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PRELIMINARY SPACE QUALIFICATION OF AN XBEE AS AN INEXPENSIVE COMMERCIAL OFF THE SHELF SMALL RANGE TRANSCEIVER FOR INTER-SATELLITE COMMUNICATION

Abstract

CubeSats have provided a standardized platform for developing low-cost missions and have helped increase accessibility to space for small companies and educational institutes. However, CubeSat mission often impose strict schedule and form-factor constraints. University projects are further constrained by the limited number of trained personnel, turnover and cost. Commercial off the Shelf (COTS) components provide an ideal alternative for such projects. These components offer easier integration and inexpensive replacement compared to their space-grade counterparts. However, these components require rigorous testing to increase performance reliability during mission operations. A small range transceiver is one such example of a COTS device that could be utilized by CubeSats that are a part of constellations or are in close formation flying, to maintain a communication link between them. This also eliminates the need for putting a ground-to-space transceiver on each of these satellites. Instead, one satellite in the constellation with a ground-to-space transceiver can act as node between the other satellites and the ground station, using the small range transceivers. These transceivers have the capability of delivering data rates of up to 200 kbps over a few hundred meters using only a small coiled antenna. Their electrical and mechanical footprint is ideal for the constraints imposed by the CubeSat platform. This paper discusses the space qualification procedures of an Xbee transceiver for the DESCENT mission. DESCENT is a tethered CubeSat mission, comprising of a 100m long tether that connects two 1U CubeSats. The two CubeSats use the Xbee for inter-satellite communication post tether-deployment, while only one of the CubeSats will communicate with the ground station. The paper will characterize the performance of the device as it undergoes thermal cycling and load cycling. The paper will also discuss techniques to estimate the beam patterns of the antennas without using anechoic chambers, and how this information will be utilized to provide coarse distance measurement between the two CubeSats after the tether has been deployed.