Radiation Hardness Assurance (RHA) Guideline


RHA Definition and Consideration
RHA consists of all activities undertaken to ensure that the electronics and materials of a space system perform to their design specifications after exposure to the mission space environment.

The subset of interests for NEPP and the RAG, are EE items. It is important to register that all of these undertakings are in a feedback loop and require constant iteration and updating throughout the mission life. More detail can be found in the reference materials on applicable test data for usage on parts.

Reference Materials

Heavily Rely Upon Documentation for RHA

• NASA Documents
  Guidelines and Lessons Learned found on radhome

• Military Performance Specifications
  19500, 38510, 38534, 38553

• Military Handbooks
  814,815,816,817,339

• Military Test Methods
  MIL-STD-750, MIL-STD-883

DTRA Documents

ASTM Standards by Subcommittee
F1.11, E10.07, E13.09

• EIA/JEDC Test Methods and Guides
  JEDEC, JESD07, JESD08, JEP153, FOTP-64

• ESA Test Methods and Guides
  ESA/SCC No. 22900 and 25100, ESA PSS-01-609

Drivers for a new approach and Future Considerations

Varied Missions – National Assets to CubeSats

• Risk Tolerant vs. Risk Avoidance
• Low budget, shortened schedule
• Short mission duration
• High data rates
• On board processing
• Multi-instrument dependent datasets
• Data continuity from one satellite to the next

Emerging Technologies and COTS parts usage increasing

• System on a chip solutions, COTS parts are meeting complex needs
• Highly coveted performance
• 3D structures
• Complex radiation response
• Experimentation cannot cover space

Acronyms

Acronyms

PDR
• Preliminary Design Review

Radiation Effects and Analysis Group

RHA Definition and Consideration

Requirements need to be written and incorporated into mission documents such that they are able to flow from mission level to subsystem and then to the parts selection. These requirements are determined from the hazard definition and evaluation.

The requirements need to be understood in the context of mission success and then updated and applied such that meeting those requirements provides assurance to a working system in the intended environment. This is iterated throughout mission design lifecycle to build a set of requirements that are useful, driving cost and schedule.

Depending on hazard and requirement assessments, parts testing may be necessary.

Evaluate the Design

Risk Classification and Tracking

Documentation of the risks and available data on the part are kept with the official parts identification lists, the as designed lists, and finally the as built lists to incorporate changes in the design as it matures. Risk classification helps with trade studies on whether or not the system requirements are being met and where testing can buy down risk to the project.

Mission Timeline and Deliverables

During the Propose/Feasibility Phase
• Draft Environment definition
• Draft Hardness assurance requirement
• Preliminary studies
At the Preliminary Design Review (PDR)
• Final Environment definition
• Electronic design approach
• Preliminary spacecraft layout for shielding analysis
• Preliminary analysis
• Final shielding analysis
• Check design analysis results
• At the Critical Design Review (CDR)
• Final test results
• Final shielding analysis
• Check design analysis results
• After CDR
• Remapping Radiation Likelihood Acceptance tests
• Approved As Built Parts Lists
• After Launch
• Failure Analysis
• Ancillary Risk Case

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