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SALSAT: A NANOSATELLITE TO ANALYZE THE GLOBAL VHF, UHF AND S BAND SPECTRUM
UTILIZATION - READY FOR LAUNCH!**Abstract**

More and more small satellites have been launched in the past years. The resulting intensification of radio communication and number of users inherits an increasing risk of commonly occurring interferences in the bands reserved for satellite communications. This development can compromise the reliable satellite operation in these bands. Therefore, the nanosatellite mission SALSAT (Spectrum AnaLysis SATellite) aims to investigate the global RF spectrum in bands which are often used for small-satellite communications. The mission, which is carried out by the Technische Universität Berlin (TU Berlin), will analyze the spectrum utilization in the VHF and UHF amateur radio bands and the S band frequencies allocated for space research and operation service. SALSAT is equipped with the spectrum analyzer payload SALSA as the primary payload. It is based on a Software Defined Radio (SDR) and fully reconfigurable in-flight. An initial study using the commercially available LimeSDR has been successfully performed during the MarconISSta experiment aboard the ISS in 2018-2019. The experiment revealed first insights of the global spectrum usage for regions overflowed by the ISS. Due to its high inclined orbit the SALSAT mission will achieve a global coverage. The collected mission data shall be used for further studies and concepts to improve the utilization of the available communication spectrum.

The spectrum data of the SALSAT payload can either be processed via an FFT and signal processing chain to a waterfall representation or be forwarded as raw I/Q data. All operations on the FPGA of the payload are performed in real time. A parallel SDRAM can be utilized to store up to 2 GBit of spectrum samples before it is processed further or downlinked. The raw I/Q data can be utilized to perform in-situ measurements of a variety of RF parameters and modulation schemes. A future use-case can be to analyze and optimize the uplink parameters of a given ground station. Another being the support of a spacecraft commission (e.g. if the antenna deployment is unsuccessful). In all cases the collected RF data can be downlinked directly or stored and processed. A Linux based System on Module (SoM) features multiple software frameworks to enable the processing of the collected spectrum data on-board SALSAT. Consequently, SALSAT is an advanced in-orbit testbed to collect and analyze the spectrum usage and perform in-situ measurements.

This paper will introduce the flight configuration of the SALSAT mission with respect to the primary payload. A brief overview of the flight hard- and software as well as the mission's ground segment will be given. The spectrum analyzer and the possible operation modes and scenarios will be outlined. Additionally, the on-board processing capabilities will be explained. The launch of SALSAT is scheduled for June 15th – July 15th 2020. First flight results will be presented as they become available.