 Overview

The objectives of ASIC, FPGA or IP Core DEVICE product assurance are to provide adequate confidence to the customer and to the supplier that the DEVICE satisfies its requirements throughout the system lifetime. In particular, that the DEVICE is developed to perform properly and safely in its operational environment, meeting the quality objectives agreed for the project.

This Standard contributes to these objectives by defining the DEVICE product assurance requirements to be met in a particular space project. These requirements deal with quality management and ECSS framework, DEVICE development flow activities and process/phase definition and quality characteristics of products.

One of the fundamental principles of this Standard is the customer/supplier relationship, assumed for all DEVICE developments. The organizational aspects of this are defined in ECSS-M-ST-10. The concept of the customer/supplier relationship is applied recursively, i.e. the customer can himself be a supplier to a higher level in the space system hierarchy.

The requirements of this Standard are applicable to the supplier, unless otherwise explicitly stated.

The supplier demonstrates compliance with the DEVICE product assurance requirements and provides the specified evidence of compliance.

To this end, the customer specifies the DEVICE product assurance requirements for its suppliers, taking into account their responsibilities and the specific nature of their deliverables.

This Standard complements ECSS-E-ST-20-40 “Space engineering — ASIC, FPGA and IP Core engineering”, with product assurance aspects, integrated in the space system DEVICE engineering processes as defined in ECSS-E-ST-20-40. Together the two standards specify all processes for space ASIC, FPGA and IP Core DEVICE development.

4.2 Organization of this Standard

This Standard is organized into five main parts:

- DEVICE product assurance programme implementation
- DEVICE process assurance
- DEVICE product quality assurance
- DEVICE configuration management
- Tailoring of ECSS-Q-ST-60-03 by criticality.

Annex A and Annex B specify the DRDs (document requirements definitions) of the DEVICE product assurance documents (DPAP and DPAR). Annex C specifies the DEVICE Reuse File (DRF). The DRDs of other engineering and management documents are included in ECSS-Q-ST-20, ECSS-E-ST-10-02, ECSS-E-ST-20-40 and ECSS-M-ST-40.

The DEVICE expected document outputs of the ECSS-Q-ST-60-03 requirements and ECSS-E-ST-20-40 requirements is summarized in Annex D.

Annex E shows the traceability from ECSS-Q-ST-60-03 to ECSS-Q-ST-60-02.

This standard details for the DEVICE Product Assurance aspects some of the general requirements already addressed by the ECSS Management, Product Assurance and Quality Assurance standards.

4.3 Tailoring

The general information and requirements for the selection and tailoring of applicable standards are defined in ECSS-S-ST-00.

There are several drivers for tailoring, such as dependability and safety aspects, development constraints, product quality objectives and business objectives.

Tailoring for dependability and safety aspects is based on the selection of requirements related to the verification, validation and levels of proofs demanded by the criticality of the DEVICE. Clause 9 contains a tailoring of this Standard based on DEVICE criticality.

Tailoring for DEVICE type aspects is based on the selection of requirements related to the verification, validation and levels of proofs demanded by the type of the DEVICE. Tailoring of the requirements of ECSS-Q-ST-60-03 by DEVICE type is based on the DEVICE types defined in ECSS-E-ST-20-40 Clause 3.4.3. It is noted that PA activities are consistently applied to all DEVICE types so no tailoring table is provided in this document as the tailoring is explicitly stated in 6.2.3.2c NOTE 3, 6.2.3.3a.3(c) and 7.2.5a.

5

Product Assurance programme implementation

5.1 Organization and responsibility

5.1.1 Organization

ECSS-Q-ST-60-03_1590001

- a. The supplier shall ensure that a PA organizational structure is defined for DEVICE development, and that individuals have defined tasks and responsibilities in compliance with clause 5.1.1 of ECSS-Q-ST-10 and with DRD from Annex A.

5.1.2 Responsibility and authority

ECSS-Q-ST-60-03_1590002

- a. The responsibility, the authority and the interrelation of personnel who manage, perform and verify work affecting DEVICE quality shall be defined and documented.

ECSS-Q-ST-60-03_1590003

- b. The responsibilities and the interfaces of each organisation on the project, either external or internal, involved in a project shall be defined and documented.

ECSS-Q-ST-60-03_1590004

- c. The delegation of DEVICE product assurance tasks by a supplier to a lower level supplier shall be done in a documented and controlled way, with the supplier retaining the responsibility towards the customer.

5.1.3 DEVICE product assurance responsible

5.1.3.1 General

ECSS-Q-ST-60-03_1590005

- a. The DEVICE product assurance responsible shall:
 - 1. report to the project manager through the project product assurance manager.

2. have organisational authority and independence to propose and maintain a DEVICE product assurance programme in accordance with the project DEVICE product assurance requirements.
3. have access to higher management as necessary to fulfil his/her duties.
4. be invited to all project reviews.

5.1.3.2 Training

ECSS-Q-ST-60-03_1590006

- a. The supplier shall review the project requirements to establish and make provision for acquiring or developing the resources and skills for the management and technical staff.

ECSS-Q-ST-60-03_1590007

- b. The supplier shall maintain training records and ensure that trained personnel are available for the planned activities and tasks.

ECSS-Q-ST-60-03_1590008

- c. The supplier shall ensure that personnel conducting activities in compliance with ECSS-Q-ST-60-03 and ECSS-E-ST-20-40 are trained.

ECSS-Q-ST-60-03_1590009

- d. The supplier shall specify the training subjects based on the specific tools, techniques, methodologies and computer resources for use in the development and management of the DEVICE product.

NOTE Personnel can undergo training to acquire skills and knowledge relevant to the specific field with which the DEVICE is to deal.

5.2 DEVICE product assurance programme management

5.2.1 DEVICE product assurance planning and control

ECSS-Q-ST-60-03_1590010

- a. The supplier shall provide a DEVICE product assurance plan for baseline at DEVICE Definition Phase Review, in response to the DEVICE product assurance requirements and in compliance with DRD in Annex A for customer approval.

NOTE The DEVICE product assurance plan can be either a standalone document or a section of the supplier overall product assurance plan.

ECSS-Q-ST-60-03_1590011

- b. The DEVICE Product assurance programme shall include all internal manuals, standards or procedures listed in the DEVICE product assurance plan.

ECSS-Q-ST-60-03_1590012

- c. The DEVICE product assurance plan shall be revisited and updated to ensure that the activities to be undertaken in the following phase are defined.

ECSS-Q-ST-60-03_1590013

- d. The supplier shall include in the DEVICE product assurance plan a compliance matrix documenting conformance with the individual DEVICE product assurance requirements applicable for the project or business agreement.

ECSS-Q-ST-60-03_1590014

- e. For each DEVICE product assurance requirement, the compliance matrix shall provide a reference to the document where the expected output of that requirement is located.

5.2.2 DEVICE product assurance reporting

ECSS-Q-ST-60-03_1590015

- a. The supplier shall provide a Product assurance report for each review and for each DEVICE delivery in compliance with DRD from Annex B covering the DEVICE product assurance activities performed during the past project phases, in accordance with the contract.

5.2.3 Audits

ECSS-Q-ST-60-03_1590016

- a. For DEVICE audits, ECSS-Q-ST-10 clause 5.2.3 shall apply.

ECSS-Q-ST-60-03_1590017

- b. Reviews and audits of processes and of products shall be carried out by personnel not directly involved in the DEVICE work being performed.

ECSS-Q-ST-60-03_1590018

- c. The supplier shall report on DEVICE Audits in the DEVICE Product Assurance Report in compliance with DRD in Annex B.

5.2.4 Alerts

ECSS-Q-ST-60-03_1590019

- a. For alerts impacting the DEVICE development, ECSS-Q-ST-10 clause 5.2.9 shall apply.

ECSS-Q-ST-60-03_1590020

- b. The supplier shall report on alerts impacting the DEVICE development in the DEVICE Product Assurance Report in compliance with DRD in Annex B.

5.2.5 DEVICE problems reporting

ECSS-Q-ST-60-03_1590021

- a. The supplier shall define and implement procedures for the logging, analysis and correction of DEVICE problems encountered during DEVICE development in the DEVICE Product Assurance Plan in compliance with DRD in Annex A.

ECSS-Q-ST-60-03_1590022

- b. The DEVICE problem report shall contain the following information:
 - 1. Identification of the DEVICE item,
 - 2. Description of the problem,
 - 3. Root cause analysis
 - 4. Recommended solution,
 - 5. Final disposition,
 - 6. Modifications implemented in documents, code and tools, and
 - 7. Tests re-executed.

ECSS-Q-ST-60-03_1590023

- c. The procedures for DEVICE problems reporting shall define the interface with the nonconformance system and the circumstances under which a problem qualifies as a nonconformance.

ECSS-Q-ST-60-03_1590024

- d. The supplier shall verify the application of problem reporting procedures and report the results in the DEVICE Product Assurance Report in compliance with DRD in Annex B.

5.2.6 Nonconformances

ECSS-Q-ST-60-03_1590025

- a. For DEVICE nonconformance handling, ECSS-Q-ST-10-09 shall apply.

ECSS-Q-ST-60-03_1590026

- b. When dealing with DEVICE nonconformance, the NRB shall include a representative from the DEVICE product assurance and the DEVICE engineering organizations in compliance with ECSS-Q-ST-10-09 requirement 5.2.2.1.

ECSS-Q-ST-60-03_1590027

- c. The DEVICE product assurance plan shall specify the point in the DEVICE development flow from which the nonconformance procedures apply.

5.3 Risk management and critical item control

5.3.1 Risk management

ECSS-Q-ST-60-03_1590028

- a. The DEVICE Product Assurance responsible shall provide input to Risk management for DEVICE in compliance with ECSS-M-ST-80.

5.3.2 Critical item control

ECSS-Q-ST-60-03_1590029

- a. For critical item control, ECSS-Q-ST-10-04 shall apply.

ECSS-Q-ST-60-03_1590030

- b. The supplier shall identify the characteristics of the DEVICE that qualify for inclusion in the Critical Item List.

NOTE DFRAR defined in ECSS-E-ST-20-40 can be one of the inputs for CIL.

5.4 Supplier selection and control

5.4.1 Supplier selection

ECSS-Q-ST-60-03_1590031

- a. For supplier selection ECSS-Q-ST-20 clause 5.4.1 shall apply.

ECSS-Q-ST-60-03_1590032

- b. For suppliers of existing DEVICE, including DEVICE contained in OTS equipment and units, the selection shall be performed in compliance with requirements from clause 6.2.3.

5.4.2 Supplier requirements

ECSS-Q-ST-60-03_1590033

- a. The supplier shall establish DEVICE product assurance requirements for the next level suppliers, tailored to their role in the project.

ECSS-Q-ST-60-03_1590034

- b. The supplier shall provide the DEVICE product assurance requirements applicable to the next level suppliers for customer approval in the DEVICE Product Assurance Plan in compliance with DRD in Annex A.

5.4.3 Supplier monitoring

ECSS-Q-ST-60-03_1590035

- a. The supplier shall monitor the next lower level suppliers' conformance to the product assurance requirements.

ECSS-Q-ST-60-03_1590036

- b. The monitoring process shall include the review and approval of the next lower level suppliers' product assurance plans, the continuous verification of processes and products, and the monitoring of the final validation of the product.

ECSS-Q-ST-60-03_1590037

- c. The supplier shall ensure that DEVICE development processes are defined and applied by the next lower level suppliers in conformance with the DEVICE product assurance requirements for suppliers.

ECSS-Q-ST-60-03_1590038

- d. The supplier shall provide the next lower level suppliers' DEVICE product assurance plan for customer's acceptance.

5.4.4 Criticality classification

ECSS-Q-ST-60-03_1590039

- a. The supplier shall provide the lower level suppliers with the results of the safety and dependability analyses performed at higher level as provided by the customer and his level in compliance with requirements from clause 6.2.1, including:
 - 1. The criticality classification of the DEVICE products to be developed,
 - 2. Information about the failures that can be caused at higher level by the DEVICE products under development.

5.5 Tools and supporting environment

5.5.1 Methods and tools

ECSS-Q-ST-60-03_1590040

- a. Methods and tools to be used for all the activities of the development cycle, including requirements analysis, specification, modelling, design, coding, validation, testing, configuration management, verification and product assurance shall be identified by the supplier and agreed with the customer.

ECSS-Q-ST-60-03_1590041

- b. The choice of development methods and tools shall be justified by demonstrating through testing or documented assessment as follows:
 - 1. The development team has the experience or training to apply them,
 - 2. The tools and methods are applicable for the verification of functional and operational characteristics of the product,
 - 3. The tools are available throughout the development and maintenance lifetime of the product.

ECSS-Q-ST-60-03_1590042

- c. The correct use of methods and tools shall be verified and reported in the DEVICE product assurance report in compliance with DRD in Annex B.

5.5.2 Development environment selection

ECSS-Q-ST-60-03_1590043

- a. The DEVICE development environment shall be selected according to the following criteria:
 - 1. Availability,
 - 2. Compatibility,
 - 3. Performance,

4. Maintenance,
5. Durability and technical consistency with the operational equipment,
6. The assessment of the product with respect to requirements, including the criticality category,
7. The available support documentation,
8. The acceptance and warranty conditions,
9. The conditions of installation, preparation, training and use,
10. The maintenance conditions, including the possibilities of evolutions,
11. Copyright and intellectual property rights constraints, and
12. Dependence on one specific supplier.

ECSS-Q-ST-60-03_1590044

- b. The availability of the DEVICE development environment to developers and other users shall be verified before the start of each development phase.

6**DEVICE Process Assurance**

6.1 DEVICE development flow**6.1.1 DEVICE development flow**

ECSS-Q-ST-60-03_1590045

- a. The DEVICE development flow specified in ECSS-E-ST-20-40 shall be integrated in the DEVICE product assurance plan in compliance with DRD in Annex A.

ECSS-Q-ST-60-03_1590046

- b. The following characteristics of the DEVICE development flow shall be specified:
 - 1. Phases,
 - 2. Input and output of each phase,
 - 3. Status of completion of phase output,
 - 4. Reviews,
 - 5. Dependencies,
 - 6. Responsibilities, and
 - 7. Role of the customer at each review, in conformance with ECSS-M-ST-10 and ECSS-M-ST-10-01.

ECSS-Q-ST-60-03_1590047

- c. The Customer shall review the DEVICE development flow against the contractual DEVICE engineering and product assurance requirements.

ECSS-Q-ST-60-03_1590048

- d. The Customer shall review the DEVICE development flow for the availability of resources.

NOTE Resources can include tools and human resources.

6.2 Requirements applicable to all DEVICE engineering processes and phases

6.2.1 DEVICE dependability and safety

6.2.1.1 Criticality classification

ECSS-Q-ST-60-03_1590049

- a. The PA responsible shall report the criticality classification at system-level in the DEVICE Product Assurance Plan in compliance with DRD in Annex A.

NOTE For the system-level analyses leading to the criticality classification of DEVICE products based on the severity of failures consequences, see ECSS-Q-ST-40 clause 6.4.1, and ECSS-Q-ST-30 clause 5.4.

6.2.1.2 DEVICE dependability and safety analysis

ECSS-Q-ST-60-03_1590050

- a. The supplier shall perform a dependability and safety analysis at the DEVICE level, using the results of system-level safety and dependability analyses, in order to determine the criticality of each DEVICE function in compliance with ECSS-Q-ST-30 clause 5.4.

ECSS-Q-ST-60-03_1590051

- b. The DEVICE PA engineer shall report the results of the DEVICE dependability and safety analysis and the status of DEVICE dependability and safety recommendations in the DEVICE Product Assurance Report in compliance with DRD in Annex B.

NOTE The DPAR can refer to dependability and safety documents.

ECSS-Q-ST-60-03_1590052

- c. The supplier shall identify the methods and techniques for the dependability and safety analysis at DEVICE level throughout the DEVICE lifecycle.

NOTE Dependability and safety methods and techniques are documented in ECSS-Q-ST-30 and ECSS-Q-ST-40.

ECSS-Q-ST-60-03_1590053

- d. Methods and techniques for DEVICE dependability and safety analysis shall be agreed between the supplier and customer.

- e. The supplier shall report the methods and techniques used for DEVICE dependability and safety analysis in the DEVICE Product Assurance Plan in compliance with DRD in Annex A.

- f. The supplier shall report on the status of the implementation and verification of the DEVICE dependability and safety analysis recommendations in the DEVICE product assurance report in compliance with DRD in Annex B.

NOTE Dependability and safety recommendations are documented in artefacts from ECSS-Q-ST-30 and ECSS-Q-ST-40.

- g. The supplier shall provide the results of the DEVICE dependability and safety analysis for integration into the system-level dependability and safety analyses, in the DEVICE Product Assurance Report in compliance with DRD in Annex B, addressing the following:
1. Additional failure modes identified at DEVICE level which had not been identified at system level,
 2. Recommendations for system-level activities.

NOTE For example: introduction of hardware inhibits, and modifications of the system architecture.

6.2.2 Handling of critical DEVICES

6.2.2.1 General

- a. The supplier shall define, justify and apply measures to assure the dependability and safety of critical DEVICES.

