



## Coordinated Starlink User Terminal Testing at NRAO/AUI Sites

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NRAO and SpaceX have undertaken a series of coordinated radio frequency (RF) measurement tests to gauge the impact of Starlink User Terminals (UTs) uplink (14.0-14.5 GHz) and downlink (10.7-12.7 GHz) transmissions on the normal operations of the Very Large Array (VLA), the Very Long Baseline Array (VLBA) and the Green Bank Telescope (GBT). Phase I testing (September 2021) involved running the User Terminals in normal mode at a variety of locations near the Very Large Array and the Pie Town VLBA antenna. Phase II testing (October 2021) involved fixed channel downlink frequency illumination of the VLA by Starlink satellites, and Phase III testing (to be undertaken at the GBT in West Virginia in late January 2022) will look at the impact of normal UT operations on GBT observing. Early analysis of the Phase I testing indicates that UT uplink transmissions (between 14.0 and 14.5 GHz) have minimal impact on VLA and VLBA operations in locations where there is no line of sight from the UT to the VLA. Phase II testing demonstrated that analytical models have good correlation to real world observations, and as predicted by the model, satellite downlink transmissions were detected on some of the shortest baselines of the B configuration. The impacted baselines change (as predicted) according to the location of the transmitting satellite at any given time. As part of a pilot test, installing and operating UTs in Socorro County near the VLA will allow NRAO to gauge the impact of a large number of UTs operating in the proximity of a sensitive instrument. We present the results of the Phase I, Phase II and Phase III tests, and present plans for future coordinated testing of spectrum sharing with SpaceX and other satellite operators. These early coordination tests could serve as pilot studies for the type of spectrum sharing that could be tested in an eventual National Radio Dynamic Zone (NRDZ).