Airbus Defence & Space
Newspace approach
and commercial components

DEFENCE AND SPACE

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Agenda

1. Heritage (use of commercial components)
2. Definition of Newspace EEE Requirements
3. Why and how the use of AEC-Q components is allowed
4. The main points of Newspace EEE Requirements
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1. Heritage (use of commercial components)

Commercial EEE parts in European space systems is already a reality since several years !

- CNES programs : more than 20 programs (class 1 to 3) including commercial EEE parts.
- ESA programs : several programs (including class 1), already use commercial EEE parts.
- Airbus-D&S programs : commercial EEE parts introduced in earth observation programs since 2004.
- Some concrete examples
  - Ariane 5 : several operational equipment with 80% of active parts in commercial
  - FNP *(class 1)* : 6 microcircuits in commercial
  - Pleïades *(class 2)* : 36 active devices and some passive parts (resistors, capas, connect) in commercial
  - Myriades *(class 3)* : 80% of parts used in OBC in commercial
  - AS250 *(class 2)* : 6 active devices in commercial
  - Gaïa *(class 1)* : 5 microcircuits in commercial
  - Metop-SG *(class 1)* : several microcircuits in commercial

2. Definition of Newspace EEE Requirements

- Derived from ECSS-Q-ST-60-13, an ADS standard has been created for Newspace EEE Requirements.

- The constellations programs are not experimental missions (as for cubesat or microsat) but are commercial requiring a high degree of quality/reliability. However, the objective is to find alternatives in term of management, selection, procurement and usage of components in order to access performing components not available in hirel quality level and drastically reduce the cost of ownership of components.

- To this end, the “Newspace EEE Requirements” open the door to the use of automotive qualified components as are. This is based on the consideration that such automotive components offer an equivalent quality assurance than classical space components, quality being achieved differently.

- General concept

  1) Any qualified component (space, military, automotive) may be used as is : no JD, no add. screening, no lot test.
  2) Non-qualified part with complete quality/reliability data may be used as is : JD, no add. screening, no lot test.
  3) Non-qualified part without data shall be justified and lot tested (qualif level) : JD, no add. screening, lot test.

- The innovative EEE requirements proposed for “EEE New Space” shall be deployed and managed together with their mounting processes and tests at board/equipment levels (testability) shall be done to meet the mission requirements.

3. Why and how the use of AEC-Q components is allowed

- To build the Newspace EEE Requirements, ADS run several actions :

  1) Lessons learned exercise from past experience with commercial components

  2) Deep technical review of AEC-Q documents

  3) Meetings with several industries dealing with commercial components (Aircrafts, Defense, Launchers)

  4) Meetings with several EEE manufacturers (European & US) dealing with commercial components.

- Differently from ECSS-Q-ST-60-13, ADS came to the conclusion that the automotive qualified components (AEC-Q) may be used as is for space, from a EEE quality point of view :

  a) Access to all EEE parts families (including passive parts)

  b) No Justification Document required for parts AEC-Q qualified.

  c) No additional screening required at component level for parts AEC-Q qualified.

  d) No lot validation test required for parts AEC-Q qualified.

- This approach is supported by the constellations customer.

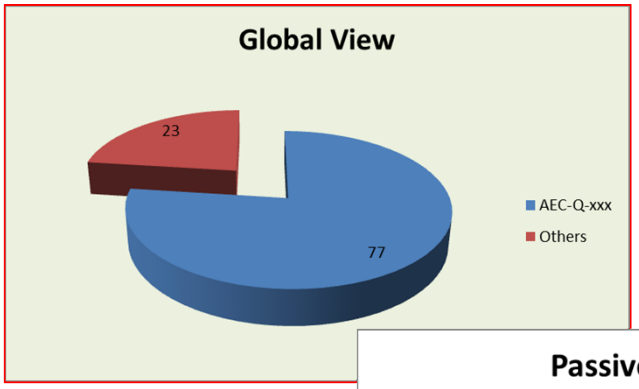
4. The main points of Newspace EEE requirements (1/2)

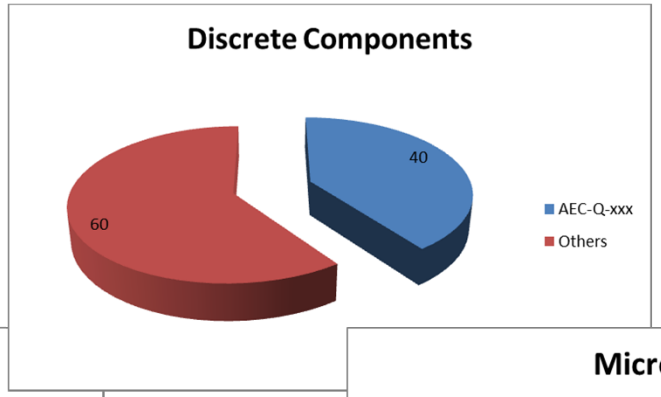
- Commercial components allowed => Minimum temperature range (-40C/+85C).
- Restricted components : The ECSS-Q-ST-60 restrictions list is applied.
  - For passive components, “end of range” values shall be justified (even if qualified).
  - Commercial relays and non-hermetic relays are added in the list of forbidden products.
  - Limitation of wire-link fuses relaxed to 3A.
- Derating requirements are maintained. ECSS-Q-ST-30-11, NASA EEE-INST-002 or supplier’s derating rules are required.
- Pure tin terminations allowed => Parts shall be JESD-201 class 2 evaluated or a mitigation plan to be defined (e.g. coating)
- Approval of non qualified parts required to be done by JD (simplified format compare to Q60-13).
- Counterfeiting : Parts to be procured only from EEE manufacturers or from franchised distributors.

