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PERFORMANCE ENHANCEMENTS FOR NANOSATELLITE COMMUNICATION SYSTEMS BASED ON THE BRITE-AUSTRIA MISSION

Abstract

TUGSAT-1/BRITE-Austria is the first Austrian nanosatellite and will be part of the BRITE (BRIght Target Explorer) mission. The main scientific goal of this constellation, which currently consists of six satellites (two from Austria, two from Poland and two from Canada), is the observation of brightness oscillations of massive luminous stars by differential photometry. The use of nanosatellites in low Earth orbit for the fulfillment of manifold tasks has gained major interest during the last years. Due to their small size, low mass and manageable development and launch costs, they represent a cost-efficient way in carrying out science and observation tasks or in supporting in-orbit testing of new technologies. However, due to the growing complexity of future mission tasks and the combined increase in data amounts, efficient communication strategies must be developed to enhance the performance of existing systems and to overcome shortages in the available power and bandwidth.

This paper presents innovative solutions for the performance enhancement on the communication link. Emphasis hereby is put on the improvements of the current communication system used on TUGSAT-1/BRITE-Austria. After the investigation of the system requirements the currently used design is described and corresponding performance measurements and results (during testing and in-orbit after the launch in summer 2012) are given. The focus is especially laid on the advancement of the downlink chain on the physical and data link layer, as the transmitter is one of the main power consumers on a nanosatellite and the data budget is mainly affected by the telemetry and science data. To enhance the throughput suitable modulation and coding schemes are introduced and data compression and reduction methods are investigated. Besides, improvements on the current transmitter hardware design are presented, e.g. the use of linearization methods to mitigate non-linear effects of power amplifiers.