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SALSAT - AN INNOVATIVE NANOSATELLITE FOR SPECTRUM ANALYSIS BASED ON SDR TECHNOLOGY

Abstract

Reliable radio communication is a highly critical element for the success of a space mission. Especially the increase of small satellite deployments in recent years poses new challenges to international frequency coordination and interference-free satellite communication. Frequency assignments become progressively difficult as the spectrum is already heavily used with more users to come. While the International Telecommunication Union (ITU) already pursues the timely and efficient coordination from a regulatory perspective, the general practice often deviates from the notified use. Additionally, the influence of terrestrial interferences to satellite communication still contains uncertainties and cannot be analyzed by terrestrial spectrum analysis systems. Therefore, the project SALSAT (Spectrum Analysis for LEO SATellites) of the DLR and Technische Universität (TU) Berlin has the goal to develop, qualify and launch a novel nanosatellite for spectrum analysis. SALSAT will primarily investigate the radio use communication in the VHF, UHF and S band. It is based on the TUBiX10 bus architecture, developed at the chair of space technology of TU Berlin. The satellite bus has been space qualified during the S-Net mission.

The main payload of SALSAT is the SALSA board, which features a miniaturized, novel spectrum analyzer based on software defined radio technology. The SALSA board is designed to fit into a 1U CubeSat and support multiple data bus systems. The field programmable and fully reconfigurable Lime Microsystems LMS7002M chip is used as the RF receiver, supporting a frequency range of 100.00 - 2500.00 MHz. Spectrum data is processed and stored on board utilizing an Intel Cyclone IV FPGA and then downlinked

by the TUBiX10 S band transceiver. The SALSAT mission will also perform in-flight tests of two newly developed, deployable shape memory alloy VHF antennas and a novel Fluid Dynamic Actuator (FDA) for attitude control.

SALSAT will be launched in 2019. The mission is designed to provide global spectrum data at a minimum effort by using a satellite based and fully customizable RF system. The SALSA experiment will generate up to date measurements of the utilized spectrum in a variety of frequency bands and help to ultimately enable interference-free satellite communication. The scientific results might as well be utilized for ITU studies. The paper will present an overview of the SALSAT mission, satellite bus and developed communication payloads. Details on the design of the novel SALSA spectrum analyzer and shape memory antennas along with qualification results and key performance parameters will be outlined.