URSI GASS 2021, Rome, Italy, 28 August - 4 September 2021

Holdover Performance of a Remotely Disciplined Rubidium Oscillator in the NRC TimeLink™ System

Andre Charbonneau*(1), Rob Douglas(1), and Marina Gertsvolf(1)
(1) National Research Council Canada, Ottawa, Ontario, Canada, K1A 0R6
andre.charbonneau@nrc-cnrc.gc.ca

Extended Abstract

The NRC TimeLink™ suite of services implements traceable time dissemination and remote calibration to help clients meet today's demand for traceable and accurate time. Developed at the National Research Council Canada, the NRC TimeLink™ Remote Clock[1] unit is a remotely disciplined clock that can be installed at the client's premise and be used to disseminate accurate and traceable time to a sub-network, allowing the client to meet strict timing and auditing requirements, such as required in the financial market, power grids or high speed networks. The Remote Clock can also be used as a portable calibration unit, providing in-field time and frequency measurements that are traceable to the SI and UTC.

An important performance metric for any disciplined clock is its stability during holdover, where the discipling of the internal oscillator to an external reference is interrupted (due to the unavailability of the reference source for example). In such cases the unit's internal oscillator is either left to free run or is subject to predictive corrections made by the unit's controlling software. The accumulated time error during holdover is a main contributor to the overall uncertainty budget of any disciplined clock. For OCXO, mitigating the oscillator drift using predictive adjustment has been shown to offer significant improvements in holdover performance. Here we apply predictive corrections to the rubidium oscillator that are based on its phase measurements and noise characteristics.

Leveraging on performance data collected by the Remote Clock unit during normal operation, we predict the phase and frequency drift characteristics of the local rubidium oscillator and apply corrections during holdover to reduce the overall accumulated time offset from UTC(NRC). A performance overview of the NRC TimeLink™ Remote-Clock during normal operation followed by holdover will be given along with an uncertainty budget analysis. We will also show the effect of some predictive phase and frequency correction methods applied during holdover and evaluate their impact on the clock's uncertainty budget.

References

[1] M. Gertsvolf, J. Bernard, A. Charbonneau, B. Hoger, and H. Pham, "NRC Remote Clock Secure Dissemination of Traceable Time," *Inside GNSS*, 12(3):42, 2017.