Parts Quality Assurance on Nanosat
ANGELS project

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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 developped 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 developped 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 correponds to the mission needs and to accept a medium-risk-taking

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

	QM1	QM2	FM1	FM2
RF Tests	X	X	X	X
TC screening	X	X	X	X
BI 240h	X	X	X	X
Elec tests	X	X	X	X
LT	X			
RF&elec tests	X	X	X	X
Vib		X	X	X
elec tests		X		
Chocs		X		
Elec tests		X		
CEM	**If necessary**	X		
Elec tests		X		
TV		X		
TID	X			
RF&elec tests	X	X	X	X

Lesssons learned

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

- Be aware that chocs & 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 datas 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 datas

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

Thank you for your attention