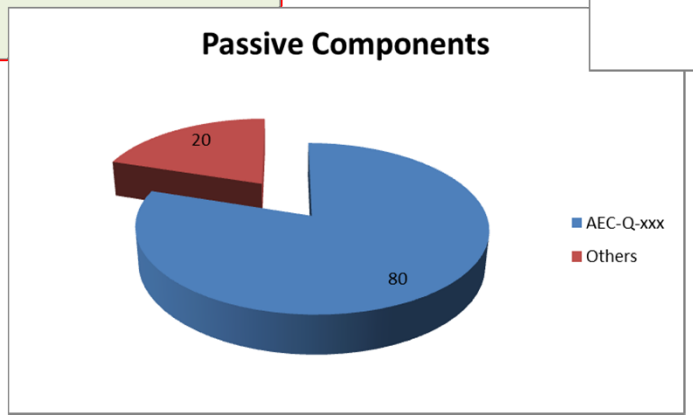
4. The main points of Newspace EEE requirements (2/2)

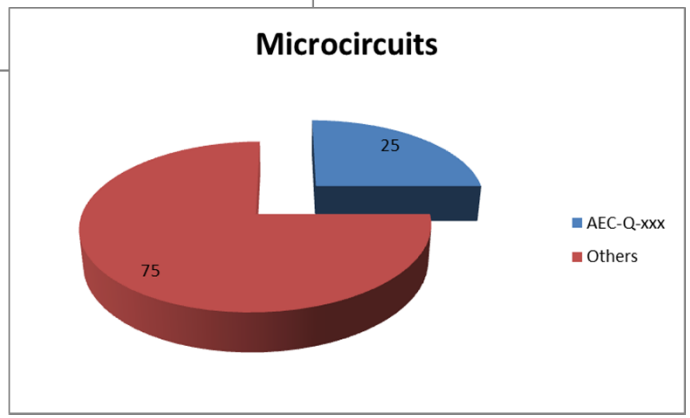
- Configuration control : For non qualified components, the supplier shall implement a configuration control system to ensure that any change of the components (e.g. mask, manufacturing or assembly process) is known.
- Uprating of components (characterization and used beyond the specified temperature range) is intentionally not addressed by this standard : risky, heavy (test programs to be developed), costly and loosing the manufacturer's guarantee.
- Lot acceptance limited to non-qualified parts without quality/reliability data => Rely on qualifying systems and review of quality/reliability data vs process control and reliability.
- Relifing tests not required => Parts be stored in good conditions for long-term and parts older than 15 years forbidden.
- Storage of plastic package => Specific storage conditions added for plastic package.
- Errata sheets issued for commercial components => Errata sheets to be managed as alerts.
- Traceability of commercial components => Tracecode asked to be managed for commercial components.

5. Ratio of use of AEC-Q components at system level









→Passive : Large usage of Automotive Components (>95% of resistors and capacitors, few RF passives)

→Active : 25 % to 40% Automotive Components used (but no MOSFET nor RF parts)

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6. ADS lessons learned (1/2)

- **SCREENING**
  - Most of automotive components have not screening (e.g. burn-in).
  - ADS considers the absence of screening as acceptable for automotive parts, based on AEC-Q qualification results.
  - Additional screening at component level may induce more risk (additional handling of components).
  - Screening at board level to be seen as mainly for mounting.

- **PURE TIN**
  - Forget the SnPb terminations for commercial (including automotive) parts !
  - Pb free components does not systematically mean “pure tin” components (e.g. SAC305, NiAuPd are more & more common).
  - No risk to deal with pure tin if JESD-201 class 2 validated.
  - When JESD-201 class 2 is not demonstrated, the use of conformal coating is considered as an acceptable risk mitigation.
  - Pure tin components not to be used in power functions (V > 15V and I > 2A).
  - Retinning parts is seen as bringing more risk (additional handling of components & thermal constraints if not well done).

- **TRACEABILITY**
  - Tracecode is enough to manage the quality aspects but insufficient to handle radiation requirements.
  - The automotive industry (users) does not manage the traceability at its level (guarantee given by the EEE manufacturers and manufacturer responsiveness is possible due to market size).

6. ADS lessons learned (2/2)

- **RADIATIONS**
  - Depending on the environment, radiation requires to be managed per diffusion lot or per wafer fab.
  - A tracecode may include parts from several wafer fabs and several diffusion lots.
  - To manage radiations, the following information is needed : die revision, mask set, wafer fab, diffusion lot, assembly lot.
  - However, solutions to use automotive parts are possible but are quite heavy.
  - “EP like” products bring a significant added value compare to AEC-Q components.

- **OBSOLESCENCE & PCN (Product Change Notice)**
  - Turnover of commercial components (including automotive parts) is higher than hirel => obsolescence to be managed.
  - Many PCNs are generated for commercial components (including automotive parts).

  => This requires to be managed, representing additional efforts at subs and prime level => efforts and/or tools are necessary.

- **RF COMPONENTS**

  Few RF components are available as AEC-Q qualified parts.

Thank you

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