

Interconnecting Navman GPS & Temex Smart SRO Rubidium SynClock+[®]

Interconnecting & Evaluating the System Performance of Navman Jupiter-T GPS Engine & Spectratime Smart SRO-100 Rubidium SynClock+[®]

SmarTiming+[™] Technology
INSIDE

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Introduction

In this AppNote, Spectratime's Smart SRO-100 Rubidium SynClock+[®] is referred to as the "Smart SynClock+[®]" and Navman Jupiter-T GPS is referred to as the "GPS".

The patented SynClock+[®] is the industry's first smart Rubidium clock, integrating a host of complex timing and synchronization functions all in one low-cost, ultra-small package. It intelligently synchronizes, disciplines and controls any Stratum-1 reference such as GPS, Cesium, Hydrogen Maser, and T1/E1 at cutting-edge 1ns (nanosecond) resolution. The SynClock+[®] utilizes SmarTiming+[™] technology to perform the following functions, which were previously implemented externally on a separate circuit board:

- Multi-vendor GPS interface with auto-adaptive reference filtering, disciplining, control, and Time RAIM/Position Hold signal optimization
- Auto-adaptive Stratum-1 reference disciplining and jitter/wander/noise filtering between 0-100,000 at 1ns resolution, exceeding MTIE/TDEV G.823/T1.101 standards for T1/E1 reference
- Auto-adaptive frequency stability over fast temperature changes at 0.1°C resolution
- Auto-adaptive frequency stability over temperature range within 2E-11
- Programmable 1PPS output phase/time offset adjustments between 0-1 sec through a 1ns-phase comparator
- Programmable or hardware Sync/Track setting mode to either a) phase align 1PPSout from a 1PPS GPS reference through the Sync mode or b) to frequency track 1PPSout from a 1PPS Stratum-1 reference through the Track mode
- Programmable EEPROM for TIE performance measurements, frequency calibration and backup setting in case of power failure, and seamless software upgrades
- Standard RS-232 communication interface with user-friendly ASCII commands for control, configuration, fault, and performance management

The purpose of this AppNote is to help engineers quickly design a complete GPS and Rubidium timing reference solution. The AppNote addresses the following design issues:

- How to connect, set up, and monitor the Smart GPS/SynClock+[®] timing system
- What kind of cutting-edge performance can be achieved through the Smart GPS/SynClock+[®] timing system

Evaluating the Smart GPS/SRO SynClock+® System Performance

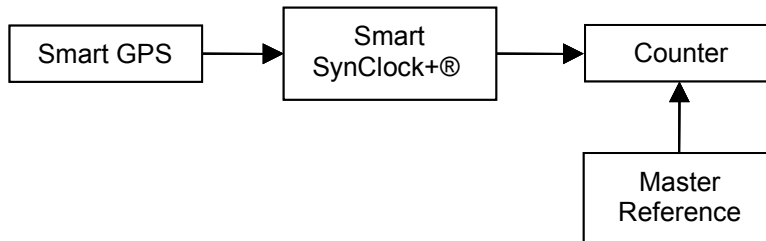
Below is a series of typical cutting-edge phase performance graphs that can be achieved through the Smart GPS/SynClock+® timing system.

Test Equipment & Diagram

The following equipment was used to test and measure the performance of the Smart GPS/SRO SynClock+® system:

GPS Vendor:	Navman at www.navman.com/oem/products
GPS Product:	Jupiter-T receiver, type TU60-D120-031
GPS Antenna:	Consult with Navman. The Motorola antenna also works with the Jupiter-T GPS
Spectratime Master Reference:	Hydrogen Maser, type H-MASER EFOS-C
Spectratime Clock:	Smart SRO-100 Rubidium SynClock+®
Counter Vendor:	Agilent, type 53131A counter
Notes:	A frequency difference of 3E-12 between the Hydrogen Maser and the GPS was removed to compute the performance data.

The testing diagram is as follows:



System Performance

Figure 3 illustrates the performance of the GPS which was installed in a poor location where the reception of the GPS signal was weak. The GPS was located on the balcony of Spectratime's building in Neuchâtel, Switzerland. The building is located in a small valley which blocks the constant line-of-sight view of the satellites to the building's balcony.