NOTE 1 For definition of DEVICES criticality A, B or C (Catastrophic, Critical or Major) see ECSS-Q-ST-30 clause 6.5

NOTE 2 These measures can include:

- use of DEVICE development methods that have performed successfully in a similar application;
- insertion of features for failure isolation and handling
- defensive development techniques, such as input verification and consistency checks;
- test or simulation coverage percentage;

- witnessed or independent verification and validation;
- gathering and analysis of failure statistics;
- removing deactivated DEVICE functions or showing through a combination of analysis and testing that the means by which such DEVICE function can be inadvertently executed are prevented, isolated, or eliminated.

ECSS-Q-ST-60-03_1590058

- b. The application of the chosen measures to handle the critical DEVICE shall be verified in the DEVICE Product Assurance Report in compliance with DRD in Annex B.

ECSS-Q-ST-60-03_1590059

- c. The need for updating the DRS, and any of DEVICE Development, verification or validation Plans and its impact in the development flow for critical DEVICE shall be analysed, in the DEVICE Product Assurance Report in compliance with DRD in Annex B, after:

1. Any change of the underlying platform hardware,
2. Any change in the environment in which the DEVICE operates,
3. Any change of the tools, including configuration of the tools, that affect directly or indirectly the development of the DEVICE.

NOTE 1 For 2 example is memory used with reprogrammable FPGA.

NOTE 2 Additional verification and validation, or regression testing which can be done at DEVICE or system-level

6.2.2.2 Unreachable functions

ECSS-Q-ST-60-03_1590060

- a. Identified unreachable DEVICE functions shall be removed and the need for re-verification and re-validation be analysed and reported in the DEVICE Product Assurance Report in compliance with DRD in Annex B.

6.2.3 Reuse of existing DEVICES

6.2.3.1 Reuse Category

ECSS-Q-ST-60-03_1590061

- a. The supplier shall identify the reused DEVICE and classify the DEVICE in one of reuse categories, in compliance with ECSS-E-ST-10-02 Table 5-1, and report it in the DEVICE Product Assurance Report in compliance with DRD in Annex B.

6.2.3.2 DEVICE Reuse File

ECSS-Q-ST-60-03_1590062

- a. The supplier shall provide the DEVICE Reuse File in compliance with DRD in Annex C at DEVICE Definition Phase Review.

ECSS-Q-ST-60-03_1590063

- b. The DEVICE Reuse File shall be provided for reuse categories B and C specified in ECSS-E-ST-10-02 Table 5-1.

ECSS-Q-ST-60-03_1590064

- c. The supplier shall provide the DEVICE Reuse File with its qualification status at the Equipment Qualification Status Review, in compliance with ECSS-E-ST-10-02 requirement 5.2.4.2.d.

NOTE 1 If no qualification status is available at EQSR time, the device is declared as Reuse Category D.

NOTE 2 For Reuse Category A, qualification evidence is included in equipment qualification documentation.

NOTE 3 For IP Core, as there is no Equipment Qualification Status Review, the DEVICE Reuse File is expected for each review as listed in Annex D.

ECSS-Q-ST-60-03_1590065

- d. For Reuse Category D, the full DEVICE development flow defined in ECSS-E-ST-20-40 shall apply.

ECSS-Q-ST-60-03_1590066

- e. The Delta qualification activities shall be completed prior to the qualification review at upper level.

ECSS-Q-ST-60-03_1590067

- f. Corrective actions shall be identified, documented in the DEVICE Reuse File and applied to the reused DEVICE.

6.2.3.3 DEVICE Licensing scheme

ECSS-Q-ST-60-03_1590068

- a. The supplier shall characterise, in the DRF, the deliverable DEVICE, which comprises both developed DEVICE and existing reused DEVICE, in terms of constituent elements and the associated licensing schemes, at all reviews, including:
 - 1. The Intellectual Property Rights regime and licensing scheme of the developed DEVICE, as defined by the contract,
 - 2. The licence under which the reused DEVICE is accessible by the end user,
 - 3. The analysis of compatibility between the reused DEVICE licence and the developed DEVICE Intellectual Property Rights regime and licensing scheme as defined by the contract. This shall include as a minimum:
 - (a) analysis of the reused DEVICE licence terms,
 - (b) whether any modification has been made to the reused DEVICE and whether this modification is in line with the reused licence terms and the developed DEVICE Intellectual Property Rights regime and licensing scheme, as defined by the contract,
 - (c) the development and licensing strategy for both developed DEVICE and reused DEVICE, in order to ensure the compatibility.

NOTE For IP Core related development activities, item c is essential.

6.2.3.4 Reuse Missing documentation

ECSS-Q-ST-60-03_1590069

- a. Reverse engineering techniques shall be applied to generate missing documentation and to achieve the needed verification and validation coverage.

ECSS-Q-ST-60-03_1590070

- b. For existing DEVICE whose development flow data from previous development is not available and reverse engineering techniques are not applicable, the following methods shall be applied:
 - 1. Generation of validation and verification documents based on the available user documentation, and execution of tests to achieve the needed level of test coverage,
 - 2. Use of the existing DEVICE heritage to provide evidence of the product's suitability for the current application, including following information:
 - (a) relevance of the existing DEVICE heritage for the new operational environment,

- (b) configuration management and change control of the DEVICE,
- (c) effectiveness of problem reporting,
- (d) actual error rates and maintenance records, and
- (e) impact of modifications.

6.2.3.5 Reuse Configuration Control

ECSS-Q-ST-60-03_1590071

- a. The DEVICE reuse file shall be updated at project reviews to reflect the results of the identified corrective actions for the existing DEVICE(s) not meeting the project requirements.

6.2.3.6 Reuse Configuration Management

ECSS-Q-ST-60-03_1590072

- a. All the reused DEVICES and Building Blocks shall be kept under configuration control in compliance with ECSS-Q-ST-60-03 clause 8.

6.2.4 Automatic code generation

ECSS-Q-ST-60-03_1590073

- a. For the selection of tools for automatic code generation, the supplier shall evaluate the following:
 - 1. Evolution of the tools in relation to the tools that use the generated code as an input,
 - 2. Customization of the tools to comply with project requirements,
 - 3. Collection of the design and code metrics,
 - 4. Verification of generated code,
 - 5. Configuration control of the tools including the parameters for customization, and
 - 6. Compliance to any standards identified by the supplier as relevant for the DEVICE development.

ECSS-Q-ST-60-03_1590074

- b. The requirements on verification and validation applicable to the automatically generated code shall ensure the achievement of the same objectives as those for manually generated code.

ECSS-Q-ST-60-03_1590075

- c. In case the tool is used to skip verification or testing activities on the generated code, the level of verification and validation of the automatic generation tool shall be at least the same as the one for the generated code.

ECSS-Q-ST-60-03_1590076

- d. Coding rules for automatic code generation tools shall be defined in the DEVICE Product Assurance Plan in compliance with DRD in Annex A and applied.

NOTE The DPAP can refer to ECSS-E-ST-20-40 requirements 5.5.5.e and C.2.1.<2>f and DEVICE Development Plan.

ECSS-Q-ST-60-03_1590077

- e. Compliance to coding rules shall be verified and reported in the DEVICE Product Assurance Report in compliance with DRD in Annex B.

NOTE The DPAP can refer to ECSS-E-ST-20-40 DEVICE Verification Plan.

ECSS-Q-ST-60-03_1590078

- f. Requirements in ECSS-E-ST-20-40 Annex C.2.1.<2> shall apply to automatically generated code, unless the supplier demonstrates that the automatically generated code is not manually modified to comply with the coding and design rules applied to the manually generated code.

ECSS-Q-ST-60-03_1590079

- g. The verification and validation documentation shall address separately the activities to be performed for manually and automatically generated code.

6.2.5 Project Security Assurance

ECSS-Q-ST-60-03_1590080

- a. The supplier shall define PA tasks and responsibilities related to the security requirements of the project for which the DEVICE is being developed, in the DEVICE Product Assurance Plan in compliance with DRD in Annex A for customer approval.

ECSS-Q-ST-60-03_1590081

- b. The supplier shall define methods and tools used to fulfil compliance to the security requirements.

ECSS-Q-ST-60-03_1590082

- c. The supplier shall report on conformance to the methods and tools used to fulfil the project security requirements in the DEVICE Product Assurance Report in compliance with DRD in Annex B.

ECSS-Q-ST-60-03_1590083

- d. The supplier shall report on conformance to the project security requirements in the DEVICE Product Assurance Report in compliance with DRD in Annex B.

6.2.6 Independent Verification and Validation

ECSS-Q-ST-60-03_1590084

- a. If the risks associated with the project justify the costs involved, Independent Verification and Validation shall be performed by a third party in line with ECSS-E-ST-20-40 development flow and as agreed with the customer.

NOTE 1 Where the DEVICE validation process and the DEVICE verification process are executed by an organization independent of the supplier, it is called Independent Verification and Validation (IVV).

NOTE 2 The customer can consider a less rigorous level of independence, for example, an independent team in the same organization.

NOTE 3 Project integrated risk management is in compliance with ECSS-M-ST-80.

ECSS-Q-ST-60-03_1590085

- b. The supplier shall report all IVV activities and tasks defined in the IVV Plan defined in 6.3.1a in the IVV Report.

6.3 Requirements applicable to individual DEVICE engineering processes and activities

6.3.1 DEVICE Definition Phase

ECSS-Q-ST-60-03_1590086

- a. The supplier shall define the Independent Verification and Validation activities and tasks in the IVV Plan.

6.3.2 DEVICE Design and Verification Phase

ECSS-Q-ST-60-03_1590087

- a. Design rules and coding rules shall be defined in the DEVICE Product Assurance Plan in compliance with DRD in Annex A and applied.

NOTE The DPAP can refer to ECSS-E-ST-20-40 requirements 5.5.2.n, 5.6.2.n and C.2.1<2>f and DEVICE Development Plan.

ECSS-Q-ST-60-03_1590088

- b. Compliance to design rules and coding rules specified in requirement 6.3.2a shall be verified and reported in the DEVICE Product Assurance Report in compliance with DRD in Annex B.

NOTE The DPAP can refer to ECSS-E-ST-20-40 DEVICE Verification Plan.

6.3.3 DEVICE Implementation Phase

ECSS-Q-ST-60-03_1590089

- a. The supplier shall ensure through internal review that the test procedures and data are feasible and traceable to the DRS and that they satisfy the DEVICE requirements.

ECSS-Q-ST-60-03_1590090

- b. Test tool development or acquisition, hardware and software, shall be planned the DEVICE Development Plan defined in ECSS-E-ST-20-40 Annex B.

ECSS-Q-ST-60-03_1590091

- c. The supplier shall establish and review the test procedures and data before starting testing activities and document the constraints of the tests concerning physical, performance, functional, controllability and observability limitations.

6.3.4 DEVICE Design Validation, Qualification and Acceptance Phase

ECSS-Q-ST-60-03_1590092

- a. DEVICE qualification testing shall be performed in accordance with ECSS-E-ST-20-40 DEVICE Validation Plan defined in DRD Annex D, and with ECSS-Q-ST-20 sections 5.3.2.4.3 which include the means and organizations to perform assurance function for testing and validation.

ECSS-Q-ST-60-03_1590093

- b. The representativeness of the qualification model against the flight model shall be justified in accordance with ECSS-Q-20 clause 5.3.2.4.3, in the DEVICE Product Assurance Report in compliance with DRD in Annex B.

ECSS-Q-ST-60-03_1590094

- c. The supplier shall ensure that nonconformances and problem reports detected during testing are documented and reported.

NOTE For example: test coverage evaluation, test failure

ECSS-Q-ST-60-03_1590095

- d. The completion of actions related to problem reports generated during testing and validation shall be verified and recorded in the DEVICE Product Assurance Report in compliance with DRD in Annex B.

ECSS-Q-ST-60-03_1590096

- e. Provisions shall be made to allow witnessing of tests by the customer as agreed by the project, in compliance with ECSS-Q-ST-20 clause 5.6.4.

ECSS-Q-ST-60-03_1590097

- f. Provisions shall be made to allow witnessing of tests by supplier personnel independent of the development.

NOTE For example: specialist product assurance personnel.

ECSS-Q-ST-60-03_1590098

- g. The supplier shall verify that:
 - 1. Tests are conducted in accordance with approved test procedures and data,
 - 2. Configuration of DEVICE under test is correct,
 - 3. The tests are documented, and
 - 4. The test reports are in compliance with DRD from E-ST-10-02 Annex D.

ECSS-Q-ST-60-03_1590099

- h. The supplier shall ensure that tests are repeatable by verifying for the DEVICE under test, the recording of support software and hardware, test environment, supporting documents and problems found.

ECSS-Q-ST-60-03_1590100

- i. The supplier shall report that the tests are successfully completed, or that nonconformance and problem reports are raised for unsuccessful tests, in the DEVICE Product Assurance Report in compliance with DRD in Annex B.

ECSS-Q-ST-60-03_1590101

- j. Functional areas affected by any modification shall be identified and retested.

NOTE 1 This can be triggered by a nonconformance or problem report fix.

NOTE 2 This can be triggered by a new FPGA bit stream and can result in full testing of the DEVICE

ECSS-Q-ST-60-03_1590102

- k. The need to perform again in full or only partially verification and validation of the DEVICE shall be analysed after a change or update of any tool used to generate it, and reported in the DEVICE Product Assurance Report in compliance with DRD in Annex B.

ECSS-Q-ST-60-03_1590103

- l. Any qualification status maintenance activities shall be identified and performed.

ECSS-Q-ST-60-03_1590104

- m. In case of retesting, all test related documentation shall be updated.

NOTE Test related documentation includes test procedures, test specifications, data and reports.

ECSS-Q-ST-60-03_1590105

- n. Validation shall be carried out by staff who have not taken part in the design of the DEVICE being validated.

ECSS-Q-ST-60-03_1590106

- o. The necessary resources for testing shall be identified early in the DEVICE development flow, by considering the operating and maintenance requirements.

ECSS-Q-ST-60-03_1590107

- p. The validation shall include testing in the different configurations possible or in a representative set of them when the number of possible configurations is too high to allow validation in all of them.

ECSS-Q-ST-60-03_1590108

- q. DEVICE containing deactivated functions shall be verified and validated to ensure that the deactivated functions cannot be activated or that their accidental activation cannot harm the operation of the system.

6.3.4.2 Qualification Status

ECSS-Q-ST-60-03_1590109

- a. The supplier shall report the assessment of the Qualification Status for the DEVICE in the DEVICE Product Assurance Report in compliance with DRD in Annex B.

ECSS-Q-ST-60-03_1590110

- b. The supplier shall assess the DEVICE qualification status as follows:
 1. Evidence of compliance to the verification and validation process defined in ECSS-E-ST-20-40 and ECSS-Q-ST-60-03 is provided,
 2. The VCD, as defined in ECSS-E-ST-20-40 clause 5.1.5, is confirmed complete,
 3. All known unresolved issues impact assessment is provided with a correction plan, and
 4. Statement that the qualification status is achieved.

NOTE 1 Examples of unresolved issue in requirement 6.3.4.2b.3 includes: Problem Reports, NCRs, RFD, RFW.

NOTE 2 ECSS-M-ST-10 clause 4.4.3.6.3 objectives are used for project phasing.

ECSS-Q-ST-60-03_1590111

- c. The qualification status shall be approved by the Customer.

NOTE 1 The qualification status declaration is an input to the System level Qualification Review defined in ECSS-M-ST-10 Clause 4.4.3.6.3.

NOTE 2 The DEVICE Qualification Status can be included in the upper-level Qualification Status List (QSL), for example, equipment QSL. QSL is defined in ECSS-Q-ST-10 Annex B.

ECSS-Q-ST-60-03_1590112

- d. The supplier shall ensure that a Verification Control Board (VCB) is established to monitor the qualification process.

NOTE The DEVICE VCB can be included in the upper level VCB

6.3.4.3 Recurring Products

ECSS-Q-ST-60-03_1590113

- a. For recurring products, the supplier shall produce release documentation as agreed with the customer.

NOTE The release documentation can be the EIDP.

ECSS-Q-ST-60-03_1590114

- b. The Customer shall authorise production of each recurring product.

6.3.4.4 Acceptance

ECSS-Q-ST-60-03_1590115

- a. The customer shall establish an acceptance test plan specifying the intended acceptance tests and inspection.

NOTE 1 The acceptance tests can be partly made up of tests used during previous test activities.

NOTE 2 The acceptance test plan takes into account the requirement for operational demonstration, either as part of acceptance or after acceptance.

ECSS-Q-ST-60-03_1590116

- b. The acceptance test shall take place on the flight hardware.

ECSS-Q-ST-60-03_1590117

- c. The customer shall ensure that the acceptance tests are performed in accordance with the approved acceptance test plan.

ECSS-Q-ST-60-03_1590118

- d. Test witnessing by PA personnel shall be defined in the acceptance Test Plan.

ECSS-Q-ST-60-03_1590119

- e. Test performance shall be monitored by the PA personnel in compliance with ECSS-Q-ST-20 clause 5.6.4.

ECSS-Q-ST-60-03_1590120

- f. The supplier shall provide an End Item Data Pack for each deliverable end item in conformance with ECSS-Q-ST-20 Annex B.

