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Author: Mr. Remi LaBelle
National Aeronautics and Space Administration (NASA), Jet Propulsion Laboratory, United States,
remi.labelle@jpl.nasa.gov

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 mirror and diplexer/polarizer, and these will be described here along with the new K-band system design. The upgrade is planned to be 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 initial operational support by the first antenna is required to support the Lunar Gateway in 2022. Technology development for the key new components has been completed and the prototype results are shown here.