

Advanced Software-Defined Radio Testbed for a Emergency Location Beacon System (Fortgeschrittenes SDR-Testbett für ein Notfunkbakensystem)

Master's Thesis

Project

Previous efforts at CEL have yielded a standards-compliant implementation of the next generation of the COSPAS/SARSAT emergency satellite beacon transmitter and receiver side for real-time capable simulation. This system allows persons in distress to communicate the need for rescue to satellite network. Often, these emergency satellite beacons come with the added functionality of emitting a UHF chirp tone to allow helicopters and other rescue vessels to determine the direction in which to move, simply by heading in the direction of the loudest reception, so-called *homing*.

This project is about taking this implementation, and porting it to a testbed composed of Software-Defined Radio hardware, and extending it to simulate satellite orbit-caused Doppler shifts, as well as implementing or applying appropriate frequency correction measures. Based on that system, functionality to incorporate data as an underlay, i.e., without interfering with the original functionality of the system, needs to be integrated. Here, we can choose from methods evaluated before at CEL to modulate the properties of the chirp homing signal, or by applying differential amplitude shift modulation to the direct-sequence spread spectrum signal bound to the satellite. An analysis of the link budget, power requirements and feasible data volumes rounds off this thesis

Deliverables

1. Become acquainted with basics of the upcoming COSPAS/SARSAT standard
2. Based on the existing GNU Radio transceiver, build a hardware testbed of communicating beacon and satellite nodes
3. Implementation of Doppler simulation and frequency correction with state-of-the-art methods
4. Communication of data in the underlay in the homing and satellite-bound signals
5. Link and power budgeting calculation

Requirements

- ✓ Experience in Python/C++ beyond *Praktikum Informationstechnik*
- ✓ Ability to familiarize with the control of SDRs from PC hardware
- ✓ Understanding of Communications Engineering 2 (Nachrichtentechnik II)
- ✓ Willingness to both work into the theory of established mathematical estimation, as well as creation of your own algorithms

Institute

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