Bachelor's Aerospace Engineering Project (EP)

Communications Module Characterization for EventSat

Start date: Summer Semester 2026

Duration: max. 6 months, adaptable

Topic

This project is embedded within the EventSat satellite mission at the Chair of Spacecraft Systems (TUM SPS): https://www.asg.ed.tum.de/en/sps/eventsat-mission/

This project is about the physical and electrical characterization of the RF components for EventSat, especially the UHF and S-Band antennas and transceivers and their performance characteristics. The characterization methodology and test procedures developed in this project are applicable to any COTS transceiver evaluation for small satellite missions. The test setup, measurement protocol, and analysis approach for mapping commanded vs. actual RF output power constitute a reusable contribution to the CubeSat community's understanding of COTS transceiver performance. The deliverable documentation should be structured such that the methodology sections can be released independently of EventSat-specific results.

Goals

The goals of this EP are the following:

- Characterize the RF and operational properties of the EventSat UHF transceiver (EnduroSat UHF Transceiver II) and antenna, and S-Band transceiver (EnduroSat S-Band Transmitter) and antenna, focusing on parameters critical to link budget and power budget accuracy
- Establish an empirical mapping between the configurable "set output power" parameter and the actual measured RF output power for both transceivers, quantifying deviations from datasheet values across the operating range
- Measure the power consumption of each transceiver across its operational modes (idle, receiving, transmitting, platform command execution), providing validated input data for the EPS power budget and thermal analysis
- Document test procedures and results in a format directly usable for the COM subsystem verification campaign

Tasks

The tasks of the EP are the following. Time to completion is given in full-time work dedication:

1. Review the datasheets and command interfaces of the EnduroSat UHF Transceiver II and S-Band Transmitter; and the related antennas, identify all configurable parameters relevant to RF output and power consumption as well as antenna directivity and S-Parameters (~1 week)
2. Define the test setup and measurement procedure for RF output power characterization, including required test equipment (spectrum analyzer, power meter, RF cables, attenuators, dummy loads); coordinate with SPS lab for equipment availability (~1 week)

3. Execute the output power characterization: sweep through all configurable output power settings and record actual measured output power for both transceivers. Repeat measurements to establish statistical confidence (~2 weeks)
4. Measure power consumption (current draw at bus voltage) for each transceiver in each operational mode: idle, Rx, Tx at multiple power levels, and during platform command execution (~2 weeks)
5. Compile results into a characterization report with tables and plots mapping commanded vs. actual output power and mode-dependent power consumption. Identify deviations from datasheet specifications (~2 weeks)
6. Deliver test procedures as standalone documents suitable for re-execution during subsystem verification (~2 weeks)

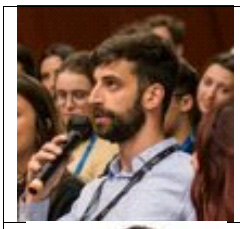
Expected results

- A characterization dataset and report for both transceivers and antennas with empirical output power curves and power consumption per operational mode, S-Parameters and directivity plots
- Standalone test procedure documents for RF output power measurement and power consumption measurement
- A summary of deviations from datasheet values, with recommendations for link budget and power budget updates

Prerequisites / Required Background

- Basic understanding of RF engineering concepts
- Ability to operate lab test equipment (spectrum and vector network analyzer, multimeter, power supply) or willingness to learn quickly
- Familiarity with serial/UART communication for commanding the transceivers

Advisors

	Ramón García Alarcia COM System Lead Phone: +49 89 289 – 55752 E-Mail: ramon.garcia-alarcia@tum.de
	Jaspar Sindermann Project Manager Phone: +49 89 289 – 55753 E-Mail: jaspar.sindermann@tum.de