SPACE SYSTEMS SYMPOSIUM (D1)
Space Systems Architectures (4)

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NASTRAC (NITTE AMATEUR SATELLITE TRACKING CENTER) - A GROUND STATION TO TRACK AND COMMUNICATE WITH SATELLITES IN AMATEUR BAND.

Abstract

The ground station is the first and final terrestrial end of a communication link to an object in the space. The primary purpose of the ground stations is to track and receive telemetry and image data from satellite for data analysis, and also to control the satellite through tele-commands.

Nitte Amateur Satellite Tracking Center (NASTRAC) is part of the ongoing Student Satellite Program. This satellite tracking facility was designed and built by undergraduate students initially for Half Duplex mode of communication for STUDSAT -1 (A Satellite under Pico-category which was first of its kind in India and launched on July 12th 2010) at Nitte Meenakshi Institute of Technology, India. NASTRAC is now being upgraded for a full duplex mode of the communication needs of STUDSAT-2, a twin satellite development project which is a follow-up of STUDSAT-1. NASTRAC would track the two satellites using Yagi-Uda Antenna. For the uplink of the commands to satellites, the station uses frequency in VHF range 144 to 147MHz whereas for the downlink, UHF band 435 to 437MHz is used.

This paper presents the detailed link analysis required to calculate the link margin to establish a communication link between the satellites in the LEO and NASTRAC. The architecture, block diagram, functionality, segmentation and scheduling of NASTRAC to track and communicate with the two satellites are described. The design of UHF Quad- Stacked, Crossed, Circularly Polarized Yagi - Uda Antenna and VHF Crossed linear Yagi Uda antenna and the radiation pattern, gain and other simulation results are presented. The tower installation and the wind-load calculations for the required drive of antenna, the tracking hardware and software requirements are presented in detail. The Doppler shift correction required for the frequency shift of the satellite while tracking is calculated and compared with the software correction. The tracking results of beacon received by few Cube Sats and Indian small satellites are presented. The Command Generation and the Implementation of AX.25 Protocol, Morse code decoder for beacon data decoding, the image processing software developed in house for processing the STUDSAT-2 payload data is presented.