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DEVELOPMENT OF A NEW COMMUNICATION PAYLOAD FOR THE EDUCATIONAL SMALL SATELLITE PROJECT UWE

Abstract

The UWE mission series at the University of Würzburg serves the education of students in space studies and tests new components and approaches in orbit. The project was started more than 15 years ago and has so far launched four CubeSats into orbit. This makes it not only the first program in Germany to implement and operate a small satellite, but also a good example of problem-oriented education in the field of aerospace engineering. This paper is about the next generation of the satellite series, UWE-5, whose technical focus is on the communications subsystem.

The main goal of the UWE-5 mission is to design and evaluate an innovative communications payload with respect to the integration of two 3U nanosatellites into a 5G network. Here, we investigate and compare the transmission in the S-, Ku- and Ka-band both for the satellite-to-ground as well as the intersatellite link. Concepts and technologies regarding Narrow Band IoT (NB-IoT) applications will be analyzed, developed and demonstrated. In NB-IoT, protocol adaptations will be proposed, implemented and tested in orbit, which enable dynamic backhaul switching "space enabled", i.e. with satellites, and provide quality-of-service metrics for the targeted application. Another important goal in the area of future networks is the investigation of common 5G slicing methods and the adaptation of similar concepts, which have already been prepared with the previous missions.

The paper presents the mission design of UWE-5 and the planned experiments in the field of the communications payload as well as the educational aspects in the field of small satellite development. The UWE project is a good example for practical education due to its embedding in the space curricula of the University of Würzburg.