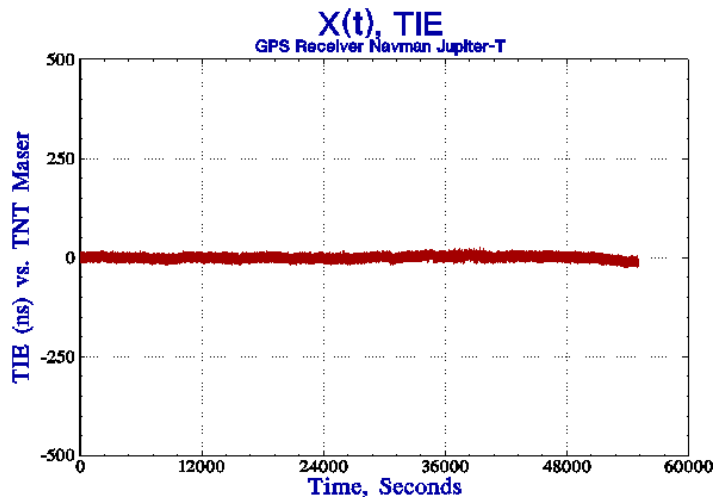


Figure 3 - GPS Time Interval Error Performance

The phase performance in Figure 3 is typical for a GPS receiver. The GPS was automatically set in Position Hold mode and the Time-RAIM was activated by the Smart SynClock+®.

Figure 4 illustrates the TIE holdover performance of Smart Synclock+® when the GPS reference is absent.

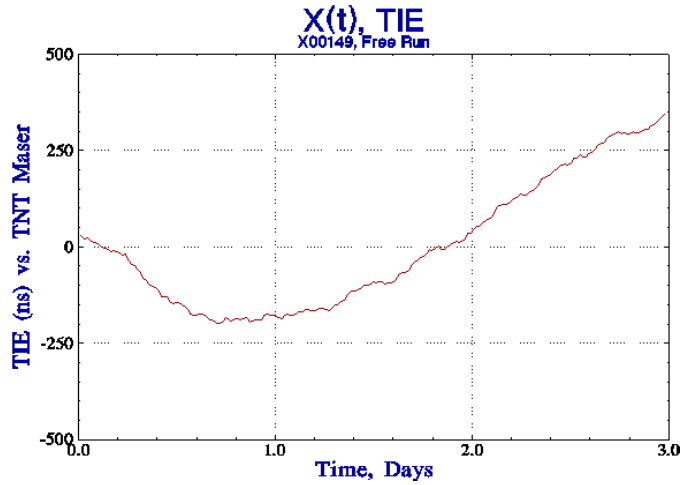


Figure 4 – Smart Synclock+® Holdover Performance

Figure 5 illustrates the MTIE Holdover performance of the Smart Synclock+® versus Stratum-1 ITU-T G.811 and ANSI T1.101 standard masks. The measurements were performed in a non-air-conditioned room, with typical temperature deviations of +/- 2°C.

