

# Satellite Communication Laboratory

*Possible project for winter term 2018/2019*

## 2. Indication of physical communication layer software status to a satellite operator

### Problem description:

The operation of a satellite requires many different technical systems to work together. While the satellite operators are familiar with all of these systems they can not be expected to have an expert understanding of all of these systems at the same time. Thus it is of great importance to provide them with a reliable, yet simple indication of the status of each system so they can quickly identify anomalies and contact the right experts to resolve the anomaly.

For the MOVE-II mission the communication to the satellite is split into several different systems. The physical layer is responsible to convert digital data (bytes) into radio waves that can be send/received towards/from space. The data link layer passes the bytes between the application layer and the physical layer and ensures -if required- a correct reception of the data by using forward error correcting codes as well as re-transmission of data packets. The application layer organizes data from different satellite subsystems and tasks.

The operation of the MOVE-II satellite is performed over a web front-end that is connected to a back-end server which is corresponding with different applications running on the satellite through the communication link.

### Your task in the SatComLab:

Within this lab course the status of the physical layer communication software should be collected and forwarded to the operations back-end, such that the status of the physical layer software can be presented to the operators in a meaningful way. This lab will focus on the downlink software implemented as a GNURadio flowgraph.

During the lab, the existing physical layer software should be studied and the information necessary to give a complete but concise status overview of the software should be identified.

Once the list of status information has been discussed and agreed with the lab supervisor the implementation of the status reporting shall be performed.

### Expected results:

By the end of the lab a working implementation of the status reporting is expected to be integrated into the MOVE-II physical layer software. The implementation will collect all identified status information in a single non-time critical part of the receiver software and send this information over a defined placeholder network protocol. The source code of the implementation shall be according to the GNURadio programming baselines, well documented and inserted into our software version

control system. The correct functionality of your implementation is demonstrated by meaning full tests and their results are documented in the final report.

### **Requirements:**

- Basic knowledge of signal processing, required to understand the function of a receiver and transmitter implementation
- Basic understanding of network communication
- Experience in C++ and python programming or comparable languages (The signal processing has to be programmed in C++ and the testing is done in python, however neither tasks requires specific knowledge about these specific two programming languages)

### **Topics discussed during this lab:**

- Status information of a physical layer communication system
- European standard for satellite downlink signals: *ECSS-E-ST-50-01C Telemetry synchronization and channel coding*
- Software defined radios, USRP & GNURadio
- Network protocols
- Live status monitoring of a real satellite communication link