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DESIGNING A 3GPP NB-IOT NTN SERVICE FOR CUBESATS IN LOW DENSITY CONSTELLATIONS

Abstract

The Third Generation Partnership Project (3GPP), the standard development organization in charge of the 5G mobile system specifications, is currently developing the adaption of the NB-IoT protocol for non-terrestrial networks (NTN), referred to as NB-IoT NTN [1]. The NB-IoT NTN protocol is expected to operate, among others, in LEO constellations. To that end, the protocol is being enhanced with those features needed to address the specific characteristics of LEO satellite channels (e.g. time offsets to deal with the longer propagation delays, Doppler pre-compensation mechanisms, etc.). Mobility management improvements to cope with moving satellite cells and non-continuous operation of the service link are also being worked out (e.g. broadcasting of satellite ephemerides in control channels, tracking area management, etc.). The possibility to use the same protocol NB-IoT for both terrestrial and satellite access offers an unprecedented opportunity for massive IoT services, which will benefit from the global coverage provided by satellites.

In this context, this presentation will describe requirements and key design considerations of a NB-IoT NTN solution that is being developed for operation with CubeSat platforms. The emphasis will be given to the Radio Frequency (RF) subsystems needed on the CubeSat (e.g. antennas, RF front-ends)

to close the link budget as well as to the protocol processing capabilities to be on-boarded. Results on achievable service performance indicators will be presented as well as the identification of potential technology improvement areas that would enhance the realization of these sort of solutions in CubeSats.