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AIS SPECTRUM ANALYSIS FROM A LEO SATELLITE USING RAW SPECTRUM RECORDINGS

Abstract

The AAUSAT3 satellite is a 1U cubesat, which has been developed by students at Aalborg University, Denmark in collaboration with the Danish Maritime Authority. The satellite was launched in February 2013 on a mission to monitor ships from space using their AIS broadcast signals as an indication of position. The SDR receiver developed to listen for these AIS signals also allows for sampling and storing of the raw intermediate frequency spectrum, which has been used in order to map channel utilization over the areas of interest for the mission, which is mainly the arctic regions.

The SDR based receiver used onboard the satellite is using a single chip front-end solution, which down converts the AIS signal located around 162 MHz into an intermediate frequency, with a up to 200 kHz bandwidth. This I/F signal is sampled with a 750 kSPS A/D converter and further processed by an Analog Devices DSP. The receiver also allows for this 750 kSPS signal to be stored onboard the receiver and later downloaded. A number of 330 ms samples have been downloaded via the satellite and further analyzed.

The results shows, that there is a large variation of AIS band utilization depending on if it is the northern or southern regions of the arctics which is monitored. This is also what is to be expected since, especially during the winter time, there is a lot more activity in the southern regions of the arctic. The raw samples was used to evaluate and further develop the receiving algorithm for better detection rate and at the same time simplified the DSP. The raw samples shows not only a picture of the channel utilization based on mathematical models or decoded date, but it shows the full picture - including the effects of linear antenna in LEO and large field of view.

The presented raw samples and algorithm improvements has added value to the AAUSAT3 mission and truly shows the advantages of tuneable RF in conjunction with a low power SDRs in space. Today the total power consumption of the receiver is less than 800 mW, and the commercial spinoff has enhanced this by an additionally 10Using a 1U cubesat for in-orbit spectrum monitoring has shown to be a very cost effective way of getting a global estimate of frequency utilization fast and on a relative low budget.