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Author: Dr. Maximilian Boettcher
Institute of Space Systems, University of Stuttgart, Germany, max@anders-space.com

Mr. Steffen Gaisser
Institute of Space Systems, University of Stuttgart, Germany, gaisser@irs.uni-stuttgart.de

Prof. Christoph Noeldeke
IRS, University of Stuttgart, Germany, noeldeke@irs.uni-stuttgart.de

Dr. Johannes Henneberg
Germany, johannes.henneberg@henneberg-acoustics.com

Dr. Stefan Jacob
Royal Institute of Technology (KTH), Sweden, sjacob@kth.se

Prof. Sabine Klinkner
IRS, University of Stuttgart, Germany, klinkner@irs.uni-stuttgart.de

Mr. Peter Taubenreuther
Germany, peter.taubenreuther@stt-systemtechnik.de

IN-ORBIT MEASUREMENT OF S-BAND RADIO NOISE DURING THE FLYING LAPTOP
SATELLITE MISSION

Abstract

The Flying Laptop small satellite was developed as a technology demonstration platform and is operated by the University of Stuttgart's Institute of Space Systems (Germany) and was launched on July 14th 2017 into a 600 km Sun synchronous Low Earth Orbit (LEO). For data exchange with ground stations, the satellite is equipped with the S-band radio transceivers SSTRX-1100. The receiver operates at a center frequency of 2083.5 MHz and additionally provides various information about the received signals. A power indicator value is used to determine the incoming radio power on this frequency. Whereas this information would be normally disregarded if the satellite is not communicating with a ground station, for this analysis, the power indication value has been used to derive the background noise temperature within 100 kHz bandwidth.

For the period between February 2018 and January 2021, the incoming signal power was recorded every 20 s and later extended by the corresponding satellite position, based on on-board GPS measurements. Although the exact direction of the incoming signal cannot be determined due to the quasi-omnidirectional antenna design, a statistical analysis has been performed for the great amount of measurement points in a 1 degree Longitude/Latitude grid. Finally, the background noise temperature is derived for each position on the Earth, characterizing the S-band radio. Several maps show interferences and man-made noise, and their seasonal and yearly variations. The presented results provide an important insight on the radio environment for a commonly used frequency for Earth-observation LEO satellites.