Laser Diode ESCC Specification Working Group

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ESCC=European Space Components Coordination

Web sites;

https://spacecomponents.org

https://escies.org

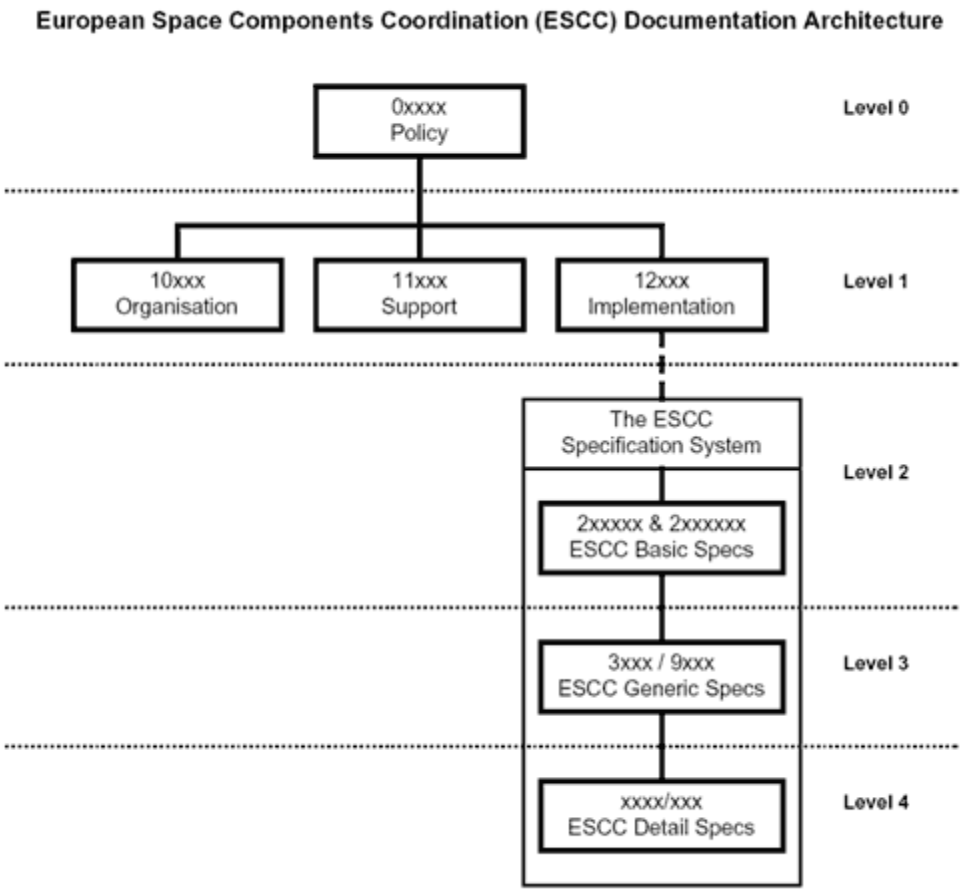
ESCC bodies

- SCSB = Space Component Steering Board
- CTB = Component Technology Board
- PSWG = Policy and Standards Working Group

ESCC members

- Eurospace; EADS Astrium, Alcatel Alenia Space (including ETCA), Saab Ericsson Space, Tesat, Tecnologica, TopRel
- Component Manufacturers; STM, Atmel, UMS, Alcatel Alenia Space (Hybrid), Vishay
- Space Agencies; ASI, BNSC, CNES, DLR, ESA

ESCC
European Space Components Coordination



Basic Specifications provide test methods, qualification methodology and general requirements applicable to all ESCC components

Sectional Basic Specifications provide test methods, evaluation methodology and general requirements applicable individual families

Generic Specifications provide the requirements for screening, periodic or lot acceptance testing and qualification testing for individual families of components

Detail Specifications provide the performance requirements for individual or ranges of particular components (basically, detail specifications are comprehensive data sheets)

esa

ESCC specifications

Resistors and Thermistors
Inductors
Capacitors
Wires and Cables
Connectors
Relays and Switches
Crystals and SAW Devices
Miscellaneous Passive
Discrete Semiconductors
Integrated Circuits
Optoelectronics

Anything for laser diodes?