NOTE 1 The DEVICE EIDP can be part of the system or equipment EIDP.

NOTE 2 For recurrent products, delivery can be organised by a lot.

NOTE 3 The EIDP can refer to expected output documents of ECSS-E-ST-20-40 and this standard.

ECSS-Q-ST-60-03_1590121

- g. The Supplier shall ensure that a Delivery Review Board is convened in compliance with ECSS-Q-ST-20 clause 5.7.3

6.4 Process Assessment and improvement

6.4.1 Process assessment control

ECSS-Q-ST-60-03_1590122

- a. The supplier shall monitor and control the effectiveness of the processes used during the development of the DEVICE including the relevant processes corresponding to the services called from other organisational entities outside the project team and report it in the DEVICE Product Assurance Report in compliance with DRD in Annex B.

NOTE 1 The process assessment and improvement performed at organization level can be used to provide evidence of compliance for the project.

NOTE 2 This encompasses processes defined in ECSS-Q-ST-60-03 and phases defined in ECSS-E-ST-20-40.

NOTE 3 Process assessment can be based on supplier internal standards.

ECSS-Q-ST-60-03_1590123

- b. The process assessment model and method used when performing any DEVICE process assessment shall be documented in the DEVICE Product Assurance Plan in compliance with DRD in Annex A.

6.4.2 Process assessment reporting

ECSS-Q-ST-60-03_1590124

- a. The process assessment results shall be reported in the DEVICE Product Assurance Report in compliance with DRD in Annex B.

6.4.3 Process improvement

ECSS-Q-ST-60-03_1590125

- a. The suppliers shall ensure that the results of the process assessments are used in its project activities and reported in the DEVICE Product Assurance Report in compliance with DRD in Annex B.

DEVICE Product Quality Assurance

7.1 Product quality objectives and metrication

7.1.1 Assurance activities for product quality requirements

ECSS-Q-ST-60-03_1590126

- a. The supplier shall define assurance activities to ensure that the DEVICE meets the quality requirements, in the DEVICE Product Assurance Plan in compliance with DRD in Annex A.

7.1.2 Product Metrics definition and reporting

ECSS-Q-ST-60-03_1590127

- a. In order to verify the implementation of the product quality requirements, the supplier shall define a metrication programme in the DEVICE Product Assurance Plan in compliance with DRD in Annex A, specifying:
 - 1. The metrics to collect and store,
 - 2. Measurement method used to collect the metrics,
 - 3. The target values, with reference to the product quality requirements,
 - 4. The analyses to perform on the collected metrics, including the ones to derive:
 - (a) descriptive statistics,
 - (b) trend analysis.
 - 5. How the results of the analyses performed on the collected metrics are fed back to the development team and used to identify corrective actions,
 - 6. The schedule of metrics collection, storing, analysis and reporting, with reference to the whole DEVICE development flow.

7.1.3 Basic metrics

ECSS-Q-ST-60-03_1590128

- a. The following basic products metrics shall be used:
 - 1. Coverage of DRS requirements by validation tests,
 - 2. Coverage of System Requirements by validation tests
 - 3. Number of failures,
 - 4. Trend analysis on problem report and NCs.

7.1.4 Reporting of metrics

ECSS-Q-ST-60-03_1590129

- a. The results of metrics collection and analysis shall be included in the DEVICE product assurance report in compliance with DRD in Annex B, in order to provide the customer with an insight into the level of quality obtained.

7.2 IP Core or DEVICES intended for Reuse

7.2.1 Overview

DEVICE intended for reuse can be IP Core either as a standalone project or in a frame of a project with other DEVICES under development.

7.2.2 Self-contained information

ECSS-Q-ST-60-03_1590130

- a. The information related to components developed for reuse in the applicable expected outputs from ECSS-E-ST-20-40 and ECSS-Q-ST-60-03 shall be self-contained.

7.2.3 Requirements for intended reuse

ECSS-Q-ST-60-03_1590131

- a. The DEVICE Requirement Specification, in compliance with DRD in ECSS-E-ST-20-40 Annex A, of DEVICES developed for reuse shall include requirements for portability.

7.2.4 Configuration management for intended reuse

ECSS-Q-ST-60-03_1590132

- a. The configuration management system shall include provisions for handling specific aspects of DEVICE developed for reuse.

NOTE For example: longer lifetime of the components developed for reuse compared to the other DEVICES of the project; evolution or change of the development environment for the next project that intends to use the DEVICES; transfer of the configuration and documentation management information to the next project reusing the DEVICE.

7.2.5 Testing on different EEE component

ECSS-Q-ST-60-03_1590133

- a. Where the IP core, developed for reuse, are developed for multiple IC technologies, the verification and validation of the DEVICE shall be performed on all of them.

ECSS-Q-ST-60-03_1590134

- b. Statement that tests have been successfully completed on all IC technologies specified in requirement 7.2.5a shall be provided in release documentation.

7.2.6 Certificate of conformance

ECSS-Q-ST-60-03_1590135

- a. The supplier shall provide a certificate of conformance in compliance with DRD in ECSS-Q-ST-20 Annex D.

8

DEVICE Configuration Management

8.1 Configuration Management planning and control

8.1.1 Configuration Management Plan

ECSS-Q-ST-60-03_1590136

- a. The supplier shall provide a DEVICE configuration management plan in conformance with DRD in ECSS-M-ST-40 Annex A at DEVICE Definition Phase Review for baseline.

ECSS-Q-ST-60-03_1590137

- b. The DEVICE configuration management plan shall be either a standalone document or a section of the supplier overall configuration management plan.

NOTE The CMP includes as a minimum:

- configuration identification; including identification of configuration baseline;
- configuration control;
- configuration status accounting;
- configuration audits and reviews;
- interface control;
- supplier control.

ECSS-Q-ST-60-03_1590138

- c. For each DEVICE phase specified in ECSS-E-ST-20-40, the supplier shall ensure that the outputs defined in ECSS-E-ST-20-40 and in ECSS-Q-ST-60-03 are under configuration management in compliance with of this standard clause 8.

ECSS-Q-ST-60-03_1590139

- d. For each DEVICE phase specified in ECSS-E-ST-20-40, the supplier shall ensure that changes and baseline departure for each output and deliverables are under configuration control.

ECSS-Q-ST-60-03_1590140

- e. Problems found during verification and validation activities defined in each of ECSS-E-ST-20-40 phase shall be managed in compliance with ECSS-Q-ST-60-03 clause 5.2.5.

- f. The supplier shall report on configuration management compliance in the DEVICE Product Assurance Report in compliance with DRD in Annex B.

8.1.2 Software tools

- a. The DCMP shall cover the DEVICE and its associated software tools.

NOTE For example, FPGA programming tools or RTL synthesis tools.

8.2 Configuration Management implementation

8.2.1 DEVICE Configuration management implementation

- a. The DEVICE configuration management system shall allow regeneration of any reference version from backups.

8.2.2 CIDL and ABCL

- a. The DEVICE Configuration Item Data List and the As-Built Configuration List shall be provided with each DEVICE delivery.

- b. The CIDL shall be in compliance with DRD from ECSS-M-ST-40 Annex C.

NOTE The CIDL can be combined with the System CIDL.

- c. The ABCL shall be in compliance with DRD from ECSS-M-ST-40 Annex D.

NOTE The ABCL can be combined with the System ABCL.

- d. The CIDL and ABCL shall be provided and up to date for each project review.

ECSS-Q-ST-60-03_1590148

- e. Any components of the automatic code generation tool that are customizable by the user shall be put under configuration control in the Software Configuration File in compliance with ECSS-M-ST-40 Annex E.

ECSS-Q-ST-60-03_1590149

- f. For components specified in the requirement 8.2.2e the change control procedures defined for the project shall address their specific aspects.

ECSS-Q-ST-60-03_1590150

- g. The supplier shall ensure that all authorized changes are implemented in accordance with the configuration management plan.

ECSS-Q-ST-60-03_1590151

- h. The mask generation and verification for ASICs shall be performed under the foundry's configuration control system.

ECSS-Q-ST-60-03_1590152

- i. All inputs to the DEVICE development that are not automatically generated and are needed to reproduce the design shall be put under a revision control mechanism agreed with the customer.

NOTE Examples are simulation pattern, schematics,
 VHDL source codes, synthesis scripts

ECSS-Q-ST-60-03_1590153

- j. Each DEVICE development step using design inputs shall reflect the revision numbers of the inputs in a log file to prove consistency.

ECSS-Q-ST-60-03_1590154

- k. The following documents shall be controlled in compliance with ECSS-Q-ST-10 clause 5.2.5:
 - 1. Procedural documents describing the quality system applied during the DEVICE development flow,
 - 2. Planning documents describing the planning and progress of the activities,
 - 3. Documents describing a particular DEVICE, including:
 - (a) development phase inputs,
 - (b) development phase outputs,
 - (c) verification and validation plans and results,
 - (d) test case specifications, test procedures and test reports,
 - (e) traceability matrices,
 - (f) documentation for the DEVICE and system operators and users, and
 - (g) maintenance documentation.

8.2.3 Software configuration management implementation

ECSS-Q-ST-60-03_1590155

- a. Software configuration status for the DEVICE software tools shall be documented in a SCF in compliance with DRD in ECSS-M-ST-40 Annex E.

NOTE The SCF can be combined with the ABCL.

ECSS-Q-ST-60-03_1590156

- b. The SCF shall be available and up to date for each DEVICE phase review.

8.3 Configuration Control

ECSS-Q-ST-60-03_1590157

- a. Configuration control shall be defined in conformance with ECSS-M-ST-40 clause 5.3.2.

ECSS-Q-ST-60-03_1590158

- b. Configuration control shall include problem reports produced during development, in compliance with clause 5.2.5

ECSS-Q-ST-60-03_1590159

- c. Configuration control boards shall be defined in compliance with ECSS-M-ST-40 clause 5.3.2.

ECSS-Q-ST-60-03_1590160

- d. Each change and departure from baseline shall be classified in accordance with ECSS-M-ST-40 clause 5.3.2.

NOTE A change is initiated by the customer, a departure is initiated by the supplier as defined in ECSS-M-ST-40 clause 5.3.2

ECSS-Q-ST-60-03_1590161

- e. At each review, the supplier shall report on any change and departure which took place during the DEVICE development phase and assess impact on previous review conclusions.

NOTE Example, a need to update previous review baseline document(s); or a need to perform regression test; or need to assess qualification status and define qualification maintenance.

Tailoring by DEVICE criticality

9.1 Device criticality categories

Criticality categories are assigned to DEVICE products as specified in ECSS-Q-ST-30 clause 5.4.

Table 9-1 defines the relationship between the criticality category of the DEVICE, the highest criticality of the functions implemented by the DEVICE and the existing system compensating provisions, as described in ECSS-Q-ST-30, clause 5.4.

To any DEVICE defined in the right column, the corresponding criticality category in the left column is assigned.

Table 9-1: DEVICE criticality category

DEVICE criticality category	Definition
A	DEVICE involved in category I functions <u>AND</u> : no compensating provisions exist
	DEVICE included in compensating provisions for category I functions
B	DEVICE involved in category I functions <u>AND</u> : at least one of the following compensating provisions is available, meeting the requirements defined in ECSS-Q-ST-30 clause 5.4: - A hardware implementation; in case of DEVICE implementation it shall be classified as criticality A - A software implementation; this software implementation shall be classified as criticality A - An operational procedure
	DEVICE involved in category II functions <u>AND</u> : no compensating provisions exist
	DEVICE included in compensating provisions for category II functions
	DEVICE involved in category II functions <u>AND</u> : at least one of the following compensating provisions is available, meeting the requirements defined in ECSS-Q-ST-30 clause 5.4: - A hardware implementation; in case of DEVICE implementation it shall be classified as criticality B - A software implementation; this software implementation shall be classified as criticality B - An operational procedure
C	DEVICE involved in category III functions <u>AND</u> : no compensating provisions exist
	DEVICE included in compensating provisions for category III functions
	DEVICE involved in category III functions <u>AND</u> : at least one of the following compensating provisions is available, meeting the requirements defined in ECSS-Q-ST-30 clause 5.4: - A hardware implementation; in case of DEVICE implementation it shall be classified as criticality C - A software implementation; this software implementation shall be classified as criticality C - An operational procedure
D	DEVICE involved in category IV functions <u>AND</u> : no compensating provisions exist

9.2 Applicability Matrix

The following applicability matrix represents a tailoring of the requirements ECSS-Q-ST-60-03 based on the DEVICE criticality categories defined as per 9.1.

For each clause of this Standard and for each DEVICE criticality category, an indication is given whether that clause is applicable (Y), not applicable (N), agreed with Customer (C) or applicable under the conditions thereby specified to that DEVICE criticality category.

Table 9-2: Tailoring by criticality

Clause	Requirement	Cat A	Cat B	Cat C	Cat D
5.1.1a	The supplier shall ensure that a PA organizational structure is defined for DEVICE development, and that individuals have defined tasks and responsibilities in compliance with clause 5.1.1 of ECSS-Q-ST-10 and with DRD from Annex A.	Y	Y	Y	Y
5.1.2a	The responsibility, the authority and the interrelation of personnel who manage, perform and verify work affecting DEVICE quality shall be defined and documented.	Y	Y	Y	Y
5.1.2b	The responsibilities and the interfaces of each organisation on the project, either external or internal, involved in a project shall be defined and documented.	Y	Y	Y	Y
5.1.2c	The delegation of DEVICE product assurance tasks by a supplier to a lower level supplier shall be done in a documented and controlled way, with the supplier retaining the responsibility towards the customer.	Y	Y	Y	Y
5.1.3.1a	The DEVICE product assurance responsible shall: 1. report to the project manager through the project product assurance manager. 2. have organisational authority and independence to propose and maintain a DEVICE product assurance programme in accordance with the project DEVICE product assurance requirements. 3. have access to higher management as necessary to fulfil his/her duties. 4. be invited to all project reviews.	Y	Y	Y	Y

Clause	Requirement	Cat A	Cat B	Cat C	Cat D
5.1.3.2a	The supplier shall review the project requirements to establish and make provision for acquiring or developing the resources and skills for the management and technical staff.	Y	Y	Y	Expected output not required
5.1.3.2b	The supplier shall maintain training records and ensure that trained personnel are available for the planned activities and tasks.	Y	Y	Y	Expected output not required
5.1.3.2c	The supplier shall ensure that personnel conducting activities in compliance with ECSS-Q-ST-60-03 and ECSS-E-ST-20-40 are trained.	Y	Y	Y	Expected output not required
5.1.3.2d	The supplier shall specify the training subjects based on the specific tools, techniques, methodologies and computer resources for use in the development and management of the DEVICE product.	Y	Y	Y	Expected output not required
5.2.1a	The supplier shall provide a DEVICE product assurance plan for baseline at DEVICE Definition Phase Review, in response to the DEVICE product assurance requirements and in compliance with DRD in Annex A for customer approval	Y	Y	Y	Y
5.2.1b	The DEVICE Product assurance programme shall include all internal manuals, standards or procedures listed in the DEVICE product assurance plan.	Y	Y	Y	Expected output not required
5.2.1c	The DEVICE product assurance plan shall be revisited and updated to ensure that the activities to be undertaken in the following phase are defined.	Y	Y	Y	Y
5.2.1d	The supplier shall include in the DEVICE product assurance plan a compliance matrix documenting conformance with the individual DEVICE product assurance requirements applicable for the project or business agreement.	Y	Y	Y	Y
5.2.1e	For each DEVICE product assurance requirement, the compliance matrix shall provide a reference to the document where the expected output of that requirement is located.	Y	Y	Y	Expected output not required

Clause	Requirement	Cat A	Cat B	Cat C	Cat D
5.2.2a	The supplier shall provide a Product assurance report for each review and for each DEVICE delivery in compliance with DRD from Annex B covering the DEVICE product assurance activities performed during the past project phases.	Y	Y	C	C
5.2.3a	For DEVICE audits, ECSS-Q-ST-10 clause 5.2.3 shall apply.	Y	Y	Y	C
5.2.3b	Reviews and audits of processes and of products shall be carried out by personnel not directly involved in the DEVICE work being performed.	Y	Y	Y	Y
5.2.3c	The supplier shall report on DEVICE Audits in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	Y	Y	Y	Y
5.2.4a	For DEVICE alerts, ECSS-Q-ST-10 clause 5.2.9 shall apply.	Y	Y	Y	Y
5.2.4b	The supplier shall report on DEVICE Alerts in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	Y	Y	Y	Y
5.2.5a	The supplier shall define and implement procedures for the logging, analysis and correction of DEVICE problems encountered during DEVICE development in the DEVICE Product Assurance Plan in compliance with DRD in Annex A.	Y	Y	Y	Y
5.2.5b	The DEVICE problem report shall contain the following information: 1. Identification of the DEVICE item, 2. Description of the problem, 3. Root cause analysis 4. Recommended solution, 5. Final disposition, 6. Modifications implemented in documents, code and tools, and 7. Tests re-executed.	Y	Y	Y	Y
5.2.5c	The procedures for DEVICE problems reporting shall define the interface with the nonconformance system and the circumstances under which a problem qualifies as a nonconformance.	Y	Y	Y	Y
5.2.5d	The supplier shall verify the application of problem reporting procedures and report the results in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	Y	Y	Y	Y

