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Author: Mr. Yongmyung Seo
Kyung Hee University, Korea, Republic of, ymseo@khu.ac.kr

Dr. Kyu-Sung Chae
Kyung Hee University, Korea, Republic of, kschae@khu.ac.kr
Mr. Brent Mochizuki
University of California, United States, brentm@ssl.berkeley.edu
Mr. David Clarino
University of California, United States, dclarino@ssl.berkeley.edu
Mr. Nick Yeung
University of California, United States, nick.yeung@ssl.berkeley.edu
Mr. Seyoung Yoon
Kyung Hee University, Korea, Republic of, zerosp@khu.ac.kr
Prof. Jongho SEON
Kyung Hee University, Korea, Republic of, jhseon@khu.ac.kr
Prof. Ho Jin
Kyung Hee University, Korea, Republic of, benho@khu.ac.kr
Prof. Dong-Hun Lee
Kyung Hee University, Korea, Republic of, dhlee@khu.ac.kr
Prof. Robert P. Lin
University of California, United States, rlin@ssl.berkeley.edu
Mr. John Sample
University of California, United States, jsample@ssl.berkeley.edu
Dr. Thomas Immel
University of California, United States, immel@ssl.berkeley.edu
Mr. Patrick Brown
Imperial College London, United Kingdom, patrick.brown@imperial.ac.uk
Prof. Timothy S. Horbury
Imperial College London, United Kingdom, t.horbury@imperial.ac.uk

INSTRUMENT INTERFACE MODULE BETWEEN THE ON-BOARD-COMPUTER AND PAYLOADS IN CINEMA CUBESAT AS DEVELOPED WITH FPGA

Abstract

TRiplet Ionospheric Observatory-Cubesat for Ion, Neutral, Electron and MAgnetic fields (TRIO-CINEMA) is a space science mission consisting of three identical 3U CubeSats to provide stereo Energetic Neutral Atom (ENA) imaging of the ring current, multi-point in-situ measurement of supra thermal electrons and ions, and measurement of magnetic fields in Low Earth Orbit (LEO). Each spacecraft is equipped with a Supra Thermal Electrons, Ions, Neutrals (STEIN) instrument and a MAGnetometer from Imperial College (MAGIC) instrument in order to measure the plasma particles with diverse species and energies and magnetic fields. STEIN is able to distinguish electrons, ions, and neutrals by applying electric field in the entrance aperture. MAGIC is a dual 3-axis magnetoresistive sensor intended for attitude

control and scientific measurement. The standard spacecraft CubeSat employed for the TRIO-CINEMA mission often utilizes Commercial-Off-The Shelf (COTS) electronics to build bus avionics that provides power, communications, and Command and Data Handling (C&DH), whereas payloads are usually built according to specific requirements that are often more demanding in terms of generation, transmission and storage of the data and power consumption. Therefore, designing and developing the interface to be compatible between mission payloads and the CubeSat avionics built with COTS will be the required tasks for many CubeSat missions. In this presentation, we describe the instrument interfacing module between the on-board-computer (OBC) and the mission payloads for TRIO-CINEMA spacecraft. The module is developed to provide required communication and power interfaces. In the instrument interface module, an FPGA is employed to support computing power of the OBC and communication interfaces. It is exclusively operated as data buffer and framer for generated data from mission payloads and their subsequent transmission through S-band to the ground station. The interface module provides various electrical powers at different voltages that are not supplied by the standard Electrical Power System (EPS) module of the CubeSat. The module also contains circuits for shaping the sun sensor for attitude determination, torque coils for attitude control, and a few actuators for adjustment of dynamic range of STEIN and deployment of UHF antenna and the magnetometer.