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A LOW-COST FULL DUPLEX GROUND STATION AND ANTENNA SYSTEM DESIGN FOR NANOSATELLITES

Abstract

The College of Engineering, Pune (COEP) Satellite Initiative is a team of undergraduate students that launched Swayam in 2016 and is currently working on their second mission COEPSAT-2. COEPSAT-2 is a nanosatellite using a full duplex communication system operating at 145 Mhz and 437 MHz, thereby making a low-cost ground station essential. A nanosatellite offers limited space and power reserve allowing only a simplistic communication system to be placed onboard. Hence, to overcome the reduced signal strength, a robust, noise-tolerant and high gain ground station system is required. Design of a system of circularly polarized, directional antennas for reliable signal reception and transmission is described in this paper. Analysis of various antenna parameters has been done through simulations and the results have been corroborated through testing. The control room containing the transceivers, RF switches, high power amplifier and a micro-controller operates on the telemetry and telecommand packets, as well as the beacon received. A detailed description of the ground station block diagram and a link budget highlighting the sensitivity and signal-to-noise (SNR) margin has also been presented in this paper.