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RANGE TEST OF AN INTER-SATELLITE COMMUNICATION SYSTEM USING A STRATOSPHERIC BALLOON

Abstract

Nowadays the use of inter-satellite communication has become a frequent phenomenon. In this work, the result of testing the communication system is presented. The purpose of the tests was a complete test of the inter-satellite communication system of two CubeSats 3U. They exchange information over a VHF radio channel at amateur radio frequencies in the range of 430-440 MHz. Among the items that were tested: the algorithm and mechanism for opening satellite antennas, the operating modes of the antenna-transmitting COTS modules, as well as checking data transmission over distances of at least 500 km. The characteristics of the radio channel were checked simultaneously at three different points: at the start point, at a distance of 200 km from the start point, and at a distance of 400 km from the start point. At these points, transceivers were installed, similar to those used on the second satellite. We chose to launch a stratospheric balloon as a way to ensure the necessary distance. During the lifting up, it moved away from ground stations, which allowed us to estimate the maximum range of maintaining radio communication. At the same time, the mechanism of opening the antennas was tested at the time of the balloon bursting. Thus, we got short-term weightlessness. The range was checked using ground stations, which is a mock-up of the second satellite. The distance from the launch site of the farthest ground station was more than 500 km in a straight line. The device, suspended on the stratospheric probe, maintained a vertical orientation, without controlling the angular velocity. The team developed an algorithm for the behavior of the ground layout to test the interaction with different mutual orientations.

As a result of the test, estimates of the antenna radiation pattern were made, which allowed us to confirm the calculated data. The experiment allowed us to find out the maximum communication range in the conditions of man-made noise at the operating frequency of the satellite transceiver. Also, in addition to the assembled device, several variants of antenna deployment mechanisms were tested in conditions of low temperatures and low atmospheric pressure.