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DESIGN AND FIRST TEST OF A COMBINED 19.7 AND 39.4 GHZ BEACON RECEIVER FOR THE ALPHASAT PROPAGATION EXPERIMENT

Abstract

The aim to use frequencies higher than Ka-band for satellite multimedia systems calls for a research of the atmospheric propagation effects at these bands (attenuation, depolarization, and signal scintillation). To study these propagation effects, the upcoming Alphasat experiments will include a propagation payload with beacon signals at Ka-band (19.7 GHz) and Q-band (39.4 GHz) in addition to an experimental Ka- and Q/V-band communications payload. The Q-band beacon covers the whole of Europe while the Ka-band beacon coverage additionally includes North Africa.

In the frame of ESA's ARTES-5 programme, a beacon receiver based on a software-defined radio platform was designed and manufactured. This receiver will measure co-polar and cross-polar signals at Ka- and Q-band with one antenna feed. The beacon receiver system consists of an outdoor and an indoor unit. The outdoor unit includes a 1.2 m offset prime focus antenna on an easy to set up pedestal (flyaway principle), a customized Ka- and Q-band LNB that is protected by an LNB box (first down-conversion), and an outdoor supply box for power distribution and network communication. The indoor unit houses the second down-conversion stage, a processing computer with data acquisition cart and data storage media, a control/data network, and a GPS based frequency/time reference. It also provides the power distribution for the outdoor unit. The system allows remote control and remote data access. The components of the beacon receiver system were chosen in the face of the planned identical reproduction. The equipment is designed to be used for the measurement of various Ka-band satellite beacons besides that of the Alphasat.

Recently, several weeks of field measurements have been carried out in Graz, Austria. For these tests, the attenuation and the depolarization of the EUTELSAT Hotbird 6 satellite beacon signal was measured. When Alphasat I-XL is launched (expected for summer 2013), the propagation terminal will measure attenuation and depolarization at 19.7 and 39.4 GHz simultaneously along the very same satellite link geometry.

This paper gives an overview of the design and the components of the receiver. It reports on the experimental tests carried out so far and describes the planned long term measurements where the measured propagation statistics will be related to meteorological data from a weather station, a radiometer, and a distrometer.