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Ship-Based Satellite Communication for the One Web India-2 Mission support: Objectives and Challenges

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The objective of the OneWeb India-2 mission, undertaken by ISRO as a follow-up to OneWeb India-1, was to deploy 36 commercial satellites of OneWeb into a predetermined circular orbit using the LVM3-M3 launch vehicle. ISTRAC's role in the mission included tracking the launch vehicle and transmitting real-time data to the Mission Control Center (MCC). Due to the mission trajectory, tracking the launch vehicle from an observation point in the southern Indian Ocean was essential. To achieve this, a ship-based tracking and communication system was proposed. Data transfer from the ship to the MCC utilized geostationary satellites, facilitated by the Maritime 3-axis Stabilized VSAT System (MVSAT), capable of maintaining satellite lock despite the sea's roll, pitch and yaw movements. Comprehensive tests were conducted, encompassing EIRP, G/T, XPD, and BER measurements, to ensure the integrity of the communication link. To optimize the MVSAT's polarizer, a pilot carrier in the desired polarization was transmitted from a known station to auto-track the geostationary satellite through the MVSAT's control system. The FDMA-SCPC technique was employed to access the transponder bandwidth, ensuring uninterrupted availability. Advanced modulation and coding techniques were implemented to meet the mission's high data rate requirements and enhance bandwidth efficiency. Power sizing for the amplifier was calculated based on thorough link budgeting to provide sufficient margin. The location for the antenna terminal installation on the ship was selected considering low RF transmission losses and following a blockage survey. Careful consideration was given to ensure unobstructed antenna access to the satellite at all necessary angles throughout the ship's journey from port to the observation point. Sun-outage predictions were computed for the ship's trajectory, particularly crucial as the mission was scheduled for March-April, after the March equinox. During this period, there was a risk of the sun aligning directly behind the antenna-satellite line of sight in the southern hemisphere, potentially causing a complete link outage. Continuous real-time monitoring and control systems were employed to assess and optimize the communication link's performance, enabling swift adjustments to antenna positioning and power levels to maintain optimal signal quality. The mission successfully met all its objectives as planned.