Clause	Requirement	Cat A	Cat B	Cat C	Cat D
5.2.6a	For DEVICE nonconformance handling, ECSS-Q-ST-10-09 shall apply.	Y	Y	Y	Y
5.2.6b	When dealing with DEVICE nonconformance, the NRB shall include a representative from the DEVICE product assurance and the DEVICE engineering organizations in compliance with ECSS-Q-ST-10-09 requirement 5.2.2.1.	Y	Y	Y	Y
5.2.6c	The DEVICE product assurance plan shall specify the point in the DEVICE development flow from which the nonconformance procedures apply.	Y	Y	Y	Y
5.3.1a	The DEVICE Product Assurance responsible shall provide input to Risk management for DEVICE in compliance with ECSS-M-ST-80.	Y	Y	Y	Y
5.3.2a	For critical item control, ECSS-Q-ST-10-04 shall apply.	Y	Y	Y	N
5.3.2b	The supplier shall identify the characteristics of the DEVICE that qualify for inclusion in the Critical Item List.	Y	Y	Y	N
5.4.1a	For supplier selection ECSS-Q-ST-20 clause 5.4.1 shall apply.	Y	Y	Y	N
5.4.1b	For suppliers of existing DEVICE, including DEVICE contained in OTS equipment and units, the selection shall be performed in compliance with requirements from clause 6.2.3.	Y	Y	Y	N except for licensing/ Intellectual Property Rights information
5.4.2a	The supplier shall establish DEVICE product assurance requirements for the next level suppliers, tailored to their role in the project.	Y	Y	Y	Y
5.4.2b	The supplier shall provide the DEVICE product assurance requirements applicable to the next level suppliers for customer approval in the DEVICE Product Assurance Plan in compliance with DRD in Annex A.	Y	Y	Y	Y
5.4.3a	The supplier shall monitor the next lower level suppliers' conformance to the product assurance requirements.	Y	Y	Y	Y

Clause	Requirement	Cat A	Cat B	Cat C	Cat D
5.4.3b	The monitoring process shall include the review and approval of the next lower level suppliers' product assurance plans, the continuous verification of processes and products, and the monitoring of the final validation of the product.	Y	Y	Y	Y
5.4.3c	The supplier shall ensure that DEVICE development processes are defined and applied by the next lower level suppliers in conformance with the DEVICE product assurance requirements for suppliers.	Y	Y	Y	Y
5.4.3d	The supplier shall provide the next lower level suppliers' DEVICE product assurance plan for customer's acceptance.	Y	Y	Y	Y
5.4.4a	The supplier shall provide the lower level suppliers with the results of the safety and dependability analyses performed at higher as provided by the customer and his level in compliance with requirements from clause 6.2.1, including: 1. The criticality classification of the DEVICE products to be developed, 2. Information about the failures that can be caused at higher level by the DEVICE products under development.	Y	Y	Y	N
5.5.1a	Methods and tools to be used for all the activities of the development cycle, including requirements analysis, specification, modelling, design, coding, validation, testing, configuration management, verification and product assurance shall be identified by the supplier and agreed with the customer.	Y	Y	Y	Y
5.5.1b	The choice of development methods and tools shall be justified by demonstrating through testing or documented assessment as follows: 1. The development team has the experience or training to apply them, 2. The tools and methods are applicable for the verification of functional and operational characteristics of the product, 3. The tools are available throughout the development and maintenance lifetime of the product.	Y	Y	Y	Y
5.5.1c	The correct use of methods and tools shall be verified and reported in the DEVICE product assurance report in compliance with DRD in Annex B.	Y	Y	Y	Expected output not required

Clause	Requirement	Cat A	Cat B	Cat C	Cat D
5.5.2a	The DEVICE development environment shall be selected according to the following criteria: 1. Availability, 2. Compatibility, 3. Performance, 4. Maintenance, 5. Durability and technical consistency with the operational equipment, 6. The assessment of the product with respect to requirements, including the criticality category, 7. The available support documentation, 8. The acceptance and warranty conditions, 9. The conditions of installation, preparation, training and use, 10. The maintenance conditions, including the possibilities of evolutions, 11. Copyright and intellectual property rights constraints, and 12. Dependence on one specific supplier.	Y	Y	Y	Expected output not required
5.5.2b	The availability of the DEVICE development environment to developers and other users shall be verified before the start of each development phase.	Y	Y	Y	Expected output not required
6.1.1a	The DEVICE development flow specified in ECSS-E-ST-20-40 shall be integrated in the DEVICE product assurance plan in compliance with DRD in Annex A.	Y	Y	Y	Y
6.1.1b	The following characteristics of the DEVICE development flow shall be specified: 1. Phases, 2. Input and output of each phase, 3. Status of completion of phase output, 4. Reviews, 5. Dependencies, 6. Responsibilities, and 7. Role of the customer at each review, in conformance with ECSS-M-ST-10 and ECSS-M-ST-10-01.	Y	Y	Y	Y

Clause	Requirement	Cat A	Cat B	Cat C	Cat D
6.1.1c	The Customer shall review the DEVICE development flow against the contractual DEVICE engineering and product assurance requirements.	Y	Y	Y	Y
6.1.1d	The Customer shall review the DEVICE development flow for the availability of resources.	Y	Y	Y	Y
6.2.1.1a	The PA responsible shall report the criticality classification at system-level in the DEVICE Product Assurance Plan in compliance with DRD in Annex A.	Y	Y	Y	Y
6.2.1.2a	The supplier shall perform a dependability and safety analysis at the DEVICE level, using the results of system-level safety and dependability analyses, in order to determine the criticality of each DEVICE function in compliance with ECSS-Q-ST-30 clause 5.4.	Y	Y	Y	Y
6.2.1.2b	The DEVICE PA engineer shall report the results of the DEVICE dependability and safety analysis and the status of DEVICE dependability and safety recommendations in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	Y	Y	Y	N
6.2.1.2c	The supplier shall identify the methods and techniques for the dependability and safety analysis at DEVICE level throughout the DEVICE lifecycle.	Y	Y	Y	N
6.2.1.2d	Methods and techniques for DEVICE dependability and safety analysis shall be agreed between the supplier and customer.	Y	Y	Y	N
6.2.1.2e	The supplier shall report the methods and techniques used for DEVICE dependability and safety analysis in the DEVICE Product Assurance Plan in compliance with DRD in Annex A.	Y	Y	Y	N
6.2.1.2f	The supplier shall report on the status of the implementation and verification of the DEVICE dependability and safety analysis recommendations in the DEVICE product assurance report in compliance with DRD in Annex B.	Y	Y	Y	N

Clause	Requirement	Cat A	Cat B	Cat C	Cat D
6.2.1.2g	The supplier shall provide the results of the DEVICE dependability and safety analysis for integration into the system-level dependability and safety analyses, in the DEVICE Product Assurance Report in compliance with DRD in Annex B, addressing the following: 1. Additional failure modes identified at DEVICE level which had not been identified at system level, 2. Recommendations for system-level activities.	Y	Y	Y	N
6.2.2.1a	The supplier shall define, justify and apply measures to assure the dependability and safety of critical DEVICES.	Y	Y	Y	N
6.2.2.1b	The application of the chosen measures to handle the critical DEVICE shall be verified in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	Y	Y	Y	N
6.2.2.1c	The need for updating the DRS, and any of DEVICE Development, verification or validation Plans and its impact in the development flow for critical DEVICE shall be analysed, in the DEVICE Product Assurance Report in compliance with DRD in Annex B, after: 1. Any change of the underlying platform hardware, 2. Any change in the environment in which the DEVICE operates, 3. Any change of the tools, including configuration of the tools, that affect directly or indirectly the development of the DEVICE.	Y	Y	Y	Y
6.2.2.2a	Identified unreachable DEVICE functions shall be removed and the need for re-verification and re-validation be analysed and reported in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	Y	Y	Y	N
6.2.3.1a	The supplier shall identify the reused DEVICE and classify the DEVICE in one of reuse categories, in compliance with ECSS-E-ST-10-02 Table 5-1, and report it in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	Y	Y	Y	Y
6.2.3.2a	The supplier shall provide the DEVICE Reuse File in compliance with DRD in Annex C at DEVICE Definition Phase Review.	Y	Y	Y	Y
6.2.3.2b	The DEVICE Reuse File shall be provided for reuse categories B and C specified in ECSS-E-ST-10-02 Table 5-1.	Y	Y	Y	Y

Clause	Requirement	Cat A	Cat B	Cat C	Cat D
6.2.3.2c	The supplier shall provide the DEVICE Reuse File with its qualification status at the Equipment Qualification Status Review, in compliance with ECSS-E-ST-10-02 requirement 5.2.4.2.d.	Y	Y	Y	Y
6.2.3.2d	For Reuse Category D, the full DEVICE development flow defined in ECSS-E-ST-20-40 shall apply.	Y	Y	Y	Y
6.2.3.2e	The Delta qualification activities shall be completed prior to the qualification review at upper level.	Y	Y	Y	Y
6.2.3.2f	Corrective actions shall be identified, documented in the DEVICE Reuse File and applied to the reused DEVICE.	Y	Y	Y	Y
6.2.3.3a	The supplier shall characterise, in the DRF, the deliverable DEVICE, which comprises both developed DEVICE and existing reused DEVICE, in terms of constituent elements and the associated licensing schemes, at all reviews, including: 1. The Intellectual Property Rights regime and licensing scheme of the developed DEVICE, as defined by the contract, 2. The licence under which the reused DEVICE is accessible by the end user, 3. The analysis of compatibility between the reused DEVICE licence and the developed DEVICE Intellectual Property Rights regime and licensing scheme as defined by the contract. This shall include as a minimum: (a) analysis of the reused DEVICE licence terms, (b) whether any modification has been made to the reused DEVICE and whether this modification is in line with the reused licence terms and the developed DEVICE Intellectual Property Rights regime and licensing scheme, as defined by the contract, (c) the development and licensing strategy for both developed DEVICE and reused DEVICE, in order to ensure the compatibility.	Y	Y	Y	Y
6.2.3.4a	Reverse engineering techniques shall be applied to generate missing documentation and to achieve the needed verification and validation coverage.	Y	Y	Y	Y

Clause	Requirement	Cat A	Cat B	Cat C	Cat D
6.2.3.4b	For existing DEVICE whose development flow data from previous development is not available and reverse engineering techniques are not applicable, the following methods shall be applied: 1. Generation of validation and verification documents based on the available user documentation, and execution of tests to achieve the needed level of test coverage, 2. Use of the existing DEVICE heritage to provide evidence of the product's suitability for the current application, including following information: (a) relevance of the existing DEVICE heritage for the new operational environment, (b) configuration management and change control of the DEVICE, (c) effectiveness of problem reporting, (d) actual error rates and maintenance records, and (e) impact of modifications.	Y	Y	Y	Y
6.2.3.5a	The DEVICE reuse file shall be updated at project reviews to reflect the results of the identified corrective actions for the existing DEVICE(s) not meeting the project requirements.	Y	Y	Y	Y
6.2.3.6a	All the reused DEVICES and Building Blocks shall be kept under configuration control in compliance with ECSS-Q-ST-60-03 clause 8.	Y	Y	Y	Y
6.2.4a	For the selection of tools for automatic code generation, the supplier shall evaluate the following: 1. Evolution of the tools in relation to the tools that use the generated code as an input, 2. Customization of the tools to comply with project requirements, 3. Collection of the design and code metrics, 4. Verification of generated code, 5. Configuration control of the tools including the parameters for customization, and 6. Compliance to any standards identified by the supplier as relevant for the DEVICE development.	Y	Y	Y	Y
6.2.4b	The requirements on verification and validation applicable to the automatically generated code shall ensure the achievement of the same objectives as those for manually generated code.	Y	Y	Y	Y

Clause	Requirement	Cat A	Cat B	Cat C	Cat D
6.2.4c	In case the tool is used to skip verification or testing activities on the generated code, the level of verification and validation of the automatic generation tool shall be at least the same as the one for the generated code.	Y	Y	Y	Y
6.2.4d	Coding rules for automatic code generation tools shall be defined in the DEVICE Product Assurance Plan in compliance with DRD in Annex A and applied.	Y	Y	Y	Y
6.2.4e	Compliance to coding rules shall be verified and reported in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	Y	Y	Y	Y
6.2.4f	Requirements in ECSS-E-ST-20-40 Annex C.2.1.<2> shall apply to automatically generated code, unless the supplier demonstrates that the automatically generated code is not manually modified to comply with the coding and design rules applied to the manually generated code.	Y	Y	Y	Y
6.2.4g	The verification and validation documentation shall address separately the activities to be performed for manually and automatically generated code.	Y	Y	Y	Y
6.2.5a	The supplier shall define PA tasks and responsibilities related to the security requirements of the project for which the DEVICE is being developed, in the DEVICE Product Assurance Plan in compliance with DRD in Annex A for customer approval.	Y	Y	Y	Y
6.2.5b	The supplier shall define methods and tools used to fulfil compliance to the security requirements.	Y	Y	Y	Y
6.2.5c	The supplier shall report on conformance to the methods and tools used to fulfil the project security requirements in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	Y	Y	Y	Y
6.2.5d	The supplier shall report on conformance to the project security requirements in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	Y	Y	Y	Y
6.2.6a	If the risks associated with the project justify the costs involved, Independent Verification and Validation shall be performed by a third party in line with ECSS-E-ST-20-40 development flow and as agreed with the customer.	Y	N	N	N
6.2.6b	The supplier shall report all IVV activities and tasks defined in the IVV Plan defined in 6.3.1b in the IVV Report.	Y	N	N	N

Clause	Requirement	Cat A	Cat B	Cat C	Cat D
6.3.1a	The supplier shall define the Independent Verification and Validation activities and tasks in the IVV Plan.	Y	N	N	N
6.3.2a	Design rules and coding rules shall be defined in the DEVICE Product Assurance Plan in compliance with DRD in Annex A and applied.	Y	Y	Y	C
6.3.2b	Compliance to design rules and coding rules specified in requirement 6.3.2a shall be verified and reported in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	Y	Y	Y	C
6.3.3a	The supplier shall ensure through internal review that the test procedures and data are feasible and traceable to the DRS and that they satisfy the DEVICE requirements.	Y	Y	Y	Expected output not required
6.3.3b	Test tool development or acquisition, hardware and software, shall be planned the DEVICE Development Plan defined in ECSS-E-ST-20-40 Annex B.	Y	Y	Y	Y
6.3.3c	The supplier shall establish and review the test procedures and data before starting testing activities and document the constraints of the tests concerning physical, performance, functional, controllability and observability limitations.	Y	Y	Y	Y
6.3.4a	DEVICE qualification testing shall be performed in accordance with ECSS-E-ST-20-40 DEVICE Validation Plan defined in DRD Annex D, and with ECSS-Q-ST-20 sections 5.3.2.4.3 which include the means and organizations to perform assurance function for testing and validation.	Y	Y	Y	Y
6.3.4b	The representativeness of the qualification model against the flight model shall be justified in accordance with ECSS-Q-20 clause 5.3.2.4.3, in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	Y	Y	Y	Y
6.3.4c	The supplier shall ensure that nonconformances and problem reports detected during testing are documented and reported.	Y	Y	Y	Y
6.3.4d	The completion of actions related to problem reports generated during testing and validation shall be verified and recorded in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	Y	Y	Y	Y

Clause	Requirement	Cat A	Cat B	Cat C	Cat D
6.3.4e	Provisions shall be made to allow witnessing of tests by the customer as agreed by the project, in compliance with ECSS-Q-ST-20 clause 5.6.4.	Y	Y	Y	Y
6.3.4f	Provisions shall be made to allow witnessing of tests by supplier personnel independent of the development.	Y	Y	Y	Y
6.3.4g	The supplier shall verify that: 1. Tests are conducted in accordance with approved test procedures and data, 2. Configuration of DEVICE under test is correct, 3. The tests are documented, and 4. The test reports are in compliance with DRD from E-ST-10-02 Annex D.	Y	Y	Y	Expected output not required
6.3.4h	The supplier shall ensure that tests are repeatable by verifying for the DEVICE under test, the recording of support software and hardware, test environment, supporting documents and problems found.	Y	Y	Y	Expected output not required
6.3.4i	The supplier shall report that the tests are successfully completed, or that nonconformance and problem reports are raised for unsuccessful tests, in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	Y	Y	Y	Y
6.3.4j	Functional areas affected by any modification shall be identified and retested.	Y	Y	Y	Y
6.3.4k	The need to perform again in full or only partially verification and validation of the DEVICE shall be analysed after a change or update of any tool used to generate it, and reported in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	Y	Y	Y	Y
6.3.4l	Any qualification status maintenance activities shall be identified and performed.	Y	Y	Y	Y
6.3.4m	In case of retesting, all test related documentation shall be updated.	Y	Y	Y	Y
6.3.4n	Validation shall be carried out by staff who have not taken part in the design of the DEVICE being validated.	Y	Y	Y	Y
6.3.4o	The necessary resources for testing shall be identified early in the DEVICE development flow, by considering the operating and maintenance requirements.	Y	Y	Y	Expected output not required

