Development of a CCSDS Software Communication System for a Small Satellite

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This paper is concerned with the development of a software communication system for a small satellite. The communication system is based on the CCSDS (Consultative Committee of Space Data Systems) protocol, which is a standard communication protocol in the space industry. The complete CCSDS TC (Telecommand) and TLM(Telemetry) implementation is very complex for low-cost small satellites and hardware implementations are expensive. Therefore, the CCSDS software system developed focuses on a subset of functions such that it represents a simplified yet reliable standalone alternative software implementation of the CCSDS TC and TLM. The CCSDS Software comprises four modules(TCTX, TCRX, TMTX, TMRX) that provide both CCSDS TC and TLM services and are located inside two systems: the CCSDS Spacecraft System situated inside the On Board Computer of the spacecraft, and the CCSDS Ground System situated in the ground station. For detecting error code, a CCSDS Reed-Solomon encoder and decoder are used for the TLM channel coding, while the Bose, Chaudhuri and Hocquenghem(BCH) cyclic redundancy check(CRC) error detecting code is used for the TC coding. Also, the CCSDS software system contains the encryption scheme based on the IDEA(International Data Encryption Algorithm) to limit data access and the randomization scheme based on the Pseudo-Randomizer in order to maintain bit synchronization with the received telemetry signal. We will present the wrap-around test results covering the entire communication data-flow sending of TC data to the spacecraft, on-board processing of TC data, generation and sending of TLM data to ground.