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DEPLOYMENT MECHANISM FOR A L-BAND HELIX ANTENNA IN 1-UNIT CUBESAT

**Abstract**

In recent times, there is a renewed interest in Earth Observation (EO) of the cryosphere as a proxy of global warming, soil moisture for agriculture and desertification studies, and biomass for carbon storage. Global Navigation Satellite System - Reflectometry (GNSS-R) and L-band microwave Radiometry have independently been used to address previous applications with different measurements. However, the combination of both could largely improve current observations. For that reason, the development of a system that performs GNSS-R and microwave radiometry measurements is of great interest.

<sup>3</sup>Cat-4 mission aims at addressing this technology challenge by integrating this system in a 1-Unit CubeSat. One of the mission greatest challenges is the design of an antenna that must respect the dimensions and stowage requirements of 1-Unit CubeSat, being able to work in the different frequency bands: Global Positioning System (GPS) L1-band (1575 MHz), GPS L2-band (1227 MHz), and Radiometry L-band (1400-1427 MHz). An helix antenna becomes thus the most suitable option for this situation. This antenna has 11 turns equally distributed with 68.1 mm of diameter. This design generates an antenna with 506 mm of axial length, providing the maximum radiation gain in this direction. Additionally, a counterweight is added at the end of the antenna to promote a nadir-pointing behaviour, using the gravity gradient technique, while it also increases the antenna directivity. The deployment of this antenna is a mechanical challenge that needs to be addressed for the sake of the mission.

This work presents a mechanical solution that enables to deploy the helix antenna, from 25.5 mm (stowed configuration) to the final 506 mm (deployed configuration). By sequentially deploying different

parts of the antenna, the final configuration is reached without impacting the attitude pointing of the CubeSat. This is accomplished using dyneema lines that are melted by commands. In addition, the deployment velocity, acceleration, and waving are presented as part of its characterization. The current test results in a Thermal Vacuum Chamber indicate also that the deployment can be achieved in -35 °C. The <sup>3</sup>Cat-4 CubeSat, with the L-band helix antenna, will be launched in 2019/2020 as part of the "Fly Your Satellite!" program of the European Space Agency (ESA).