Clause	Requirement	Cat A	Cat B	Cat C	Cat D
6.3.4p	The validation shall include testing in the different configurations possible or in a representative set of them when the number of possible configurations is too high to allow validation in all of them.	Y	Y	Y	Y
6.3.4q	DEVICE containing deactivated functions shall be verified and validated to ensure that the deactivated functions cannot be activated or that their accidental activation cannot harm the operation of the system.	Y	Y	Y	Y
6.3.4.2a	The supplier shall report the assessment of the Qualification Status for the DEVICE in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	Y	Y	Y	Y
6.3.4.2b	The supplier shall assess the DEVICE qualification status as follows: 1. Evidence of compliance to the verification and validation process defined in ECSS-E-ST-20-40 and ECSS-Q-ST-60-03 is provided, 2. The VCD, as defined in ECSS-E-ST-20-40 clause 5.1.5, is confirmed complete, 3. All known unresolved issues impact assessment is provided with a correction plan, and 4. Statement that the qualification status is achieved.	Y	Y	Y	Y
6.3.4.2c	The qualification status shall be approved by the Customer.	Y	Y	Y	Y
6.3.4.2d	The supplier shall ensure that a Verification Control Board (VCB) is established to monitor the qualification process.	Y	Y	Y	Y
6.3.4.3a	For recurring products, the supplier shall produce release documentation as agreed with the customer.	Y	Y	Y	Y
6.3.4.3b	The Customer shall authorise production of each recurring product.	Y	Y	Y	Y
6.3.4.4a	The customer shall establish an acceptance test plan specifying the intended acceptance tests and inspection.	Y	Y	Y	Y
6.3.4.4b	The acceptance test shall take place on the flight hardware.	Y	Y	Y	Y
6.3.4.4d	The customer shall ensure that the acceptance tests are performed in accordance with the approved acceptance test plan.	Y	Y	Y	Y
6.3.4.4e	Test witnessing by PA personnel shall be defined in the acceptance Test Plan.	Y	Y	Y	Y

Clause	Requirement	Cat A	Cat B	Cat C	Cat D
6.3.4.4f	Test performance shall be monitored by the PA personnel in compliance with ECSS-Q-ST-20 clause 5.6.4.	Y	Y	Y	Y
6.3.4.4g	The supplier shall provide an End Item Data Pack for each deliverable end item in conformance with ECSS-Q-ST-20 Annex B.	Y	Y	Y	Y
6.3.4.4h	The Supplier shall ensure that a Delivery Review Board is convened in compliance with ECSS-Q-ST-20 clause 5.7.3	Y	Y	Y	Y
6.4.1a	The supplier shall monitor and control the effectiveness of the processes used during the development of the DEVICE including the relevant processes corresponding to the services called from other organisational entities outside the project team and report it in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	Y	C	N	N
6.4.1b	The process assessment model and method used when performing any DEVICE process assessment shall be documented in the DEVICE Product Assurance Plan in compliance with DRD in Annex A.	Y	C	N	N
6.4.2a	The process assessment results shall be reported in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	Y	C	N	N
6.4.3a	The suppliers shall ensure that the results of the process assessments are used in its project activities and reported in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	Y	C	N	N
7.1.1a	The supplier shall define assurance activities to ensure that the DEVICE meets the quality requirements, in the DEVICE Product Assurance Plan in compliance with DRD in Annex A.	Y	Y	Y	Y

Clause	Requirement	Cat A	Cat B	Cat C	Cat D
7.1.2a	In order to verify the implementation of the product quality requirements, the supplier shall define a metrication programme in the DEVICE Product Assurance Plan in compliance with DRD in Annex A, specifying: 1. The metrics to collect and store, 2. Measurement method used to collect the metrics, 3. The target values, with reference to the product quality requirements, 4. The analyses to perform on the collected metrics, including the ones to derive: (a) descriptive statistics, (b) trend analysis. 5. How the results of the analyses performed on the collected metrics are fed back to the development team and used to identify corrective actions; 6. The schedule of metrics collection, storing, analysis and reporting, with reference to the whole DEVICE development flow.	Y	Y	Y	Y
7.1.3a	The following basic products metrics shall be used: 1. Coverage of DRS requirements by validation tests, 2. Coverage of System Requirements by validation tests 3. Number of failures, 4. Trend analysis on problem report and NCs.	Y	Y	Y	Y
7.1.4a	The results of metrics collection and analysis shall be included in the DEVICE product assurance report in compliance with DRD in Annex B, in order to provide the customer with an insight into the level of quality obtained.	Y	Y	Y	Y
7.2.2a	The information related to components developed for reuse in the applicable expected outputs from ECSS-E-ST-20-40 and ECSS-Q-ST-60-03 shall be self-contained.	Y	Y	Y	Y
7.2.3a	The DEVICE Requirement Specification, in compliance with DRD in ECSS-E-ST-20-40 Annex A, of DEVICES developed for reuse shall include requirements for portability.	Y	Y	Y	Y
7.2.4a	The configuration management system shall include provisions for handling specific aspects of DEVICE developed for reuse.	Y	Y	Y	Y
7.2.5a	Where the IP core, developed for reuse, are developed for multiple IC technologies, the verification and validation of the DEVICE shall be performed on all of them.	Y	Y	Y	Y

Clause	Requirement	Cat A	Cat B	Cat C	Cat D
7.2.5b	Statement that tests have been successfully completed on all IC technologies specified in requirement 7.2.5a shall be provided in release documentation.	Y	Y	Y	Y
7.2.6a	The supplier shall provide a certificate of conformance in compliance with DRD in ECSS-Q-ST-20 Annex D.	Y	Y	Y	Y
8.1.1a	The supplier shall provide a DEVICE configuration management plan in conformance with DRD in ECSS-M-ST-40 Annex A at DEVICE Definition Phase Review for baseline.	Y	Y	Y	Y
8.1.1b	The DEVICE configuration management plan shall be either a standalone document or a section of the supplier overall configuration management plan.	Y	Y	Y	Y
8.1.1c	For each DEVICE phase specified in ECSS-E-ST-20-40, the supplier shall ensure that the outputs defined in ECSS-E-ST-20-40 and in ECSS-Q-ST-60-03 are under configuration management in compliance with of this standard clause 8.	Y	Y	Y	Y
8.1.1d	For each DEVICE phase specified in ECSS-E-ST-20-40, the supplier shall ensure that changes and baseline departure for each output and deliverables are under configuration control.	Y	Y	Y	Y
8.1.1e	Problems found during verification and validation activities defined in each of ECSS-E-ST-20-40 phase shall be managed in compliance with ECSS-Q-ST-60-03 clause 5.2.5.	Y	Y	Y	Y
8.1.1f	The supplier shall report on configuration management compliance in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	Y	Y	Y	Y
8.1.2a	The DCMF shall cover the DEVICE and its associated software tools.	Y	Y	Y	Y
8.2.1a	The DEVICE configuration management system shall allow regeneration of any reference version from backups.	Y	Y	Y	Y
8.2.2a	The DEVICE Configuration Item Data List and the As-Built Configuration List shall be provided with each DEVICE delivery.	Y	Y	Y	Y
8.2.2b	The CIDL shall be in compliance with DRD from ECSS-M-ST-40 Annex C.	Y	Y	Y	Y
8.2.2c	The ABCL shall be in compliance with DRD from ECSS-M-ST-40 Annex D.	Y	Y	Y	Y
8.2.2d	The CIDL and ABCL shall be provided and up to date for each project review.	Y	Y	Y	Y

Clause	Requirement	Cat A	Cat B	Cat C	Cat D
8.2.2e	Any components of the automatic code generation tool that are customizable by the user shall be put under configuration control in the Software Configuration File in compliance with ECSS-M-ST-40 Annex E.	Y	Y	Y	Y
8.2.2f	For components specified in the requirement 8.2.2e the change control procedures defined for the project shall address their specific aspects.	Y	Y	Y	Y
8.2.2g	The supplier shall ensure that all authorized changes are implemented in accordance with the configuration management plan.	Y	Y	Y	Y
8.2.2h	The mask generation and verification for ASICs shall be performed under the foundry's configuration control system.	Y	Y	Y	Y
8.2.2i	All inputs to the DEVICE development that are not automatically generated and are needed to reproduce the design shall be put under a revision control mechanism agreed with the customer.	Y	Y	Y	Y
8.2.2j	Each DEVICE development step using design inputs shall reflect the revision numbers of the inputs in a log file to prove consistency.	Y	Y	Y	Y
8.2.2k	The following documents shall be controlled in compliance with ECSS-Q-ST-10 clause 5.2.5: 1. Procedural documents describing the quality system applied during the DEVICE development flow, 2. Planning documents describing the planning and progress of the activities, 3. Documents describing a particular DEVICE, including: (a) development phase inputs, (b) development phase outputs, (c) verification and validation plans and results, (d) test case specifications, test procedures and test reports, (e) traceability matrices, (f) documentation for the DEVICE and system operators and users, and (g) maintenance documentation.	Y	Y	Y	Y
8.2.3a	Software configuration status for the DEVICE software tools shall be documented in a SCF in compliance with DRD in ECSS-M-ST-40 Annex E.	Y	Y	Y	Y

Clause	Requirement	Cat A	Cat B	Cat C	Cat D
8.2.3b	The SCF shall be available and up to date for each DEVICE phase review.	Y	Y	Y	Y
8.3a	Configuration control shall be defined in conformance with ECSS-M-ST-40 clause 5.3.2.	Y	Y	Y	Y
8.3b	Configuration control shall include problem reports produced during development, in compliance with clause 5.2.5	Y	Y	Y	Y
8.3c	Configuration control boards shall be defined in compliance with ECSS-M-ST-40 clause 5.3.2.	Y	Y	Y	Y
8.3d	Each change and departure from baseline shall be classified in accordance with ECSS-M-ST-40 clause 5.3.2.	Y	Y	Y	Y
8.3e	At each review, the supplier shall report on any change and departure which took place during the DEVICE development phase and assess impact on previous review conclusions.	Y	Y	Y	Y

Annex A (normative)

DEVICE Product Assurance Plan (DPAP) - DRD

A.1 DRD identification

A.1.1 Requirement identification and source document

This DRD is called from ECSS-Q-ST-60-03 requirement 5.1.1a.

A.1.2 Purpose and objective

The purpose of the DEVICE product assurance plan is to provide information on the organizational aspects and the technical approach to the execution of the DEVICE product assurance programme.

A.2 Expected response

A.2.1 Scope and content

<1> Introduction

ECSS-Q-ST-60-03_1590162

- a. The DPAP shall contain the definition of the purpose, objective, content and the reason of its preparation.

<2> Applicable and reference documents

ECSS-Q-ST-60-03_1590163

- a. The DPAP shall list the applicable and reference documents to support the generation of the document.

<3> Terms, definitions and abbreviated terms

ECSS-Q-ST-60-03_1590164

- a. The DPAP shall include any additional terms, definition or abbreviated terms used.

<4> System Overview

ECSS-Q-ST-60-03_1590165

- a. The DPAP shall include a description of the system and DEVICE being developed.

<5> DEVICE product assurance programme implementation**<5.1> Organization**

ECSS-Q-ST-60-03_1590166

- a. The DPAP shall define the organization of DEVICE product assurance activities, including responsibility, authority and the interrelation of personnel who manage, perform and verify work affecting DEVICE quality.

ECSS-Q-ST-60-03_1590167

- b. The DPAP shall include the following topics:
 - 1. Organizational structure,
 - 2. Interfaces of each organisation, either external or internal, involved in the project,
 - 3. Relationship to the system level product assurance and safety,
 - 4. Independence of the DEVICE product assurance function,
 - 5. Delegation of DEVICE product assurance tasks to a lower level supplier.

<5.2> Responsibilities

ECSS-Q-ST-60-03_1590168

- a. The DPAP shall define the responsibilities of the DEVICE product assurance function.

<5.3> Resources

ECSS-Q-ST-60-03_1590169

- a. The DPAP shall define the resources used to perform the DEVICE product assurance function.

ECSS-Q-ST-60-03_1590170

- b. The resources defined in A.2.1<5.3>a shall include human resources and skills, and software tools.

<5.4> Reporting

ECSS-Q-ST-60-03_1590171

- a. The DPAP shall define the reporting performed by DEVICE product assurance.

<5.5> Risk management

ECSS-Q-ST-60-03_1590172

- a. The DPAP shall define the contribution of the DEVICE product assurance function to the project risk management.

<5.6> Supplier selection and control

ECSS-Q-ST-60-03_1590173

- a. The DPAP shall define the contribution of the DEVICE product assurance function to the next level suppliers selection and control.

<5.7> Criticality analysis

ECSS-Q-ST-60-03_1590174

- a. The DPAP shall define the result of the criticality analysis performed at System level.

ECSS-Q-ST-60-03_1590175

- b. The DPAP shall define the method and tools used for the DEVICE criticality analysis.

<5.8> Methods and tools

ECSS-Q-ST-60-03_1590176

- a. The DPAP shall define the methods and tools used for all the activities of the development cycle, and their level of maturity.

<5.9> Maintenance (optional)

ECSS-Q-ST-60-03_1590177

- a. The DPAP shall specify the quality measures related to the operations and maintenance processes

NOTE Alternatively, a separate DPAP is produced.

<6> DEVICE process assurance

<6.1> DEVICE development cycle

ECSS-Q-ST-60-03_1590178

- a. The DPAP shall refer to the DEVICE development cycle definition in the DEVICE development plan.

ECSS-Q-ST-60-03_1590179

- b. If not covered in the DEVICE development plan, the DEVICE development flow shall be defined.

<6.2> Projects plans

ECSS-Q-ST-60-03_1590180

- a. The DPAP shall define all plans be produced and used in the project.

ECSS-Q-ST-60-03_1590181

- b. The relationship between the project plans and a timely planning for their preparation and update shall be specified.

<6.3> DEVICE dependability and safety

ECSS-Q-ST-60-03_1590182

- a. The DPAP shall contain a definition and justification of the measures applied for the handling of critical DEVICES, including the analyses performed and the standards applicable for critical DEVICE.

<6.4> DEVICE security assurance

ECSS-Q-ST-60-03_1590183

- a. The DPAP shall contain a description of the Security standards, practices and procedures applied

ECSS-Q-ST-60-03_1590184

- b. The DPAP shall contain a description of the tools and methods applied

<6.5> Process assessment and improvement

ECSS-Q-ST-60-03_1590185

- a. The DPAP shall state the scope and objectives of process assessment.

ECSS-Q-ST-60-03_1590186

- b. The DPAP shall define the methods and tools used for process assessment and improvement.

<6.6> DEVICE documentation and configuration management

ECSS-Q-ST-60-03_1590187

- a. The DPAP shall define the contribution of the DEVICE product assurance function to the proper implementation of documentation and configuration management.

ECSS-Q-ST-60-03_1590188

- b. The nonconformance control system shall be defined or referenced.

ECSS-Q-ST-60-03_1590189

- c. The point in the DEVICE development flow from which the nonconformance procedures apply shall be specified.

<6.7> Reuse of DEVICE

ECSS-Q-ST-60-03_1590190

- a. The DPAP shall define the approach for the reuse of existing DEVICE, including delta qualification.

<6.8> Product assurance planning for individual processes and activities

ECSS-Q-ST-60-03_1590191

- a. The following processes and activities shall be covered, taking into account the project scope and DEVICE development flow:
 - 1. DEVICE definition phase,
 - 2. DEVICE architecture phase,
 - 3. DEVICE Design and Verification phase,
 - 4. DEVICE Detailed Design phase,
 - 5. DEVICE Layout phase,
 - 6. DEVICE Implementation Phase,
 - 7. DEVICE Validation, Qualification and Acceptance phase,
 - 8. Independent Verification and Validation,
 - 9. DEVICE qualification process,
 - 10. DEVICE delivery and acceptance process,
 - 11. DEVICE Qualification Status Maintenance.

ECSS-Q-ST-60-03_1590192

- b. The DPAP shall define the approach to assess the qualification status of the DEVICE

ECSS-Q-ST-60-03_1590193

- c. The DPAP shall specify the approach to allow recurrent(s) production

ECSS-Q-ST-60-03_1590194

- d. The DPAP shall define the approach to assess DEVICE deactivated functions, configurable functions and unreachable functions.

ECSS-Q-ST-60-03_1590195

- e. The DPAP shall define the approach to automatic code generation.

<6.9> Procedures and standards

ECSS-Q-ST-60-03_1590196

- a. The DPAP shall define or list by reference all procedures and standards applicable to the development of the DEVICE in the project

ECSS-Q-ST-60-03_1590197

- b. The DEVICE product assurance measures to ensure compliance to the project procedures and standards shall be specified.

ECSS-Q-ST-60-03_1590198

- c. The standards and procedures defined or listed in accordance with <6.9>a shall be as a minimum those covering the following aspects:
 - 1. Project management,
 - 2. Risk management,
 - 3. Configuration and documentation management,
 - 4. Verification and validation,
 - 5. Requirements engineering,
 - 6. Design,
 - 7. Coding,
 - 8. Metrication,
 - 9. Nonconformance control,
 - 10. Audits,
 - 11. Alerts,
 - 12. Reuse of existing DEVICE,
 - 13. Use of methods and tools,
 - 14. Qualification including status assessment
 - 15. Delivery and acceptance;
 - 16. Maintenance.

