Parts Quality Assurance on Nanosat ANGELS project
The mission

• In-orbit demonstrator
• Lifetime: 2 years
• Fast development: 33 months
• Satellite dimensions: 22x22x35 cm
• Payload: Miniaturized ARGOS Instrument
• Payload mass: 2.5kg

Payload developed by Syrlinks
12U platform from Nexeya
The mission

- For the platform, several equipments come from already existing solutions
  - Star tracker, S-band modem, AOCS, etc…

- Some equipments have been developed for the project:
  - OBC from STEEL
  - PCDU from EREMS
The PA specification for the new developments

The objective was to propose a new Product Assurance Plan that corresponds to the mission needs and to accept a medium-risk-taking approach.

It results in a self-contained specification with few referenced documents (10) used as guidelines.

Introduction of quality standards:
- IPC: trade association to standardize the assembly and production requirements
- AEC-Q: Automotive Electronics Council
The PA specification in detail

• Radiation
  • Failures generated by heavy ions forbidden
    •Latchup, burnout and gate rupture sensitivity tests are mandatory
    • Delatch system to implement, if there is a failure evidence
  • For non destructive heavy ions events
    • systematic mitigation (unless we have datas) in place, with possibility to disconnect it on orbit
      • No availability figures required
      • Verification is done during ground testing.
  • For total ionizing dose
    • Risk accepted if dose received < 1krad
    • Else, test performed at board level (functional issue detection only)
  • For total non-ionizing dose
    • Risk accepted if TNIDL< 1E10p/cm² (eq proton fluence : 50MeV)
    • Else, test performed at board level
The PA specification in detail

• **Process & assembly**
  - IPC Standard, Class 3 applied
  - Qualification for each package at EMS facility.
  - Pure Tin accepted, through a case-by-case analysis

• **Required analysis**
  - Parts Stress: we keep the ECSS-Q-ST-30-11 applicable.
  - Worst case analysis at functional level.
  - No failure rates to provide. Only need to assure reliability for electrical passivation at the end of the mission (French Space Operations Act)
Focus on component procurement specifications

- Some COTS families are still forbidden
  - Relay, fuse, hybrid, …
- Parts acceptance
  - For automotive components (AEC-Q compliant)
    - Accepted through DCL review
  - For the others (commercial components)
    - We select the component with the highest temperature range
    - We ask for a Justification Document
    - If not enough data, we ask for complementary tests
- No screening on components
  - But screening at board level
Focus on complementary tests at component level

- The goal is to reduce tests at component level

- Procurement acceptance:
  - To accept a component without testing, you can gather datas from manufacturer.
  - If it is not enough, we check the quantity on QM and we consider that the test on qualification model can cover the component qualification.
  - If not enough, we perform tests at component level.
## Tests performed at payload level

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Lessons learned

- Big difficulties to get automotive component in time
  - Supply time proposed oftenly more than 30 weeks!

- Be aware that shocks & vibrations in automotive standards are a bit lower.

- Trust becomes a key word in these types of development
  - The goal is to avoid a heavy test campaign on the part lot.
  - Thus, you need to gather data from manufacturer and to estimate the confidence level that you can put on them

- You need to put in place some rules to accept radiation by similarity between lots

- Product Change Notice is a synonym of obsolescence, for radiation data

- Pay attention during parts procurement.
  - Avoid counterfeits and rejected parts
  - Try to get a single reel, to improve traceability
Thank you for your attention