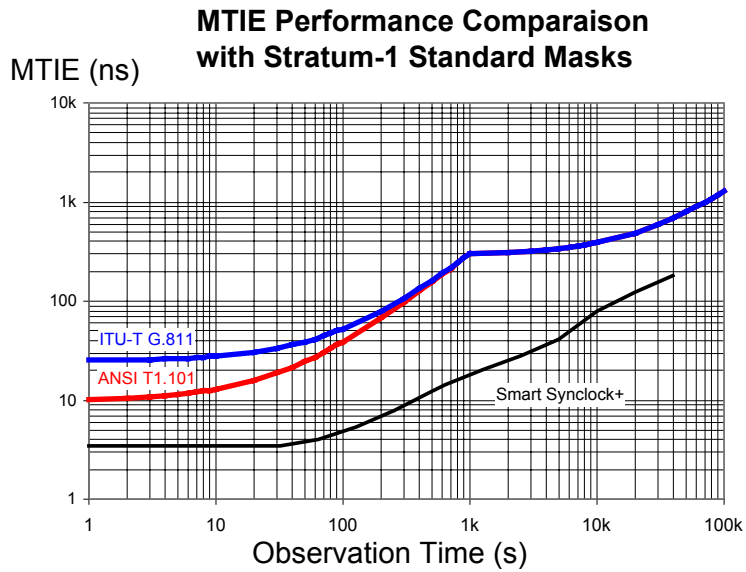


Figure 5 – Smart Synclock+® Holdover Performance vs. Stratum-1 Standard Masks

Figure 6 illustrates the TIE tracking performance of the Smart SynClock+® when locked to the GPS.

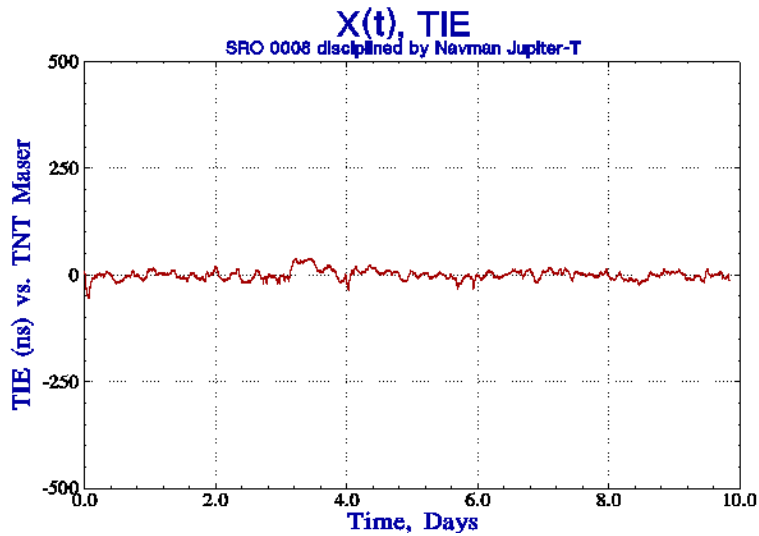


Figure 6 – Smart GPS/SynClock+® Tracking Performance

Figure 7 illustrates the MTIE tracking performance of the Smart GPS/SynClock+® versus Stratum-1 ITU-T G.811 and ANSI T1.101 standard masks.

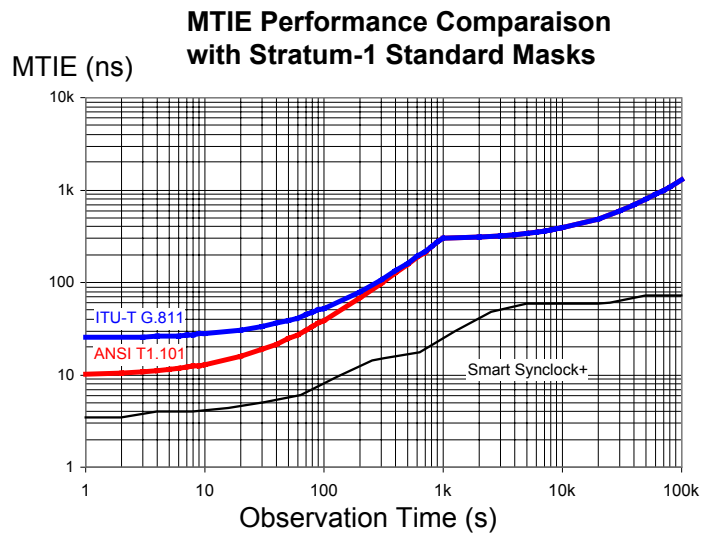


Figure 7 - Smart SynClock+® GPS Tracking Performance vs. Stratum-1 Standard Masks

Fast Q&A Support

If you have any questions about this AppNote or need tech support with your specific timing design and requirements, please feel free to contact us at fastsupport@spectratime.com.

Ordering Spectratime Smart SynClock+®

If you are interested in ordering the Smart SynClock+®, please contact us at sales@spectratime.com. For ordering the GPS, please contact Navman at www.navman.com.