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Q/V-BAND COMMUNICATIONS AND PROPAGATION EXPERIMENTS USING ALPHASAT

Abstract

As the lower frequency bands become more and more crowded, it will be necessary to exploit higher frequencies for satellite communications. New broadband applications will require additional spectrum in the future. The Ku-Band is highly utilised nowadays and Ka-Band systems which have been extensively studied in the 1990ies are already in commercial use. The next frontier is the Q/V-Band. At millimetre waves the propagation effects become pronounced. A traditional approach of implementing large fade margins is impractical as it will lead to high EIRP and G/T figures for the ground stations resulting in unacceptable costs. Fade mitigation techniques by adaptive coding and modulation (ACM) offer a cost-effective solution to this problem.

ESA will launch the ALPHASAT satellite in 2012. Apart from the main payload, the INMARSAT L-Band transponder, it will carry experimental Ka- and Q/V-Band propagation and communications payloads. They serve the purpose of enabling propagation measurements throughout Europe and communications experiments. Three communications spot beams will be covering Northern Italy, Southern Italy and Austria with some overlap.

Joanneum Research and Graz University of Technology are preparing for communications and propagation experiments using these new payloads of ALPHASAT. Under an ESA contract an advanced beacon receiver is currently being developed. It is based on a versatile software-defined radio (SDR) platform which has been elaborated by these two institutions. The beacon receiver will be installed at a weather radar site by Joanneum Research. At the same location, a Q/V-Band ground station will be set up. The design of this station has been started recently. ALPHASAT will be in a slightly inclined orbit, therefore the antenna will require precise tracking. The main goal of the communication experiments is focused on ACM techniques. In the framework of several ESA activities a meshed VSAT system has been developed which uses an MF-TDMA demand assignment access scheme and an adaptive modem and Turbo codec . The synchronisation algorithm for the modem have been optimised such that the modem can operate at a very low signal/noise ratio. This platform is ideal for the ACM experiments. The propagation studies and measurements will provide the data for the fade depth, fade slopes and scintillation effects. Based on the measurement results the ACM algorithms can be optimised and verified in the communications experiments which will be carried out together with the Italian partners (ASI, Space Engineering, Politecnico di Milano and Università Tor Vergata in Rome).