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

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ON BOARD DATA HANDLING AND TRANSMISSION IN EARTH OBSERVATION SATELLITES. NEW CHALLENGES AND EVOLUTIONS

Abstract

On-board data handling and transmission for Earth Observation satellites had been usually implemented, for many years in the past, through a set of devices (i.e. memories, radiofrequency equipments, antennas, etc...) distributed on the platform, each independently controlled by an on-board computer. Since the end of the 90's in the frame of Rasarsat-2 design, Thales Alenia Space Italia (TAS-I) has conceived a self-contained sub-system, named PDHT (Payload Data Handling and Transmission), including all these devices and an internal computer able to command their functionalities and to perform an autonomous control of their status; such architecture also allows the execution of verification and test processes at PDHT level with integration activities later on at satellite level. Starting from this innovation, PDHT performances have been improving in the last years, pushed by an increasing demand for very high resolution images with daily availability and thanks to new technologies available on the market. Main goals are high input/output data rate, high on-board memory capacity, low Bit Error Rate (BER), low power consumption, low emissions outside the allocated band (usually the X-band). To better perceive the rapid trend of performances evolution, Radarsat-2 PDHT is flying with 300Gbits of storage capacity, transmitting data at 210 Mbps, while the transmission assembly of the next generation, the three Cosmo Sky-Med satellites, is improved at 310 Mbps, with the forth under development satellite equipped with 1200 Gbits of storage capacity. The next GMES Sentinel-1 spacecraft (developed by TAS-I under ESA contract) will embark a PDHT designed to have more than 1400 GBit, a total payload data rate of 520 Mbps and lower BER performances. New challenges for future evolutions are faced by TASI by means of several studies, focused on two main alternative strategies, both with a target data rate of at least 1 Gbps: On one side, the X-band usage could be maximized through dual-polarization techniques and using advanced coding and modulation schemes to improve the spectral efficiency; to pursue this objective, studies are addressed on high Cross-polar discrimination (XPD) antennas, Serial Concatenated Convolutional Codes (SCCC) associated with high order modulation schemes, as for example MHOMS and pre-distortion techniques for interference mitigation. The alternative solution is the migration to Ka-Band, where the more severe atmospheric effects drive the research towards the identification of a

suitable PDHT architecture implementing Variable Coding Modulation (VCM) to improve the achievable performances and the flexibility of the system.