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STRATEGY AND LESSON LEARNT IN TELECOM SUBSYSTEM TESTING: THE HERMES CUBESAT CONSTELLATION CASE

Abstract

The HERMES mission is a multi-messenger astrophysics 3U six nano-satellites constellation, funded by the Italian Space Agency and the European Commission. The space assets foreseen to be launched in 2024 will be injected in a 550 km equatorial orbit, and embark a miniaturized spectrometer to continuously monitor the celestial sphere to localize Gamma-Ray Bursts (GRBs) and promptly report their occurrence and spherical coordinated (R.A. and declination) on Earth to scientists. A maximum of a 30 min time span from the random events occurrence to its data download is imposed; therefore, the Iridium Constellation has been selected as continuously in-sight network for GRB occurrence data transfer, and satellites have been equipped with the due modem and antenna. No matter of GRBs occurrence, a 1 Gb/day scientific data volume is expected, therefore an S-band link is also par of the telecommunication architecture for the mission. Moreover, that is exploited for the service module space-to-ground data exchange, in nominal phases. HERMES is also equipped with deployable omnidirectional antenna to support LEOP and contingency phases with the UHFbands. All that reflects in two patches antenna for the S-Band and transceivers for S and low frequency bands respectively (SkyLabs products). The ground segment leans on two mission devoted ground stations at Malindi (Kenya) and Katherine (Australia), both using a 3-meter dish and a UHF/VHF Yagi antennae system. The paper goes through the incremental approach adopted to test the whole telecom architecture for flight. First the Iridium EM modem is operated through AT commands using serial communication, while the EM transceivers are tested with the provider's testing software. Then, focus moved on each board interface with the main on-board computer (OBC) verification and testing, through the framework of Flight Software Development Kit (FSDK -Bright Ascension) HERMES adopts, which emulates the flight SW to run on the OBC. A Universal Software Radio Peripheral is used to assess the quality of the antennae communication, comparing a cabled with the antennae transmission. A further verification occurred on the space2ground link, exploiting the S-band C3S ground station in Hungary to validate the packets content simulating losses. Currently the telecom boards, connected to the OBC, are undergoing testing for some basic routines without a manual control. The next step sees the whole telecom test plan to run on the HERMES flatsat before assembly and integration. Lesson learnt, issues and solutions along the adopted test plan will be discussed in deep.