

NIST Evaluation of STL LEO PNT Performance

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Introduction and Background

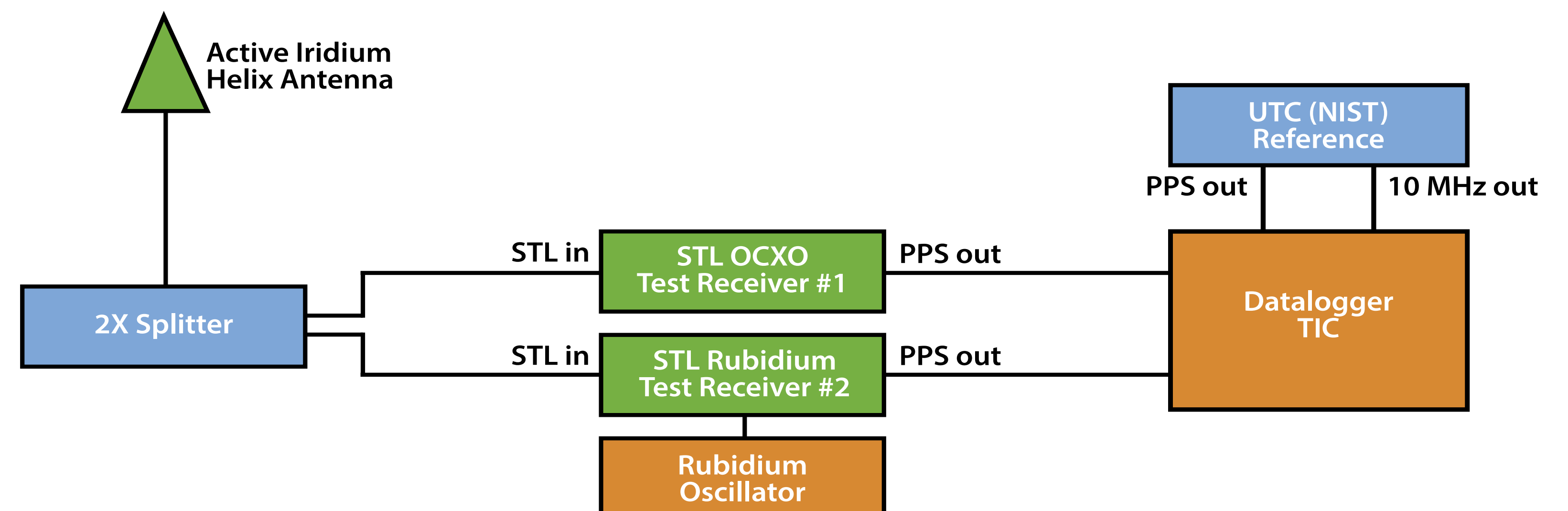
In a joint study by Satelles and the U.S. National Institute of Standards and Technology (NIST), the long-term timing performance of the Iridium Satellite Time and Location (STL) LEO PNT signal is measured against UTC(NIST), the timing reference at NIST.

The data shows that the LEO PNT receiver with a rubidium oscillator was able to provide an extremely stable timing solution with a maximum error of less than 50 nanoseconds of UTC(NIST) over a period of 100 days, and with an average long-term error (TDEV) near zero nanoseconds.

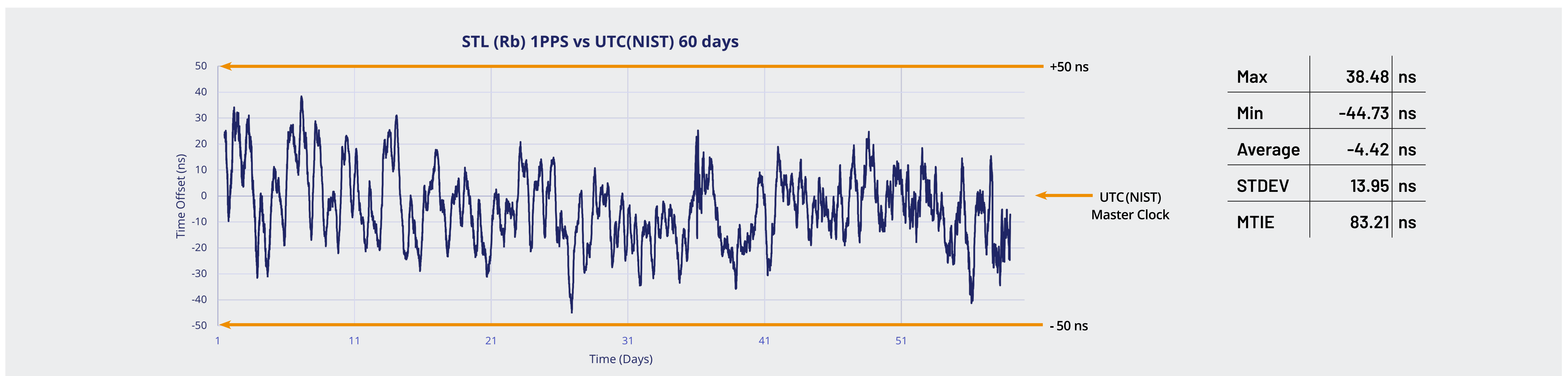
This performance meets the ITU-T G.8272 PRTC-A requirement for a primary reference clock over long durations in scenarios where Global Navigation Satellite System (GNSS) signals cannot be received at a user's location.

Configuration at NIST

- Two LEO PNT receivers (OCXO and rubidium oscillator type) were set up at NIST in Boulder, Colorado, for long-term data collection.
- The PPS output from both receivers was then simultaneously compared to UTC(NIST) using a datalogger/time interval counter (TIC), and ten-minute averages of the 1 PPS measurements were saved.



The 1PPS maximum error was less than 50 ns of UTC(NIST)



Stability Measurements – meets ITU-T G.8272 PRTC-A

- It is important to estimate the stability of the receivers' 1 PPS outputs, because their stability during a given period establishes the potential limit of their accuracy during that same period.
- The Time Stability (TDEV) of the STL receiver is less than 8 ns for all tau values, and the stability (ADEV) is below 2×10^{-13} at one day continuing to average down, reaching below 1×10^{-14} at eight days.

Summary and Conclusion

- The STL LEO PNT timing receiver can provide a globally available time reference that's a viable backup or alternative to GPS/GNSS.
- The test data verifies that a typical STL LEO PNT timing receiver can provide a very stable and accurate timing solution with an average offset within a few nanoseconds of UTC(NIST).
- The STL LEO PNT receiver with a Rubidium oscillator can maintain a Maximum Time Interval Error (MTIE) less than 100 ns for long durations, meeting the ITU-T G.8272 PRTC-A requirement for a primary reference clock.