<7> DEVICE product quality assurance

ECSS-Q-ST-60-03_1590199

- a. The DPAP shall define the approach to ensure the quality of the DEVICE product.

- b. The description of the approach specified in A.2.1<7>a shall include the:
 - 1. Specification of the product metrics, their target values and the means to collect them,
 - 2. Definition of a metrication programme,
 - 3. Analyses performed on the collected metrics,
 - 4. Way the results are fed back to the development team,
 - 5. Documentation quality requirements,
 - 6. Assurance activities meant to ensure that the product meets the quality requirements.

<8> **Compliance matrix to DEVICE product assurance requirements**

ECSS-Q-ST-60-03_1590201

- a. The DPAP shall include the compliance matrix to the applicable DEVICE product assurance requirements, or a reference to it.

NOTE For example, ECSS-Q-ST-60-03 clauses, as tailored by a product assurance requirements document.

ECSS-Q-ST-60-03_1590202

- b. The compliance matrix shall include reference to the associated document where the requirement compliance evidence can be found.

A.2.2 Special remarks

ECSS-Q-ST-60-03_1590203

- a. The response to this DRD may be combined with the response to the project product assurance plan, as defined in ECSS-Q-ST-10.

Annex B (normative)

DEVICE Product Assurance Report (DPAR)

- DRD

B.1 DRD identification

B.1.1 Requirement identification and source document

This DRD is called from ECSS-Q-ST-60-03 requirement 5.2.2a

B.1.2 Purpose and objective

The main purpose of the DEVICE product assurance report is to collect and present at project milestones the reporting on the DEVICE product assurance activities performed during the past project phases.

B.2 Expected response

B.2.1 Scope and content

<1> Introduction

ECSS-Q-ST-60-03_1590204

- a. The DPAR shall contain a definition of the purpose, objective, content and the reason prompting its preparation.

<2> Applicable and reference documents

ECSS-Q-ST-60-03_1590205

- a. The DPAR shall list the applicable and reference documents to support the generation of the document.

<3> Terms, definitions and abbreviated terms

ECSS-Q-ST-60-03_1590206

- a. The DPAR shall include any additional terms, definition or abbreviated terms used.

<4> Verification activities performed

ECSS-Q-ST-60-03_1590207

- a. The DPAR shall contain reporting on verification activities performed by the product assurance function, including:
 - 1. Reviews,
 - 2. Inspections,
 - 3. Walk-throughs,
 - 4. Review of traceability matrices,
 - 5. Documents reviewed.
- a. The DPAR shall contain reporting on the verification of the measures applied for the handling of critical DEVICE.

<5> Criticality Analysis Report

ECSS-Q-ST-60-03_1590209

- a. The DPAR shall report the result of the System level dependability and safety analysis, including the criticality(ies) assigned to the DEVICE

ECSS-Q-ST-60-03_1590210

- b. The DPAR shall report the result of the DEVICE dependability and safety analysis and identify recommendations for DEVICE and System.

<6> Methods and tools

ECSS-Q-ST-60-03_1590211

- a. The DPAR shall include or reference a justification of the suitability of the methods and tools applied in all the activities of the development cycle, including requirements analysis, specification, design, coding, validation, testing, configuration management, verification and product assurance.

ECSS-Q-ST-60-03_1590212

- b. The DPAR shall include reporting on the correct use of methods and tools.

<7> Compliance to design and coding standards

ECSS-Q-ST-60-03_1590213

- a. The DPAR shall include reporting on the compliance of DEVICE products to the applicable modelling, design and coding standards, including:
 - 1. Reporting on the application of measures meant to ensure that the design complexity and modularity meet the quality requirements;
 - 2. Reporting on design documentation. versus suitability for maintenance.

<8> Compliance to security standards

ECSS-Q-ST-60-03_1590214

- a. The DPAR shall include reporting on the compliance of DEVICE security requirements, methods and tools.

<9> Product and process metrics

ECSS-Q-ST-60-03_1590215

- a. The DPAR shall include reporting on the collected product and process metrics, the relevant analyses performed, the corrective actions undertaken and the status of these actions.

<10> Testing and validation

ECSS-Q-ST-60-03_1590216

- a. The DPAR shall include reporting on adequacy of the testing and validation documentation, including feasibility, traceability repeatability, and on the achieved test coverage versus stated goals.

<11> Deactivated, configurable and unreachable functions

ECSS-Q-ST-60-03_1590217

- a. The DPAR shall report on verification/validation activities performed on:
 - 1. Deactivated functions,
 - 2. Configurable functions,
 - 3. Unreachable functions.

<12> Automatic code generation

ECSS-Q-ST-60-03_1590218

- a. The DPAR shall include reporting on verification activities on automatically generated code.

<13> Qualification

ECSS-Q-ST-60-03_1590219

- a. The DPAR shall include reporting on the assessment of qualification status and report its status.

ECSS-Q-ST-60-03_1590220

- b. The DPAR shall include reporting on assessment of maintenance of qualification status in case of change after achieving qualified state, including delta-qualification definition and results.

<14> Independent Verification and Validation

ECSS-Q-ST-60-03_1590221

- a. The DPAR shall include reporting on the results of IVV activities.

ECSS-Q-ST-60-03_1590222

- b. The DPAR shall include references to IVV plans and reports as well status of open points with associated correction plan.

<15> Process Assessment and Improvement

ECSS-Q-ST-60-03_1590223

- a. The DPAR shall include reporting on the results of process improvement.

ECSS-Q-ST-60-03_1590224

- b. The DPAR shall include reporting on Improvement planning and results.

<16> Open points status

ECSS-Q-ST-60-03_1590225

- a. The DPAR shall include reporting on the status of problem reports, nonconformances, actions, RFDs and RFWs relevant to DEVICE.

ECSS-Q-ST-60-03_1590226

- b. The DPAR shall include the correction plan for all open points.

<17> References to progress reports

ECSS-Q-ST-60-03_1590227

- a. Whenever relevant and up-to-date information has been already delivered as part of the regular PA progress reporting, a representative summary shall be provided, together with a detailed reference to the progress report(s) containing that information.

B.2.2 Special remarks

ECSS-Q-ST-60-03_1590228

- a. The response to this DRD may be combined with the response to the project product assurance report, as defined in ECSS-Q-ST-10.

Annex C (normative)

DEVICE Reuse File (DRF) - DRD

C.1 DRD identification

C.1.1 Requirement identification and source document

This DRD is called from ECSS-Q-ST-60-03 requirement 6.2.3.1a.

C.1.2 Purpose and objective

The main purpose of the DEVICE Reuse File is to collect and present at project milestones all information relevant to reuse of existing devices.

C.2 Expected response

C.2.1 Scope and content

<1> Configuration management

ECSS-Q-ST-60-03_1590229

- a. The DRF shall include the detailed configuration status of the reused DEVICE baseline.

<2> Reuse assessment

ECSS-Q-ST-60-03_1590230

- a. The DRF shall include the analysis of the suitability of existing DEVICE for reuse, covering the following:
 - 1. The assessment of the existing DEVICE functional, performance and quality requirements against project requirements,
 - 2. The results of analysis of the existing DEVICE requirements, development and support documents,
 - 3. Justification for any non-compliance between the applicable project functional, performance and quality requirements and the actual characteristics/performances of the existing DEVICE,
 - 4. Delta qualification activities defining all tasks to be performed to confirm the fulfilment of the project requirements.
 - 5. Suitability analysis results of the Delta qualification activities,

6. The acceptance and warranty conditions,
7. The identification and registration by configuration management,
8. Maintenance responsibility and conditions, including the possibilities of changes,
9. The durability and validity of methods and tools used in the development of the existing DEVICE, that are envisaged to be reused again,
10. The copyright and Intellectual Property Rights constraints, modification rights, distribution rights,
11. The licensing conditions,
12. Exportability constraints,
13. Identification of technology of the existing DEVICE, qualification heritage, flight heritage, company utilization of the technology.

NOTE For IP Core reuse ECSS-E-ST-20-40 F.2.1.<4> of DFRAR can provide relevant information for the DRF.

<3> Licensing scheme

ECSS-Q-ST-60-03_1590231

- a. The DRF shall include the assessment of deliverable DEVICE, including both developed DEVICE and existing reused DEVICE(s) in terms of constituent elements and the associated licensing.

C.2.2 Special Remarks

None

Annex D (informative)

DEVICE Development Expected Outputs

Various types of outputs are produced during the course of the development of a DEVICE and its different phases. Table D-1 is a summary of all the document outputs expected at each review milestone for both, the engineering and the product assurance flows, as explained in ECSS-E-ST-20-40 and ECSS-Q-ST-60-03 respectively.

The DEVICE development contract defines what expected outputs are to be delivered, in which format and under which terms

Table D-1 can also be found in ECSS-E-ST-20-40 Annex K.

Table D-1: ECSS-Q-ST-60-03 and ECSS-E-ST-20-40 list of Expected Outputs

Document name	Document having a DRD annex	DEVICE Definition Phase Review (DPR)	DEVICE Architecture Definition Phase Review (ADR)	DEVICE Design and Verification Phase Review (DVR)	DEVICE Detailed Design Phase Review (DDR)	DEVICE Layout Phase Review (LPR)	DEVICE Implementation Phase Review (IPR)	DEVICE Validation, Qualification and Acceptance Phase Review (VQAR)
<p>The following notation is used:</p> <p>B = Configuration Baseline (as per ECSS-M-ST-40 clause 4.3.2.4)</p> <p>R = Review</p> <p>expected ECSS-E-ST-20-40 document outputs in blue font</p>								
DEVICE Requirements Specification (DRS)	ECSS-E-ST-20-40 Annex A	R						
DEVICE Development Plan (DDP)	ECSS-E-ST-20-40 Annex B	R						
DEVICE Verification Plan (DVeP)	ECSS-E-ST-20-40 Annex C	R	R	R				
DEVICE Validation Plan (DVaP)	ECSS-E-ST-20-40 Annex D	R	R			R		
DEVICE Support and Maintenance Plan (DSMP) (conditional)	ECSS-E-ST-20-40 Annex E	R						R

Document name	Document having a DRD annex	DEVICE Definition Phase Review (DPR)	DEVICE Architecture Definition Phase Review (ADR)	DEVICE Design and Verification Phase Review (DVR)	DEVICE Detailed Design Phase Review (DDR)	DEVICE Layout Phase Review (LPR)	DEVICE Implementation Phase Review (IPR)	DEVICE Validation, Qualification and Acceptance Phase Review (VQAR)
<p>The following notation is used:</p> <p>B = Configuration Baseline (as per ECSS-M-ST-40 clause 4.3.2.4)</p> <p>R = Review</p> <p>expected ECSS-E-ST-20-40 document outputs in blue font</p>								
DEVICE Feasibility and Risk Assessment Report (DFRAR)	ECSS-E-ST-20-40 Annex F	R	R	R	R	R	R	R
DEVICE Product Assurance Plan (DPAP)	ECSS-Q-ST-60-03 Annex A	B						
DEVICE Product Assurance Report (DPAR)	ECSS-Q-ST-60-03 Annex B	R	R	R	R	R	R	R
DEVICE Reuse File (DRF)	ECSS-Q-ST-60-03 Annex C	R	R	R	R	R	R	R
Verification Control Document (VCD)	ECSS-E-ST-10-02 Annex B	R	R	R	R	R	R	B

Document name	Document having a DRD annex	DEVICE Definition Phase Review (DPR)	DEVICE Architecture Definition Phase Review (ADR)	DEVICE Design and Verification Phase Review (DVR)	DEVICE Detailed Design Phase Review (DDR)	DEVICE Layout Phase Review (LPR)	DEVICE Implementation Phase Review (IPR)	DEVICE Validation, Qualification and Acceptance Phase Review (VQAR)
<p>The following notation is used:</p> <p>B = Configuration Baseline (as per ECSS-M-ST-40 clause 4.3.2.4)</p> <p>R = Review</p> <p>expected ECSS-E-ST-20-40 document outputs in blue font</p>								
Independent Verification Validation Plan (IVV Plan)		B						
Configuration Management Plan (CMP)	ECSS-M-ST-40 Annex A	B						
Configuration Item Data List (CIDL)	ECSS-M-ST-40 Annex C	B						
DEVICE Architecture Definition Report	ECSS-E-ST-20-40 Annex G		R					
DEVICE Design Report				R				
DEVICE Design Verification Report				R				

Document name	Document having a DRD annex	DEVICE Definition Phase Review (DPR)	DEVICE Architecture Definition Phase Review (ADR)	DEVICE Design and Verification Phase Review (DVR)	DEVICE Detailed Design Phase Review (DDR)	DEVICE Layout Phase Review (LPR)	DEVICE Implementation Phase Review (IPR)	DEVICE Validation, Qualification and Acceptance Phase Review (VQAR)
<p>The following notation is used:</p> <p>B = Configuration Baseline (as per ECSS-M-ST-40 clause 4.3.2.4)</p> <p>R = Review</p> <p>expected ECSS-E-ST-20-40 document outputs in blue font</p>								
DEVICE Data Sheet (conditional)	ECSS-E-ST-20-40 Annex H			R	R	R	R	R
Netlist Generation Report					R			
Netlist Verification Report					R			
Layout Generation Report						R		
Layout Verification Report						R		
DEVICE Radiation Test Plan (conditional)						R	R	

Document name	Document having a DRD annex	DEVICE Definition Phase Review (DPR)	DEVICE Architecture Definition Phase Review (ADR)	DEVICE Design and Verification Phase Review (DVR)	DEVICE Detailed Design Phase Review (DDR)	DEVICE Layout Phase Review (LPR)	DEVICE Implementation Phase Review (IPR)	DEVICE Validation, Qualification and Acceptance Phase Review (VQAR)
<p>The following notation is used:</p> <p>B = Configuration Baseline (as per ECSS-M-ST-40 clause 4.3.2.4)</p> <p>R = Review</p> <p>expected ECSS-E-ST-20-40 document outputs in blue font</p>								
ESCC Detail Specification (conditional)						R	R	R
ASIC Production Tests Report or FPGA Programming Test Report							R	
DEVICE Validation report								R
Radiation Test Report (conditional)								R
DEVICE User Manual (conditional)								R

Document name	Document having a DRD annex	DEVICE Definition Phase Review (DPR)	DEVICE Architecture Definition Phase Review (ADR)	DEVICE Design and Verification Phase Review (DVR)	DEVICE Detailed Design Phase Review (DDR)	DEVICE Layout Phase Review (LPR)	DEVICE Implementation Phase Review (IPR)	DEVICE Validation, Qualification and Acceptance Phase Review (VQAR)
<p>The following notation is used:</p> <p>B = Configuration Baseline (as per ECSS-M-ST-40 clause 4.3.2.4)</p> <p>R = Review</p> <p>expected ECSS-E-ST-20-40 document outputs in blue font</p>								
Experience Summary Report (conditional)	ECSS-E-ST-20-40 Annex I							R
As-Built Configuration List (ABCL)	ECSS-M-ST-40 Annex D		R	R	R	R	R	B
Software Configuration File (SCF)	ECSS-M-ST-40 Annex E	R	R	R	R	R	R	B
Independent Verification Validation Report (IVV Report)		R	R	R	R	R	R	B
End Item Data Pack (EIDP)	ECSS-Q-ST-20 Annex B							B

Annex E (informative)

Traceability from ECSS-Q-ST-60-03 to ECSS-Q-ST-60-02

Table E-1: Traceability matrix from ECSS-Q-ST-60-03 to ECSS-Q-ST-60-02

ECSS-Q-ST-60-03 Requirement	ECSS-Q-ST-60-03 Requirement text	ECSS-Q-ST-60-02 Requirement
5.1.1a	The supplier shall ensure that a PA organizational structure is defined for DEVICE development, and that individuals have defined tasks and responsibilities in compliance with clause 5.1.1 of ECSS-Q-ST-10 and with DRD from Annex A.	4.1.2.b 6 Annex A.2.1.a.2
5.1.2a	The responsibility, the authority and the interrelation of personnel who manage, perform and verify work affecting DEVICE quality shall be defined and documented.	4.1.2.b 6 Annex A.2.1.a.2
5.1.2b	The responsibilities and the interfaces of each organisation on the project, either external or internal, involved in a project shall be defined and documented.	4.1.2.b 6 Annex A.2.1.a.2
5.1.2c	The delegation of DEVICE product assurance tasks by a supplier to a lower level supplier shall be done in a documented and controlled way, with the supplier retaining the responsibility towards the customer.	4.1.2.b 6 Annex A.2.1.a.2
5.1.3.1a	The DEVICE product assurance responsible shall: 1. report to the project manager through the project product assurance manager. 2. have organisational authority and independence to propose and maintain a DEVICE product assurance programme in accordance with the project DEVICE product assurance requirements. 3. have access to higher management as necessary to fulfil his/her duties. 4. be invited to all project reviews.	4.1.2.b 6 Annex A.2.1.a.2

