EARTH OBSERVATION SYMPOSIUM (B1)
International Cooperation in Earth Observation Missions (1)

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A COMMON DESIGN APPROACH FOR GMES SENTINELS TRANSMISSION ASSEMBLIES

Abstract

Thales Alenia Space Italia (TAS-I) has been selected by European Space Agency (ESA) for the development of Sentinel-1, an Earth Observation mission aimed to observe and mitigate the effects of climate change and to ensure civil security. In the early phases of the spacecraft design, particular care was paid in activities aimed at cost and schedule reduction, covering all aspects of the project. In fact, it is well known that in Earth Observation satellite systems and in particular for new projects, industrial costs relative to engineering may be strongly reduced when a design is reused (recurrent units usually cost very less than a prototype). Since Sentinel-1 B2 phase, this concept suggested a common engineering approach with other two ESA space missions, Sentinel-2 and Sentinel-3, which are being developed by EADS Astrium Germany and TAS–France respectively. The commonality process involves several Sentinels subsystems: in particular, TAS-I was selected to coordinate the common design for the X-Band Transmission assembly (TXA) and the X-Band Antenna (XBAA), devoted to the transmission to Ground of on-board generated scientific data. The three spacecrafts were originally conceived independently: they have different operational requirements and embarked instruments (SAR for Sentinel-1, Multi-Spectral Imager for Sentinel-2, several instruments such as altimeters, IR sensor, radiometer, etc. for Sentinel-3), different orbital heights, different platforms. Hence, a crucial task consists of merging the three specific sets of requirements specifications, identifying a common solutions that may comply with the needs of the three

missions without impacting on their performances. This activity requires a strong cooperation between the three industrial parties and an effective coordination with the Agency. After the consolidation of key parameters as net downlink data rate (more than 520Mbps through), output power (more than 15dBW) and end-to-end performances (Frame Error Rate less than 10-8), three different TXA architectures were identified and traded-off, mainly differing on operational constraints, redundancy concept, reliability figures, dimensions and mass. The XBAA required performances have been defined according to the various needs of the missions: the minimum gain fulfills with the higher orbit spacecraft, the maximum gain is defined to comply with ECSS out-of-band limits, while the gain steepness outside the nominal coverage must guarantee a low interference level versus all embarked instruments. The commonality process is currently proceeding following a top-down approach, looking at a common design for what concern equipments layout accommodation, electrical interfaces, achievement of electro-magnetic and radiofrequency compatibility, verification and test philosophies.