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UHF CHANNEL AND INTERFERENCE BETWEEN LEO SATELLITES AND RECEIVERS IN THE ARCTIC

Abstract

In satellite communication where power constrained ground terminals use low gain antennas, UHF can offer a reasonable data rate. However, public information on the UHF satellite channel in high latitudes is very limited. This paper presents a review of literature on the UHF channel for LEO satellites and interference measurements. A measurement methodology using small satellites is proposed in order to reduce the knowledge gap in the high latitudes.

The application under consideration is data retrieval from sensor nodes deployed in the Arctic. Weather conditions are harsh and there is little infrastructure. The communication system has to be robust and simple, with no need for maintenance and with low power consumption. The low temperatures in the Arctic complicates antenna mechanical design as well. Power limitations and difficult antenna design make UHF communication an adequate candidate.

Signal propagation in satellite communication is affected both by channel effects, such as Doppler effect and ionospheric scintillation, as well as interference. The majority of research focuses on scintillation effects at higher frequencies, such as L band for GPS receivers. Interference from other satellites and terrestrial transmitters is also relevant in this study. The increasing number of small satellites implies even more possible interference sources.

In order to reduce the knowledge gap, in-orbit measurements using a small satellite are proposed. The main focus is on how to carry out interference measurements and process the data acquired. During post-processing, heat maps will be created and time-frequency statistics will be gathered with different temporal resolution. In addition, in-orbit calibration and channel measurements are proposed. The measurements will be carried out with an SDR (Software Defined Radio) in order to be able to modify parameters such as sampling rate and duration of recordings depending on the results observed. The effects of the measurement parameters on time and frequency resolution are analyzed.

This literature review has identified the need for experimental data of the UHF satellite channel and interference. There is a trade-off between temporal and frequency resolution to keep within a reasonable data budget. Therefore, the measurement methodology is designed to reduce the amount of data to downlink from satellites.