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A COST EFFECTIVE APPROACH FOR QUALIFYING COMMERCIAL HARDWARE FOR LOW-EARTH-ORBIT APPLICATIONS

Abstract

The use of commercial electronic components and also complete commercial-of-the-shelf (COTS) equipment is increasingly attractive for the space domain. Performance and procurement of COTS electronic components and devices is highly attractive compared to their Hil-Rel (High Reliability) / Rad-Hard (Radiation-Hardened) counterparts. Sometimes, especially for long term operational equipment, like infrastructure facilities on the International Space Station (ISS), COTS equipment could be mandatory in terms of availability, performance and nevertheless costs due to the obsolescence of spare parts.

The space is a very harsh environment, which can compromise the performance and reliability of the electronic devices. The radiation in space can directly affect the operation of electronic devices causing effects such as functional interrupts, transient effects, loss of data or memory integrity and even permanent loss of function as far as permanent damage. Furthermore, the equipment will be stressed mechanically during the launch event, mainly in terms of vibration, shock and extreme thermal cycling. Moreover, for most of the COTS devices the Bill of Materials (BoM) is not available or provided by the manufacturer, therefore mainly a radiation assessment by analysis or comparison is very difficult or unfeasible to perform.

In case the risk to fly a device "like it is" cannot be overtaken by the customer/agency, the only way to proceed is a full qualification test campaign. Even if major rules are provided by evaluation guidelines document (e.g., GPQ-MAN-002), the qualification process remains still very complex, time-consuming and user-dependent. Therefore, especially for Low-Earth-Orbit application like the ISS, such qualification process can be reduced and optimized if some key points were carefully attended. In addition, the agencies and the industry need to define a common and standard approach and roadmap to foster the utilization of COTS in the future.

This paper describes the approach applied to qualify a COTS equipment for a LEO mission on a commercial device, selected to replace an obsolete item on ISS. The implemented method, including the radiation assessment and the major results of the performed proton beam test campaign, are reported. This process can certainly be used as a "role-model" for a cost and time effective way for qualifying COTS hardware for space.