ECSS-Q-ST-60-03 Requirement	ECSS-Q-ST-60-03 Requirement text	ECSS-Q-ST-60-02 Requirement
5.1.3.2a	The supplier shall review the project requirements to establish and make provision for acquiring or developing the resources and skills for the management and technical staff.	4.1.2.b 6 Annex A.2.1.a.2
5.1.3.2b	The supplier shall maintain training records and ensure that trained personnel are available for the planned activities and tasks.	4.1.2.b 6 Annex A.2.1.a.2
5.1.3.2c	The supplier shall ensure that personnel conducting activities in compliance with ECSS-Q-ST-60-03 and ECSS-E-ST-20-40 are trained.	4.1.2.b 6 Annex A.2.1.a.2
5.1.3.2d	The supplier shall specify the training subjects based on the specific tools, techniques, methodologies and computer resources for use in the development and management of the DEVICE product.	4.1.2.b 6 Annex A.2.1.a.2
5.2.1a	The supplier shall provide a DEVICE product assurance plan for baseline at DEVICE Definition Phase Review, in response to the DEVICE product assurance requirements and in compliance with DRD in Annex A for customer approval	4.1.2.b 6 Annex A.2.1.a.2
5.2.1b	The DEVICE Product assurance programme shall include all internal manuals, standards or procedures listed in the DEVICE product assurance plan.	4.1.2.b 6 Annex A.2.1.a.2
5.2.1c	The DEVICE product assurance plan shall be revisited and updated to ensure that the activities to be undertaken in the following phase are defined.	4.1.2.b 6 Annex A.2.1.a.2
5.2.1d	The supplier shall include in the DEVICE product assurance plan a compliance matrix documenting conformance with the individual DEVICE product assurance requirements applicable for the project or business agreement.	4.1.2.b 6 Annex A.2.1.a.2
5.2.1e	For each DEVICE product assurance requirement, the compliance matrix shall provide a reference to the document where the expected output of that requirement is located.	4.1.2.b 6 Annex A.2.1.a.2
5.2.2a	The supplier shall provide a Product assurance report for each review and for each DEVICE delivery in compliance with DRD from Annex B covering the DEVICE product assurance activities performed during the past project phases.	4.1.2.b 6 Annex A.2.1.a.2

ECSS-Q-ST-60-03 Requirement	ECSS-Q-ST-60-03 Requirement text	ECSS-Q-ST-60-02 Requirement
5.2.3a	For DEVICE audits, ECSS-Q-ST-10 clause 5.2.3 shall apply.	4.1.2.b 6 Annex A.2.1.a.2
5.2.3b	Reviews and audits of processes and of products shall be carried out by personnel not directly involved in the DEVICE work being performed.	4.1.2.b 6 Annex A.2.1.a.2
5.2.3c	The supplier shall report on DEVICE Audits in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	4.1.2.b 6 Annex A.2.1.a.2
5.2.4a	For DEVICE alerts, ECSS-Q-ST-10 clause 5.2.9 shall apply.	4.1.2.b 6 Annex A.2.1.a.2
5.2.4b	The supplier shall report on DEVICE Alerts in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	4.1.2.b 6 Annex A.2.1.a.2
5.2.5a	The supplier shall define and implement procedures for the logging, analysis and correction of DEVICE problems encountered during DEVICE development in the DEVICE Product Assurance Plan in compliance with DRD in Annex A.	4.1.2.b 6 Annex A.2.1.a.2
5.2.5b	The DEVICE problem report shall contain the following information: 1. Identification of the DEVICE item, 2. Description of the problem, 3. Root cause analysis 4. Recommended solution, 5. Final disposition, 6. Modifications implemented in documents, code and tools, and 7. Tests re-executed.	4.1.2.b 6 Annex A.2.1.a.2
5.2.5c	The procedures for DEVICE problems reporting shall define the interface with the nonconformance system and the circumstances under which a problem qualifies as a nonconformance.	4.1.2.b 6 Annex A.2.1.a.2

ECSS-Q-ST-60-03 Requirement	ECSS-Q-ST-60-03 Requirement text	ECSS-Q-ST-60-02 Requirement
5.2.5d	The supplier shall verify the application of problem reporting procedures and report the results in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	4.1.2.b 6 Annex A.2.1.a.2
5.2.6a	For DEVICE nonconformance handling, ECSS-Q-ST-10-09 shall apply.	4.1.2.b 6 Annex A.2.1.a.2
5.2.6b	When dealing with DEVICE nonconformance, the NRB shall include a representative from the DEVICE product assurance and the DEVICE engineering organizations in compliance with ECSS-Q-ST-10-09 requirement 5.2.2.1.	4.1.2.b 6 Annex A.2.1.a.2
5.2.6c	The DEVICE product assurance plan shall specify the point in the DEVICE development flow from which the nonconformance procedures apply.	4.1.2.b 6 Annex A.2.1.a.2
5.3.1a	The DEVICE Product Assurance responsible shall provide input to Risk management for DEVICE in compliance with ECSS-M-ST-80.	4.1.2.b 6 Annex A.2.1.a.2
5.3.2a	For critical item control, ECSS-Q-ST-10-04 shall apply.	4.1.2.b 6 Annex A.2.1.a.2
5.3.2b	The supplier shall identify the characteristics of the DEVICE that qualify for inclusion in the Critical Item List.	4.1.2.b 6 Annex A.2.1.a.2
5.4.1a	For supplier selection ECSS-Q-ST-20 clause 5.4.1 shall apply.	4.1.2.b 6 Annex A.2.1.a.2
5.4.1b	For suppliers of existing DEVICE, including DEVICE contained in OTS equipment and units, the selection shall be performed in compliance with requirements from clause 6.2.3.	4.1.2.b 6 Annex A.2.1.a.2
5.4.2a	The supplier shall establish DEVICE product assurance requirements for the next level suppliers, tailored to their role in the project.	4.1.2.b 6 Annex A.2.1.a.2

ECSS-Q-ST-60-03 Requirement	ECSS-Q-ST-60-03 Requirement text	ECSS-Q-ST-60-02 Requirement
5.4.2b	The supplier shall provide the DEVICE product assurance requirements applicable to the next level suppliers for customer approval in the DEVICE Product Assurance Plan in compliance with DRD in Annex A.	4.1.2.b 6 Annex A.2.1.a.2
5.4.3a	The supplier shall monitor the next lower level suppliers' conformance to the product assurance requirements.	4.1.2.b 6 Annex A.2.1.a.2
5.4.3b	The monitoring process shall include the review and approval of the next lower level suppliers' product assurance plans, the continuous verification of processes and products, and the monitoring of the final validation of the product.	4.1.2.b 6 Annex A.2.1.a.2
5.4.3c	The supplier shall ensure that DEVICE development processes are defined and applied by the next lower level suppliers in conformance with the DEVICE product assurance requirements for suppliers.	4.1.2.b 6 Annex A.2.1.a.2
5.4.3d	The supplier shall provide the next lower level suppliers' DEVICE product assurance plan for customer's acceptance.	4.1.2.b 6 Annex A.2.1.a.2
5.4.4a	The supplier shall provide the lower level suppliers with the results of the safety and dependability analyses performed at higher level as provided by the customer and his level in compliance with requirements from clause 6.2.1, including: 1. The criticality classification of the DEVICE products to be developed, 2. Information about the failures that can be caused at higher level by the DEVICE products under development.	4.1.2.b 6.1 Annex A.2.1.a.2
5.5.1a	Methods and tools to be used for all the activities of the development cycle, including requirements analysis, specification, modelling, design, coding, validation, testing, configuration management, verification and product assurance shall be identified by the supplier and agreed with the customer.	4.1.2.b 6 Annex A.2.1.a.2
5.5.1b	The choice of development methods and tools shall be justified by demonstrating through testing or documented assessment as follows: 1. The development team has the experience or training to apply them, 2. The tools and methods are applicable for the verification of functional and operational characteristics of the product, 3. The tools are available throughout the development and maintenance lifetime of the product.	4.1.2.b 6 Annex A.2.1.a.2

ECSS-Q-ST-60-03 Requirement	ECSS-Q-ST-60-03 Requirement text	ECSS-Q-ST-60-02 Requirement
5.5.1c	The correct use of methods and tools shall be verified and reported in the DEVICE product assurance report in compliance with DRD in Annex B.	4.1.2.b 6 Annex A.2.1.a.2
5.5.2a	The DEVICE development environment shall be selected according to the following criteria: 1. Availability, 2. Compatibility, 3. Performance, 4. Maintenance, 5. Durability and technical consistency with the operational equipment, 6. The assessment of the product with respect to requirements, including the criticality category, 7. The available support documentation, 8. The acceptance and warranty conditions, 9. The conditions of installation, preparation, training and use, 10. The maintenance conditions, including the possibilities of evolutions, 11. Copyright and intellectual property rights constraints, and 12. Dependence on one specific supplier.	4.1.2.b 6 Annex A.2.1.a.2
5.5.2b	The availability of the DEVICE development environment to developers and other users shall be verified before the start of each development phase.	4.1.2.b 6 Annex A.2.1.a.2
6.1.1a	The DEVICE development flow specified in ECSS-E-ST-20-40 shall be integrated in the DEVICE product assurance plan in compliance with DRD in Annex A.	4.1.2.b 6 Annex A.2.1.a.2
6.1.1b	The following characteristics of the DEVICE development flow shall be specified: 1. Phases, 2. Input and output of each phase, 3. Status of completion of phase output, 4. Reviews, 5. Dependencies, 6. Responsibilities, and 7. Role of the customer at each review, in conformance with ECSS-M-ST-10 and ECSS-M-ST-10-01.	4.1.2.b 6 Annex A.2.1.a.2

ECSS-Q-ST-60-03 Requirement	ECSS-Q-ST-60-03 Requirement text	ECSS-Q-ST-60-02 Requirement
6.1.1c	The Customer shall review the DEVICE development flow against the contractual DEVICE engineering and product assurance requirements.	4.1.2.b 6 Annex A.2.1.a.2
6.1.1d	The Customer shall review the DEVICE development flow for the availability of resources.	4.1.2.b 6 Annex A.2.1.a.2
6.2.1.1a	The PA responsible shall report the criticality classification at system-level in the DEVICE Product Assurance Plan in compliance with DRD in Annex A.	4.1.2.b 6 Annex A.2.1.a.2
6.2.1.2a	The supplier shall perform a dependability and safety analysis at the DEVICE level, using the results of system-level safety and dependability analyses, in order to determine the criticality of each DEVICE function in compliance with ECSS-Q-ST-30 clause 5.4.	4.1.2.b 6 Annex A.2.1.a.2
6.2.1.2b	The DEVICE PA engineer shall report in the DEVICED Product Assurance Report the status of DEVICE dependability and safety analysis recommendations The supplier shall report the results of the DEVICE dependability and safety analysis in the in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	4.1.2.b 6 Annex A.2.1.a.2
6.2.1.2c	The supplier shall identify the methods and techniques for the dependability and safety analysis at DEVICE level throughout the DEVICE lifecycle.	4.1.2.b 6 Annex A.2.1.a.2
6.2.1.2d	Methods and techniques for DEVICE dependability and safety analysis shall be agreed between the supplier and customer.	4.1.2.b 6 Annex A.2.1.a.2
6.2.1.2e	The supplier shall report the methods and techniques used for DEVICE dependability and safety analysis in the DEVICE Product Assurance Plan in compliance with DRD in Annex A.	4.1.2.b 6 Annex A.2.1.a.2
6.2.1.2f	The supplier shall report on the status of the implementation and verification of the DEVICE dependability and safety analysis recommendations in the DEVICE product assurance report in compliance with DRD in Annex B.	4.1.2.b 6 Annex A.2.1.a.2

ECSS-Q-ST-60-03 Requirement	ECSS-Q-ST-60-03 Requirement text	ECSS-Q-ST-60-02 Requirement
6.2.1.2g	The supplier shall provide the results of the DEVICE dependability and safety analysis for integration into the system-level dependability and safety analyses, in the DEVICE Product Assurance Report in compliance with DRD in Annex B, addressing the following: 1. Additional failure modes identified at DEVICE level which had not been identified at system level, 2. Recommendations for system-level activities.	4.1.2.b 6 Annex A.2.1.a.2
6.2.2.1a	The supplier shall define, justify and apply measures to assure the dependability and safety of critical DEVICES.	4.1.2.b 6 Annex A.2.1.a.2
6.2.2.1b	The application of the chosen measures to handle the critical DEVICE shall be verified in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	4.1.2.b 6 Annex A.2.1.a.2
6.2.2.1c	The need for updating the DRS, and any of DEVICE Development, verification or validation Plans and its impact in the development flow for critical DEVICE shall be analysed, in the DEVICE Product Assurance Report in compliance with DRD in Annex B, after: 1. Any change of the underlying platform hardware, 2. Any change in the environment in which the DEVICE operates, 3. Any change of the tools, including configuration of the tools, that affect directly or indirectly the development of the DEVICE.	4.1.2.b 6 Annex A.2.1.a.2
6.2.2.2a	Identified unreachable DEVICE functions shall be removed and the need for re-verification and re-validation be analysed and reported in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	New
6.2.3.1a	The supplier shall identify the reused DEVICE and classify the DEVICE in one of reuse categories, in compliance with ECSS-E-ST-10-02 Table 5-1, and report it in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	New
6.2.3.2a	The supplier shall provide the DEVICE Reuse File in compliance with DRD in Annex C at DEVICE Definition Phase Review.	New
6.2.3.2b	The DEVICE Reuse File shall be provided for reuse categories B and C specified in ECSS-E-ST-10-02 Table 5-1.	New
6.2.3.2c	The supplier shall provide the DEVICE Reuse File with its qualification status at the Equipment Qualification Status Review, in compliance with ECSS-E-ST-10-02 requirement 5.2.4.2.d.	New
6.2.3.2d	For Reuse Category D, the full DEVICE development flow defined in ECSS-E-ST-20-40 shall apply.	New
6.2.3.2e	Device Reuse File for Reuse Category D specified in requirement 6.2.3.2d is not needed to be produced.	New
6.2.3.2f	The Delta qualification activities shall be completed prior to the qualification review at upper level.	New

ECSS-Q-ST-60-03 Requirement	ECSS-Q-ST-60-03 Requirement text	ECSS-Q-ST-60-02 Requirement
6.2.3.2g	Corrective actions shall be identified, documented in the DEVICE Reuse File and applied to the reused DEVICE.	New
6.2.3.3a	<p>The supplier shall characterise, in the DRF, the deliverable DEVICE, which comprises both developed DEVICE and existing reused DEVICE, in terms of constituent elements and the associated licensing schemes, at all reviews, including:</p> <ol style="list-style-type: none"> 1. The Intellectual Property Rights regime and licensing scheme of the developed DEVICE, as defined by the contract, 2. The licence under which the reused DEVICE is accessible by the end user, 3. The analysis of compatibility between the reused DEVICE licence and the developed DEVICE Intellectual Property Rights regime and licensing scheme as defined by the contract. This shall include as a minimum: <ol style="list-style-type: none"> (a) analysis of the reused DEVICE licence terms, (b) whether any modification has been made to the reused DEVICE and whether this modification is in line with the reused licence terms and the developed DEVICE Intellectual Property Rights regime and licensing scheme, as defined by the contract, (c) the development and licensing strategy for both developed DEVICE and reused DEVICE, in order to ensure the compatibility. 	New
6.2.3.4a	Reverse engineering techniques shall be applied to generate missing documentation and to achieve the needed verification and validation coverage.	New
6.2.3.4b	<p>For existing DEVICE whose development flow data from previous development is not available and reverse engineering techniques are not applicable, the following methods shall be applied:</p> <ol style="list-style-type: none"> 1. Generation of validation and verification documents based on the available user documentation, and execution of tests to achieve the needed level of test coverage, 2. Use of the existing DEVICE heritage to provide evidence of the product's suitability for the current application, including following information: <ol style="list-style-type: none"> (a) relevance of the existing DEVICE heritage for the new operational environment, (b) configuration management and change control of the DEVICE, (c) effectiveness of problem reporting, (d) actual error rates and maintenance records, and (e) impact of modifications. 	New
6.2.3.5a	The DEVICE reuse file shall be updated at project reviews to reflect the results of the identified corrective actions for the existing DEVICE(s) not meeting the project requirements.	New

