ECSS-Q-ST-60 Series Training Introduction

Version : 18 May 2015, ESA internal training

European Space Agency

Disclaimer and Gentle Reminder

Standards are desired to be

- **clear, pragmatic, correct, pertinent, consistent, stable (3 to 5 years and longer), …. and suitable to support the area of business that they are established for.**

But they exist in a dynamic world in terms of technology and business practices (incl. legal aspects).

They have been created by human beings, a species known to have the propensity for error.

Nothing is perfect – so read documents carefully

At times during this course we will have to point out to you some known bugs (already slated for correction) and maybe with your help, e.g. your questions, we can identify further items to improve, to do even better in the future.

Among the Flaws … already corrected

Just to illustrate what can be encountered

ECSS-Q-ST-60Crev1

e.g. paragraph omission / inadvertent renumbering

Clause 5.2.2.3 Preferred Sources is missing (much of 4.2.2.3 applies)

Further : incomplete sentences, misspellings, typos, …

Reference to class 1 will mostly get you on the right track;

ECSS-Q-ST-60Crev2 is pretty clean right now

In case of doubts go to https://ESCIES.ORG

relevant errata and complementary information is posted there

ECSS-Q-ST-30-11Crev1 includes requirements that are not derating related – until a more proper place will be found

Sorry for any irritations caused !

A word on motivation & not restricted to EEE components

- ECSS Standards and the ESCC System are based on real life experience gained since the human space adventure started. (many other documents / systems too !!!)
- They are a notable embodiment of lessons learned and best practices demonstrated across the themes covered.
- Product Assurance is an ENGINEERING DISCIPLINE and not the hobby horse of paper tigers and bureaucrats.
- Thus the requirements do have a tangible, preventative purpose.
- PA as an independent function is a necessary, complementary and constructive consultancy and watchdog for all management and engineering activities and best applied in a non-dogmatic manner. It is based on experience, knowledge and common sense.

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EEE Components in ECSS today and time permitting covered by the course

Space Product Assurance

ECSS-Q-ST-60Crev2 EEE Components

ECSS-Q-ST-60-02C ASIC and FPGA Development

ECSS-Q-ST-60-05C Generic Procurement Requirements for Hybrids

ECSS-Q-ST-60-12C Design, Selection, Procurement and Use of Die Form MMICs

ECSS-Q-ST-60-13C Commercial EEE Components

ECSS-Q-ST-60-14C Relifing Procedure – EEE Components

ECSS-Q-ST-60-15C Radiation Hardness Assurance – EEE Components (ESA Adoption Notice ESSB-AS-Q-008 issue 1)

ECSS-Q-ST-30-11Crev1 Derating – EEE Components

Also important to know

ECSS-Q-HB-30-01A (Jan. 2011) Worst Case Analysis

- **Yes, it is a system oriented analysis of a circuit build with components. The pertinence and value of a WCA depends on the accuracy and completeness of the relevant input data, which are the component characteristics.**
- **Data sheets are often incomplete and loosely defined.**
- **Component Detail Specifications are defining accept / reject criteria needed for establishing compliance in procurement and are often insufficient as a baseline for application design.**
- **Note that e.g. Hybrid Microcircuits can be rather complex by themselves and may need their own WCA, as do System on Chip (SoC), ASIC and FPGA designs.**

Also important to know

ECSS-Q-HB-30-08A (Jan. 2011) Components reliability data sources and their use

Yes, the ECSS publication date is recent but this can not be claimed for the majority of the sources.

E.g. MIL-HDBK-217 Notice 2, Dec. 1992 and then it became a victim of the US DoD Acquisition Reform,

budget cancelled, all work stopped, no revival in sight

Notice 2 is already marked as

... for guidance only – do not cite this document as a requirement

But it remains still a de facto standard / reference used world wide and not only in the space business

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Further of relevance

ECSS-Q-TM-30-12A End of Life Parameter Drifts – EEE Components

Extracted from the former ECSS-Q-60-11 Derating document

Published as Technical Memorandum due to the age of the data (= questionable validity, lack of data to cover extended operating life to 18/20 years)

ESA study performed (without data production by accelerated testing) to assess possibilities for more (e.g. degradation modeling, Physics of Failure, etc.), but not conclusive

ECSS-Q-TM-70-51A Termination of Optical Fibres

And of course all those documents listed in the Normative References Clause of those standards

Next to come

ECSS-Q-HB-60-02 Techniques for Radiation Effects Mitigation in ASICs and FPGAs

A Handbook on Radiation Hardening by Design

Based on numerous ESA and other ASIC (Application Specific Integrated Circuit) and ASSP (Application Specific Standard Product) developments for space and compiling the results of studies and best reported practices.

This New Work Item was started late in 2013 and should be released in Q3 / 2015.

Why are the EEE requirements in the Q branch (Product Assurance) ?

As elementary building blocks and “commodity items” they were automatically falling outside of the typical space engineering requirements, which have a main orientation toward system design.

It has always been the exception that EEE space components were designed and build specifically for space applications. They are mostly derived from conventional designs and produced with established industrial processes. E.g. they may be hardened to withstand the space radiation environment or other space application specific stresses encountered and they may be optimised in some way to become suitable in a space application. But they are almost always subject to special engineering processes, which were traditionally treated in other industrial or space specific standardisation systems, specifically the **US MIL and the ESCC systems.**

But of course, as later examples will show, there are some grey zones and the classification of individual documents may be arguable from a purist point of view, it has been proven to be most effective to put requirement documents close to the implementation domain (= where the implementation responsibility resides).

Who needs to know about Q-ST-60 … ?

Anyone who is involved in the selection, procurement and control of EEE components for space !

a. **Project managers**
b. **PA managers / engineers**
c. **Engineering mangers**
d. **Designers**
e. **Procurement engineers**

And Why this is so will hopefully become more clear after this introduction

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Which EEE components are covered by Q-ST-60 ... ?

It is easier to turn the question around :

The following items are not regarded as EEE components in the frame of ECSS, ESCC and ESA project practice :

- **Batteries**
- **Motors & Drives**
- **Pyrotechnic Devices**
- **Solar Cells (part of solar generator)**
- **Printed Circuit Boards (PCBs)**

- **Everything else from Passives (Wires, Cables, Connectors, Electromechanical, RLC, ...) to Actives (all types of Semiconductors, Hybrids, MEMS, etc.) are considered as EEE Components in the Space context**

A few words about ESCC

The European Space Component Coordination (ESCC) system emerged from the previous ESA/SCC system

The Charter and the founding act signed in 2002 created a single unified European System for EEE Space Component Specifications.

The system is completely dedicated to the qualification of EEE components by ESA and for the procurement of EEE components by the user industry.

More than its predecessor ESCC is based on an extended partnership involving ESA, National Space Agencies, Component Manufacturers and the User Community (represented by EUROSPACE)

Main Products (of particular relevance to parts selection) are the

- EPPL : European Preferred Parts List
- QPL : Qualified Parts List
- EQML: European Qualified Manufacturers List

For further questions

Please consult ESCIES

The European Space Components Information Exchange System

https://escies.org

Or contact the

ESCC Secretariat

esccsecretariat@esa.int

or

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Thank you for your attention !

DONE