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Entitled

DESIGN MODULAR COMMAND AND DATA HANDLING SUBSYSTEM HARDWARE ARCHITECTURES

by

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Abstract

Over the past few years, On-Board Computing Systems for satellites have been facing limited level of modularity. Modularity is the ability to reuse and reconstruct the system from a set of predesigned units, with minimal additional engineering effort. CDHS hardware systems currently available have a limited ability to scale with mission needs. This thesis addresses the integration of smaller form factor CDHS modules used for nanosatellites with the larger counterparts that are used for larger missions. In particular, the thesis discusses the interfacing between Modular Computer Systems based on Open Standard commonly used in large spacecrafts and PC/104 used for nanosatellites. It also aims to create a set of layers that would represent a hardware library of COTS-like modules. At the beginning, a review of related and previous work has been done to identify the gaps in previous studies and understand more about Modular Computer Systems based on Open Standard commonly used in large spacecrafts, such as cPCI Serial Space and SpaceVPX. Next, the design requirements have been set to achieve this thesis objectives, which included conducting a prestudy of system alternatives before creating a modular CDHS hardware architecture which was later tested. After, the hardware suitable for this architecture based on the specified requirements was chosen and the PCB was designed based on global standards. Later, several functional tests and communication tests were conducted to assess the practicality of the proposed architecture. Finally, thermal vacuum testing was done on one of the architecture's layers to test its ability to withstand the space environment, with the aim to perform the vibration testing of the full modular architecture in the future. The aim of this thesis has been achieved after going through several tests, comparing between interfaces, and understanding the process of interfacing between different levels of the CDHS. This would open the doors for further research in the field and the lessons learned could possibly help in creating modular architectures for the rest of the satellite subsystems.

Keywords: Command and Data Handling Systems, Modular Architectures, Satellites, Space