ECSS-Q-ST-60-03 Requirement	ECSS-Q-ST-60-03 Requirement text	ECSS-Q-ST-60-02 Requirement
6.2.3.6a	All the reused DEVICES and Building Blocks shall be kept under configuration control in compliance with ECSS-Q-ST-60-03 clause 8.	New
6.2.4a	For the selection of tools for automatic code generation, the supplier shall evaluate the following: 1. Evolution of the tools in relation to the tools that use the generated code as an input, 2. Customization of the tools to comply with project requirements, 3. Collection of the design and code metrics, 4. Verification of generated code, 5. Configuration control of the tools including the parameters for customization, and 6. Compliance to any standards identified by the supplier as relevant for the DEVICE development.	New
6.2.4b	The requirements on verification and validation applicable to the automatically generated code shall ensure the achievement of the same objectives as those for manually generated code.	New
6.2.4c	In case the tool is used to skip verification or testing activities on the generated code, the level of verification and validation of the automatic generation tool shall be at least the same as the one for the generated code.	New
6.2.4d	Coding rules for automatic code generation tools shall be defined in the DEVICE Product Assurance Plan in compliance with DRD in Annex A and applied.	New
6.2.4e	Compliance to coding rules shall be verified and reported in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	New
6.2.4f	Requirements in ECSS-E-ST-20-40 Annex C.2.1.<2> shall apply to automatically generated code, unless the supplier demonstrates that the automatically generated code is not manually modified to comply with the coding and design rules applied to the manually generated code.	New
6.2.4g	The verification and validation documentation shall address separately the activities to be performed for manually and automatically generated code.	New
6.2.5a	The supplier shall define PA tasks and responsibilities related to the security requirements of the project for which the DEVICE is being developed, in the DEVICE Product Assurance Plan in compliance with DRD in Annex A for customer approval.	New
6.2.5b	The supplier shall define methods and tools used to fulfil compliance to the security requirements.	New
6.2.5c	The supplier shall report on conformance to the methods and tools used to fulfil the project security requirements in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	New
6.2.5d	The supplier shall report on conformance to the project security requirements in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	New

ECSS-Q-ST-60-03 Requirement	ECSS-Q-ST-60-03 Requirement text	ECSS-Q-ST-60-02 Requirement
6.2.6a	If the risks associated with the project justify the costs involved, Independent Verification and Validation shall be performed by a third party in line with ECSS-E-ST-20-40 development flow and as agreed with the customer.	New
6.2.6b	The supplier shall report all IVV activities and tasks defined in the IVV Plan defined in 6.3.1b in the IVV Report.	New
6.3.1a	The supplier shall define the Independent Verification and Validation activities and tasks in the IVV Plan.	New
6.3.2a	Design rules and coding rules shall be defined in the DEVICE Product Assurance Plan in compliance with DRD in Annex A and applied.	4.1.2.b 6 Annex A.2.1.a.2
6.3.2b	Compliance to design rules and coding rules specified in requirement 6.3.2a shall be verified and reported in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	4.1.2.b 6 Annex A.2.1.a.2
6.3.3a	The supplier shall ensure through internal review that the test procedures and data are feasible and traceable to the DRS and that they satisfy the DEVICE requirements.	4.1.2.b 6 Annex A.2.1.a.2
6.3.3b	Test tool development or acquisition, hardware and software, shall be planned the DEVICE Development Plan defined in ECSS-E-ST-20-40 Annex B.	4.1.2.b 6 Annex A.2.1.a.2
6.3.3c	The supplier shall establish and review the test procedures and data before starting testing activities and document the constraints of the tests concerning physical, performance, functional, controllability and observability limitations.	4.1.2.b 6 Annex A.2.1.a.2
6.3.4a	DEVICE qualification testing shall be performed in accordance with ECSS-E-ST-20-40 DEVICE Validation Plan defined in DRD Annex D, and with ECSS-Q-ST-20 sections 5.3.2.4.3 which include the means and organizations to perform assurance function for testing and validation.	4.1.2.b 6 Annex A.2.1.a.2
6.3.4b	The representativeness of the qualification model against the flight model shall be justified in accordance with ECSS-Q-20 clause 5.3.2.4.3, in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	4.1.2.b 6 Annex A.2.1.a.2
6.3.4c	The supplier shall ensure that nonconformances and problem reports detected during testing are documented and reported.	4.1.2.b 6 Annex A.2.1.a.2
6.3.4d	The completion of actions related to problem reports generated during testing and validation shall be verified and recorded in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	4.1.2.b 6 Annex A.2.1.a.2

ECSS-Q-ST-60-03 Requirement	ECSS-Q-ST-60-03 Requirement text	ECSS-Q-ST-60-02 Requirement
6.3.4e	Provisions shall be made to allow witnessing of tests by the customer as agreed by the project, in compliance with ECSS-Q-ST-20 clause 5.6.4.	4.1.2.b 6 Annex A.2.1.a.2
6.3.4f	Provisions shall be made to allow witnessing of tests by supplier personnel independent of the development.	4.1.2.b 6 Annex A.2.1.a.2
6.3.4g	The supplier shall verify that: 1. Tests are conducted in accordance with approved test procedures and data, 2. Configuration of DEVICE under test is correct, 3. The tests are documented, and 4. The test reports are in compliance with DRD from E-ST-10-02 Annex D.	4.1.2.b 6 Annex A.2.1.a.2
6.3.4h	The supplier shall ensure that tests are repeatable by verifying for the DEVICE under test, the recording of support software and hardware, test environment, supporting documents and problems found.	4.1.2.b 6 Annex A.2.1.a.2
6.3.4i	The supplier shall report that the tests are successfully completed, or that nonconformance and problem reports are raised for unsuccessful tests, in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	4.1.2.b 6 Annex A.2.1.a.2
6.3.4j	Functional areas affected by any modification shall be identified and retested.	4.1.2.b 6 Annex A.2.1.a.2
6.3.4k	The need to perform again in full or only partially verification and validation of the DEVICE shall be analysed after a change or update of any tool used to generate it, and reported in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	4.1.2.b 6 Annex A.2.1.a.2
6.3.4l	Any qualification status maintenance activities shall be identified and performed.	4.1.2.b 6 Annex A.2.1.a.2
6.3.4m	In case of retesting, all test related documentation shall be updated.	4.1.2.b 6 Annex A.2.1.a.2

ECSS-Q-ST-60-03 Requirement	ECSS-Q-ST-60-03 Requirement text	ECSS-Q-ST-60-02 Requirement
6.3.4n	Validation shall be carried out by staff who have not taken part in the design of the DEVICE being validated.	4.1.2.b 6 Annex A.2.1.a.2
6.3.4o	The necessary resources for testing shall be identified early in the DEVICE development flow, by considering the operating and maintenance requirements.	4.1.2.b 6 Annex A.2.1.a.2
6.3.4p	The validation shall include testing in the different configurations possible or in a representative set of them when the number of possible configurations is too high to allow validation in all of them.	4.1.2.b 6 Annex A.2.1.a.2
6.3.4q	DEVICE containing deactivated functions shall be verified and validated to ensure that the deactivated functions cannot be activated or that their accidental activation cannot harm the operation of the system.	4.1.2.b 6 Annex A.2.1.a.2
6.3.4.2a	The supplier shall report the assessment of the Qualification Status for the DEVICE in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	4.1.2.b 6 Annex A.2.1.a.2
6.3.4.2b	The supplier shall assess the DEVICE qualification status as follows: 1. Evidence of compliance to the verification and validation process defined in ECSS-E-ST-20-40 and ECSS-Q-ST-60-03 is provided, 2. The VCD, as defined in ECSS-E-ST-20-40 clause 5.1.5, is confirmed complete, 3. All known unresolved issues impact assessment is provided with a correction plan, and 4. Statement that the qualification status is achieved.	4.1.2.b 6 Annex A.2.1.a.2
6.3.4.2c	The qualification status shall be approved by the Customer.	4.1.2.b 6 Annex A.2.1.a.2
6.3.4.2d	The supplier shall ensure that a Verification Control Board (VCB) is established to monitor the qualification process.	4.1.2.b 6 Annex A.2.1.a.2
6.3.4.3a	For recurring products, the supplier shall produce release documentation as agreed with the customer.	4.1.2.b 6 Annex A.2.1.a.2

ECSS-Q-ST-60-03 Requirement	ECSS-Q-ST-60-03 Requirement text	ECSS-Q-ST-60-02 Requirement
6.3.4.3b	The Customer shall authorise production of each recurring product.	4.1.2.b 6 Annex A.2.1.a.2
6.3.4.4a	The customer shall establish an acceptance test plan specifying the intended acceptance tests and inspection.	4.1.2.b 6 Annex A.2.1.a.2
6.3.4.4b	The acceptance test shall take place on the flight hardware.	4.1.2.b 6 Annex A.2.1.a.2
6.3.4.4d	The customer shall ensure that the acceptance tests are performed in accordance with the approved acceptance test plan.	4.1.2.b 6 Annex A.2.1.a.2
6.3.4.4e	Test witnessing by PA personnel shall be defined in the acceptance Test Plan.	4.1.2.b 6 Annex A.2.1.a.2
6.3.4.4f	Test performance shall be monitored by the PA personnel in compliance with ECSS-Q-ST-20 clause 5.6.4.	4.1.2.b 6 Annex A.2.1.a.2
6.3.4.4g	The supplier shall provide an End Item Data Pack for each deliverable end item in conformance with ECSS-Q-ST-20 Annex B.	4.1.2.b 6 Annex A.2.1.a.2
6.3.4.4h	The Supplier shall ensure that a Delivery Review Board is convened in compliance with ECSS-Q-ST-20 clause 5.7.3	4.1.2.b 6 Annex A.2.1.a.2
6.4.1a	The supplier shall monitor and control the effectiveness of the processes used during the development of the DEVICE including the relevant processes corresponding to the services called from other organisational entities outside the project team and report it in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	New
6.4.1b	The process assessment model and method used when performing any DEVICE process assessment shall be documented in the DEVICE Product Assurance Plan in compliance with DRD in Annex A.	New

ECSS-Q-ST-60-03 Requirement	ECSS-Q-ST-60-03 Requirement text	ECSS-Q-ST-60-02 Requirement
6.4.2a	The process assessment results shall be reported in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	New
6.4.3a	The suppliers shall ensure that the results of the process assessments are used in its project activities and reported in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	New
7.1.1a	The supplier shall define assurance activities to ensure that the DEVICE meets the quality requirements, in the DEVICE Product Assurance Plan in compliance with DRD in Annex A.	4.1.2.b 6 Annex A.2.1.a.2
7.1.2a	In order to verify the implementation of the product quality requirements, the supplier shall define a metrication programme in the DEVICE Product Assurance Plan in compliance with DRD in Annex A, specifying: <ol style="list-style-type: none"> 1. The metrics to collect and store, 2. Measurement method used to collect the metrics, 3. The target values, with reference to the product quality requirements, 4. The analyses to perform on the collected metrics, including the ones to derive: <ol style="list-style-type: none"> (a) descriptive statistics, (b) trend analysis. 5. How the results of the analyses performed on the collected metrics are fed back to the development team and used to identify corrective actions; 6. The schedule of metrics collection, storing, analysis and reporting, with reference to the whole DEVICE development flow. 	4.1.2.b 6 Annex A.2.1.a.2
7.1.3a	The following basic products metrics shall be used: <ol style="list-style-type: none"> 1. Coverage of DRS requirements by validation tests, 2. Coverage of System Requirements by validation tests 3. Number of failures, 4. Trend analysis on problem report and NCs. 	4.1.2.b 6 Annex A.2.1.a.2
7.1.4a	The results of metrics collection and analysis shall be included in the DEVICE product assurance report in compliance with DRD in Annex B, in order to provide the customer with an insight into the level of quality obtained.	4.1.2.b 6 Annex A.2.1.a.2
7.2.2a	The information related to components developed for reuse in the applicable expected outputs from ECSS-E-ST-20-40 and ECSS-Q-ST-60-03 shall be self-contained.	4.1.2.b 6 Annex A.2.1.a.2

ECSS-Q-ST-60-03 Requirement	ECSS-Q-ST-60-03 Requirement text	ECSS-Q-ST-60-02 Requirement
7.2.3a	The DEVICE Requirement Specification, in compliance with DRD in ECSS-E-ST-20-40 Annex A, of DEVICES developed for reuse shall include requirements for portability.	4.1.2.b 6 Annex A.2.1.a.2
7.2.4a	The configuration management system shall include provisions for handling specific aspects of DEVICE developed for reuse.	4.1.2.b 6 Annex A.2.1.a.2
7.2.5a	Where the IP core, developed for reuse, are developed for multiple IC technologies, the verification and validation of the DEVICE shall be performed on all of them.	4.1.2.b 6 Annex A.2.1.a.2
7.2.5b	Statement that tests have been successfully completed on all IC technologies specified in requirement 7.2.5a shall be provided in release documentation.	4.1.2.b 6 Annex A.2.1.a.2
7.2.6a	The supplier shall provide a certificate of conformance in compliance with DRD in ECSS-Q-ST-20 Annex D.	4.1.2.b 6 Annex A.2.1.a.2
8.1.1a	The supplier shall provide a DEVICE configuration management plan in conformance with DRD in ECSS-M-ST-40 Annex A at DEVICE Definition Phase Review for baseline	Annex B2.1.a.9
8.1.1b	The DEVICE configuration management plan shall be either a standalone document or a section of the supplier overall configuration management plan.	Annex B2.1.a.9
8.1.1c	For each DEVICE phase specified in ECSS-E-ST-20-40, the supplier shall ensure that the outputs defined in ECSS-E-ST-20-40 and in ECSS-Q-ST-60-03 are under configuration management in compliance with of this standard clause 8.	Annex B2.1.a.9
8.1.1d	For each DEVICE phase specified in ECSS-E-ST-20-40, the supplier shall ensure that changes and baseline departure for each output and deliverables are under configuration control.	Annex B2.1.a.9
8.1.1e	Problems found during verification and validation activities defined in each of ECSS-E-ST-20-40 phase shall be managed in compliance with ECSS-Q-ST-60-03 clause 5.2.5.	Annex B2.1.a.9
8.1.1f	The supplier shall report on configuration management compliance in the DEVICE Product Assurance Report in compliance with DRD in Annex B.	Annex B2.1.a.9
8.1.2a	The DCMP shall cover the DEVICE and its associated software tools.	Annex B2.1.a.9
8.2.1a	The DEVICE configuration management system shall allow regeneration of any reference version from backups.	Annex B2.1.a.9

ECSS-Q-ST-60-03 Requirement	ECSS-Q-ST-60-03 Requirement text	ECSS-Q-ST-60-02 Requirement
8.2.2a	The DEVICE Configuration Item Data List and the As-Built Configuration List shall be provided with each DEVICE delivery.	Annex B2.1.a.9
8.2.2b	The CIDL shall be in compliance with DRD from ECSS-M-ST-40 Annex C.	Annex B2.1.a.9
8.2.2c	The ABCL shall be in compliance with DRD from ECSS-M-ST-40 Annex D.	Annex B2.1.a.9
8.2.2d	The CIDL and ABCL shall be provided and up to date for each project review.	Annex B2.1.a.9
8.2.2e	Any components of the automatic code generation tool that are customizable by the user shall be put under configuration control in the Software Configuration File in compliance with ECSS-M-ST-40 Annex E.	Annex B2.1.a.9
8.2.2f	For components specified in the requirement 8.2.2e the change control procedures defined for the project shall address their specific aspects.	Annex B2.1.a.9
8.2.2g	The supplier shall ensure that all authorized changes are implemented in accordance with the configuration management plan.	Annex B2.1.a.9
8.2.2h	The mask generation and verification for ASICs shall be performed under the foundry's configuration control system.	Annex B2.1.a.9
8.2.2i	All inputs to the DEVICE development that are not automatically generated and are needed to reproduce the design shall be put under a revision control mechanism agreed with the customer.	Annex B2.1.a.9
8.2.2j	Each DEVICE development step using design inputs shall reflect the revision numbers of the inputs in a log file to prove consistency.	Annex B2.1.a.9
8.2.2k	The following documents shall be controlled in compliance with ECSS-Q-ST-10 clause 5.2.5: 1. Procedural documents describing the quality system applied during the DEVICE development flow, 2. Planning documents describing the planning and progress of the activities, 3. Documents describing a particular DEVICE, including: (a) development phase inputs, (b) development phase outputs, (c) verification and validation plans and results, (d) test case specifications, test procedures and test reports, (e) traceability matrices, (f) documentation for the DEVICE and system operators and users, and (g) maintenance documentation.	Annex B2.1.a.9
8.2.3a	Software configuration status for the DEVICE software tools shall be documented in a SCF in compliance with DRD in ECSS-M-ST-40 Annex E.	Annex B2.1.a.9
8.2.3b	The SCF shall be available and up to date for each DEVICE phase review.	Annex B2.1.a.9

ECSS-Q-ST-60-03 Requirement	ECSS-Q-ST-60-03 Requirement text	ECSS-Q-ST-60-02 Requirement
8.3a	Configuration control shall be defined in conformance with ECSS-M-ST-40 clause 5.3.2.	Annex B2.1.a.9
8.3b	Configuration control shall include problem reports produced during development, in compliance with clause 5.2.5	Annex B2.1.a.9
8.3c	Configuration control boards shall be defined in compliance with ECSS-M-ST-40 clause 5.3.2.	Annex B2.1.a.9
8.3d	Each change and departure from baseline shall be classified in accordance with ECSS-M-ST-40 clause 5.3.2.	Annex B2.1.a.9
8.3e	At each review, the supplier shall report on any change and departure which took place during the DEVICE development phase and assess impact on previous review conclusions.	Annex B2.1.a.9

Bibliography

ECSS-S-ST-00	ECSS system – Description, implementation and general requirements
ECSS-E-HB-20-40	Space engineering – Engineering techniques for radiation effects mitigation in ASICs and FPGAs handbook <i>Note: formerly ECSS-Q-HB-60-02A</i>
ECSS-Q-ST-40	Space product assurance – Safety