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KA-BAND HIGH-RATE DOWNLINK SYSTEM FOR THE NISAR MISSION

Abstract

This paper provides a description and analyses of the high-rate Ka-band telecom system for the upcoming NISAR (NASA-ISRO Synthetic Aperture Radar) mission. NISAR is a collaborative Earth-Science mission between National Aeronautics and Space Administration (NASA) and Indian Space Research Organization (ISRO), which would feature an L-band SAR instrument and an S-band SAR instrument. The simultaneous dual-frequency radar system at peak rates would produce data at gigabit per second speeds, which drives the data-volume requirements. The key driving requirement for the payload communication subsystem is to provide a minimum of 26 Terabits of data volume return to the ground per day. The high-rate transmitter on the flight system is a software-defined radio developed at the Jet Propulsion Laboratory (JPL), based on the Universal Space Transponder platform, providing an offset quadrature phase shift key modulated waveform with Low-Density Parity-Check encoding of the data transfer frames. The solid-state power amplifier is used to amplify the signal in order to overcome propagation losses and achieve a successful Earth-Ground RF link margin. Two transmitters will be used in the dual-polarization transmit system, each providing two gigasymbols per second (Gsps) of coded data for an aggregate rate of four Gsps. Several ground station sites (Alaska and Svalbard, Norway) are baselined for the direct-to-Earth communications link. A baseband processor called Data Acquisition Processor and Handling Network Environment (DAPHNE) will be included in the ground stations and will allow data processing including CCSDS File Data Protocol (CFDP), data storage and connectivity to backhaul networks to enable data transfers to the science centers at JPL and the ISRO. The system described herein would be the first operational use of Gsps-class downlink rates on an Earth-Science mission.