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FLIGHT RESULTS OF AN ADVANCED MULTIBAND COMMUNICATION SDR PAYLOAD IN
LUME-1 SATELLITE

Abstract

LUME-1 is a communication satellite developed within the European project Wildland Fire Remote Sensing (FIRE-RS) project, financed by the European Interreg SUDOE Programme that implements an innovative system for prevention, detection and mapping of natural disasters, centred on wildland fires. The main mission of the spacecraft is to provide a communication link between forest-based infrared sensors for fire in-situ detection and UAVs with a Situation Assessment Control Centre for performing efficient risk assessments and coordination strategies, both during and after the wildland fire emergency.

LUME-1, a 2U Cubesat satellite, was launched on 27 December 2018 from the Russian Vostochny Cosmodrome on a Soyuz 2-1a Fregat rocket. The satellite is orbiting in a LEO SSO orbit at 500 Km, LTAN 9:30. The LEOP and Commissioning phases of LUME-1 have been successfully completed, and the satellite platform, the communication payload and the ground transceivers are fully operational.

The communication payload, TOTEM, is based on an SDR architecture. Using a flexible hardware, all the radio parameters can be changed in-orbit by software, providing multi-mission, multi-platform capabilities, as well as, allowing in-orbit reconfiguration, in case of unexpected conditions, secondary objective updates or last-minute bugs.

Totem is basically formed by two independent parts: TOTEM –Motherboard and the RF front end. A SoC with an embedded Linux and a programmable logic plus a wide frequency range transceiver allow Totem to operate in the most used nanosatellite frequency bands and run a huge variety of applications. Totem provides direct GNURadio integration, which allows to define the most used communication application, combining standard GNURadio blocks with your own out-of-tree modules. Typically, the application is developed and tested on the EM model, and finally, the binaries and configuration files are upload to the satellite directly through the SDR communication payload or the standard TTC.

In this paper, we present the flight results for the payload configuration for LUME-1 satellite, including UHF Tx/Rx, S Band Tx/Rx and L Band Rx capabilities. In addition to the M2M/IoT application for providing communication capabilities to ground sensors and UAVs within the FIRE-RS project, ADSB and spectrum monitoring results are also included.