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THE E-ST@R CUBESAT: ANTENNAS SYSTEM

Abstract

The present work deal with the design, manufacturing and test of the deployable antenna system for the e-st@r CubeSat developed at Politecnico di Torino by students' team of the Aerospace Engineering Courses.

Analyzing the CubeSat standard and defining the physical and geometrical constraints multiple possible configurations were analyzed and compared in order to define the most suitable for the system. A deployable linear dipole antenna was chosen as the final solution. After a trade-off study among different layouts we decided to use an external support positioned on a face of the satellite.

The final configuration consists in a support able to accommodate the antenna during the launch phase and deploy it when the OBC sends the appropriate command. Although the use of COTS materials was preferred, none of them presented properties compatible with the needs, so we decided to use a space certified material to avoid problems concerning out-gassing. As far as the lock system is concerned we decided to adopt the burn-wire system as already done in other university projects.

To solve some problems of the original lock system, namely too long wires and the possibility that they would stuck, we decided to utilize a new architecture. This is realized by placing the cutting system in the middle of the coiled antenna which allow to lock both ends of it and to better exploit the available spaces.

The lock system can be seen as one of the critical points of the system because it has to ensure that the antenna will not open during launch, but also that it opens no matter what when in orbit. To have a certain level of confidence on this point we decided to use a two fault tolerant system. The first redundancy is obtained duplicating the cutting system while the second one is based on the use of a degradable material for the wire so that, also if no cut occurs, the antenna opens when placed in the space environment.

An important point to take into consideration is that this system guarantees that no debris are released in space.

The support system was produced by CNC milling of a single block of material while the antenna was realized cutting and cambering a steel strip with a specifically designed procedure.

The assembled system was tested many times in different conditions of temperature and pressure resulting in a very reliable solution (no test were failed).