No, laser diodes are not covered!

5402/005 Light Emitting Diode Infrared GaAlAs Hermetic, based on type OP224

Anything for laser diodes?

Opto Electric Devices: Photocouplers
Opto Electronic Devices: Emitters
Charge Coupled Devices, Generic + Sectionals
CCD PhotoMOS Area Arrays

So what do people do?

- Most often use ESCC 5000, Generic Specification for discrete non-microwave semiconductors

Is that wrong?

- Not necessarily if used as a baseline, but it is <u>not enough</u> as
  - Laser diodes often don't fall within the category monolithic and hermetically sealed
  - Test requirements are not the same
  - Evaluation step might be overlooked

Construction differences compared to discrete diodes

- Single chip, hermetic seal does exist – but it is rare!
- Hermetic packages, open packages and also unknown hermeticity level
- Stacks, arrays ...
- Active and passive elements often included
- Fibre coupled

Test requirements specific to laser diodes

- Vacuum sensitivity
- Proton displacement
- End of life very true concern, at least for high power
- A large number of materials may cause concerns with respect to e g radiation and outgassing (chips, glass, fibre …)
- Integrity of fibre attachment
- …

ESCC 5000 paragraph 1.2

This specification is primarily applicable to the granting of qualification approval to a component in accordance with ESCC Basic Specification No. 20100 and the procurement of such components from qualified Manufacturers. It may also be applied for procurement of unqualified components.

- By applying a generic specification to non-qualified parts, without further evaluation, certain aspects may be overseen.

This is a general concern, but more important for laser diodes as the there isn't even a dedicated generic specification available.

Two definitions of Evaluation

- As first step towards qualification of standard components within ESCC system. Described in ESCC 22600.
- To be performed on non-qualified components proposed for use in ESA programs in accordance with ECSS-Q-60 paragraph 4.2

- In both cases, evaluation contains more than testing.
- Within this activity a test plan for the former definition is prepared.

Conclusion

- Agreement necessary on test scheme to qualify laser diodes

PSWG initiated working group for creation of

- •Evaluation Test Plan
- •Generic Specification
- •Detailed Specification
- •Basic Specification – Test Methods

Working group members

Official

- EADS Astrium
- Alcatel Alenia Space
- Tesat
- CNES
- Avanex
- Nuvonyx
- ESA

Non-Official

- FBH
- Eagleyard
- ORC
- COMlase
- Sodern
- Modulight
- IXL
- Thales R&T
- Tecnologica
- Dilas

More are welcome !

Activities this far

- –Five meetings; first one January 2005, last one yesterday
- –Generic specification and evaluation test plan in draft preparation, will be further modified
- –Meetings have focused more on information exchange than actual specification preparation. Useful and necessary but has taken more time than expected →

original planning

– all activities performed within 18 months -

by far exceeded

Tests agreed for evaluation test plan

- ESD
- Step stress testing
  - temperature
  - power
- Environmental
  - vibration
  - shock
  - temperature
  - humidity
  - vacuum
- Rapid Depressurisation
- Life Test
  - up to 50% devices have failed

