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K-BAND UPLINK SYSTEM FOR THE NASA DEEP SPACE NETWORK LUNAR EXPLORATION
UPGRADE (DLEU)

Abstract

The NASA Deep Space Network (DSN) has a new requirement to support Category A (Cat A) missions (within 2 million kilometers of Earth) with simultaneous X-band uplink/downlink and K-band uplink/downlink. The X-band links are required for traditional TTC support to a spacecraft, while the K-band links are required for high-rate commanding and high-rate science returns. Several 34-meter DSN antennas have previously been upgraded to support simultaneous S/K downlinks, with the K-band downlink at 25.5 - 27 GHz. However, this K-band uplink system upgrade, in the 22.5 – 23.15 GHz band, is driven by a new requirement to support the NASA Artemis manned lunar program. Some new technology developments were required for this upgrade, in the areas of the exciter, transmitter, dichroic mirrors and diplexer/polarizer, and these will be described here along with the new system design. The upgrade is being implemented into 6 different 34-meter beam waveguide (BWG) antennas in the DSN, two at each of the complexes in Canberra (Australia), Goldstone (California) and Madrid (Spain). The first installation of the K-band uplink has been completed at Goldstone and the next one is planned for Canberra in November, 2022. Subsystem and system test results for the first installation are shown here. The initial operational support will be for the Artemis Lunar Gateway in 2023.