EARTH OBSERVATION SYMPOSIUM (B1)
Earth Observation Data Management Systems (4)

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AN OPTIMAL MICROSATELLITE SYSTEM FOR OPTICAL REMOTE SENSING DATA MANAGEMENT

Abstract

In this paper a feasibility study about the project of a specific microsatellite (100 kg of mass limit) for Optical Remote Sensing has been discussed with the purpose of inserting it in a Walker constellation of satellites in Sun-Synchronous Orbits (WSSO), that optimally solves the requirements in terms of RS data acquisition through an Inter-Satellite Linked (ISL) communication system. ISL represents an innovative aspect in remote sensing acquisitions and allows the exchange of data and commands between adjacent satellites of the constellation at a maximum distance of 3000 km with a BER inferior of 10e-6, following an upgradable routing algorithm for the optimization of the information delivery time of the requested data. The problem of the mission is represented by the fulfillment of both the continuity of the links and the payload pointing. Global performances of the system and the achievability of the requirements from satellite specific subsystems have been evaluated considering a trade-off between technological capabilities and costs. The selected WSSO 98.43: 20/20/1 provides a complete longitudinal coverage that is guaranteed in a revisit time of 15.6 hours. In this period the constellation defines on the Earth surface 187 countable ground tracks having a restricted equatorial distance of 214.3 km. After uplink reception from the ground station system, each of the 20 satellites of the system continuously take delivery and check TTC and RS data from the previous, eventually store, downlink or send them to the following node in an on board routing process of minimum data path. A limit constraint of 200 images in daily acquisition for each satellite and a minimum ground resolution of 30 meters have been considered in order to size the memory storage and the ISL data rates. Analyses on the performances of TLC, attitude accuracy, solar power access and thermal control have been achieved through specific tools for the given requirements and constraints in the worst activity conditions. The suitable TLC system has been designed in order to satisfy ITU requirements considering frequencies of 60 GHz for ISL (V-Band of oxygen absorption), X and S Bands for Uplink and Downlink transmissions. A commercial HXI V-Band antenna has been selected as the proper one for the ISL communications in terms of power consumption, dimension and weight. In addition, the use of specific turbo-codes in a QPSK modulation technique allows significant gains in the requested C/N of the signals.