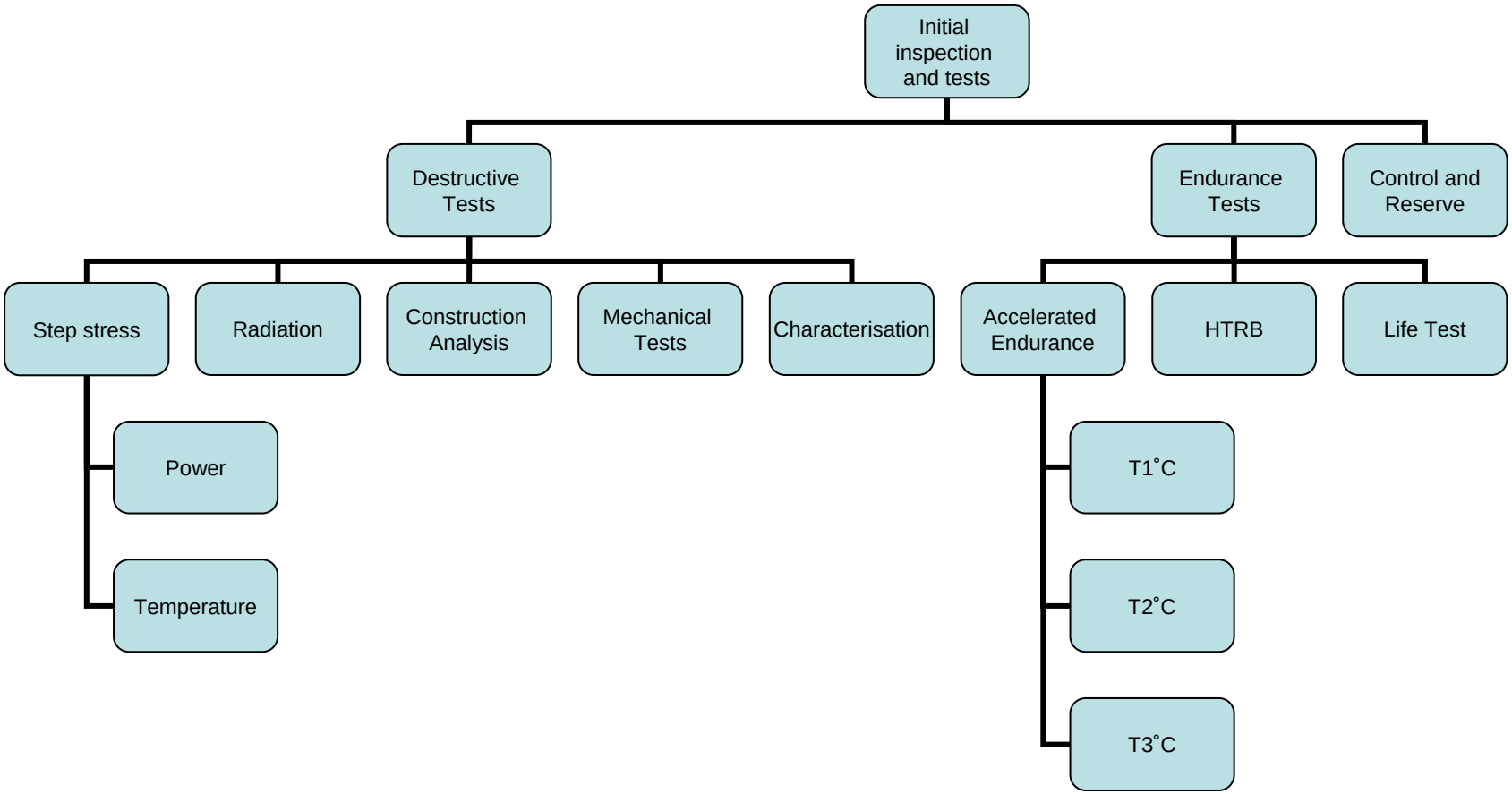
Tests agreed for evaluation test plan cont

- Characterisation
- COD threshold
- Irradiation
  - proton displacement
  - total ionising dose
- Constructional analysis
  - including External Visua Inspection, X-ray, Seal, PIND, Fibre pull, rotation and side pull, RGA, Internal Visual Inspection, SEM, Material analysis and possibly also outgassing test, μ-section, SAM

N.B. 1: List not exhaustive

N.B. 2: All tests are not applicable to all component types

Typical evaluation test plan outline



Approach for Generic Specification

- Cover all levels
  - from chip on submount to modules and stacks
  - hermetic and open packages
  - with and without fibre
  - VCSEL and edge emitting diodes
- Include requirements for add on elements (photo diodes, drivers, isolators…) similar to ECSS hybrid standard
- Include requirements for material and piece parts (package, lid, lense, fibre…)

→ Not a standard ESCC specification!

→ Work will concentrate on defining correct test scheme, how to incorporate into standard specification format has second priority