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STUDYING NASA'S TRANSITION TO KA-BAND COMMUNICATIONS FOR LOW EARTH ORBIT

Abstract

As the S-band spectrum becomes crowded, future space missions will need to consider transitioning command and telemetry services to Ka-band. NASA's Space Communications and Navigation (SCaN) Testbed provides a software-defined radio (SDR) platform for the study of this service transition. The testbed contains two S-band SDRs and one Ka-band SDR. Over the past year, SCaN Testbed has demonstrated Ka-band communications capabilities with NASA's Tracking and Data Relay Satellite System (TDRSS) using both open- and closed-loop antenna tracking profiles.

A number of technical areas need to be addressed for successful transition to Ka-band. The smaller antenna beamwidth at Ka-band increases the criticality of antenna pointing, necessitating closed loop tracking algorithms and new techniques for received power estimation. Additionally, the antenna pointing routines require enhanced knowledge of spacecraft position and attitude for initial acquisition, versus an S-band antenna.

Ka-band provides a number of technical advantages for bulk data transfer. Unlike at S-band, a larger bandwidth may be available for space missions, allowing increased data rates. The potential for high rate data transfer can also be extended for direct-to-ground links through use of variable or adaptive coding and modulation.

Specific examples of Ka-band research from SCaN Testbed's first year of operation will be cited, such as communications link performance with TDRSS, TWTA health, and the effects of truss flexure on antenna pointing.