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

Contents

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 0.1ºC 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 Startum-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

Interconnecting the Smart GPS/SRO SynClock+® Timing System

Hardware Setup

As the GDK-1 (GPS SynClock+® Designer Kit) has a connector for the Navman Jupiter-T receiver, this setup resume to a simple Plug and Play.

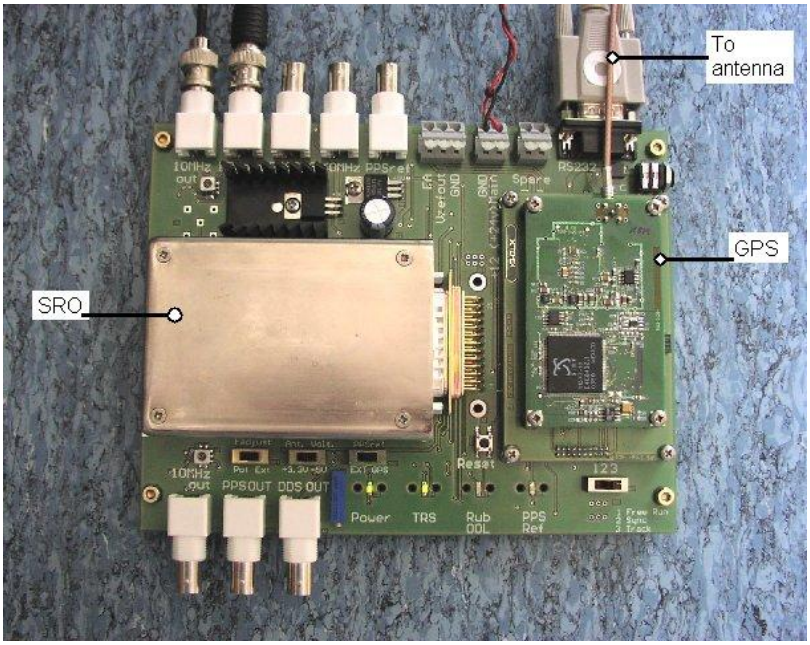


Figure 1 – Simple Plug & Play of the GPS on the GDK-1

The PCB on the picture is obsolete. Use PCB GDK-2 in place. Switch "GPS" on "1 way", left.

Software Setup

For optimum working conditions, the SRO can send out some configuration commands to the GPS. To tune the SRO to do that, the best is to use iSyncMgr.exe. Figure 2 shows how to do it from the menu Timing+Tracking / MCsxx.. . Simply click on the “cross”.

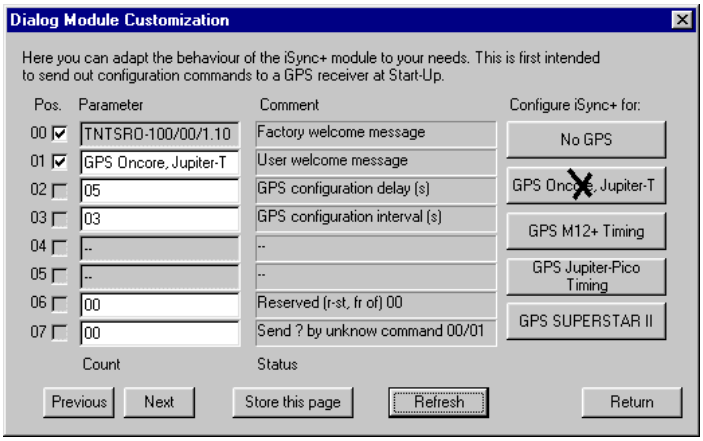


Figure 2 – Smart SynClock+® GPS Setup

Stabilization time

After power on, the SRO was stabilized during 48 hours before the start of the tests. This way the “position hold” of the GPS works properly and the performance of the system become optimum.

Evaluating the Smart GPS/SRO SynClock+® System Performance

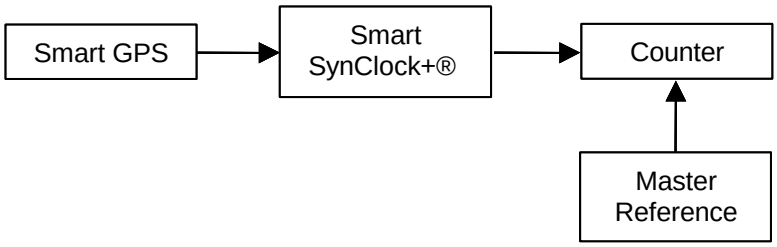
Below is a series of typical cutting-edge phase performance graphs that can be achieved through the Smart GPS/SynClock+® timing system.

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.

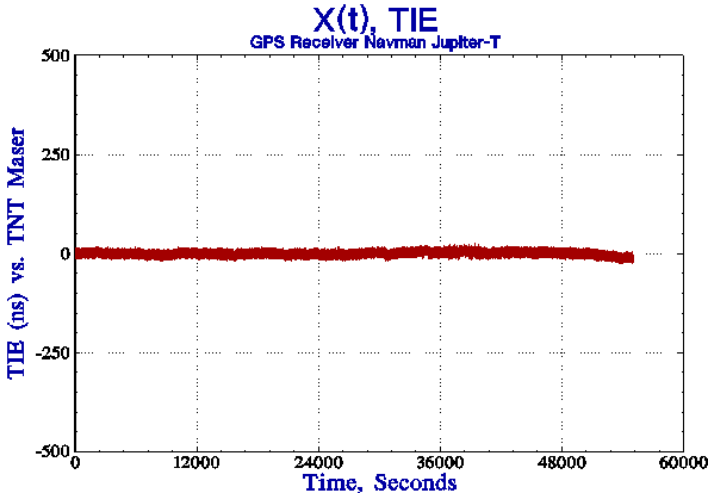


Figure 3 - GPS Time Interval Error Performance

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.

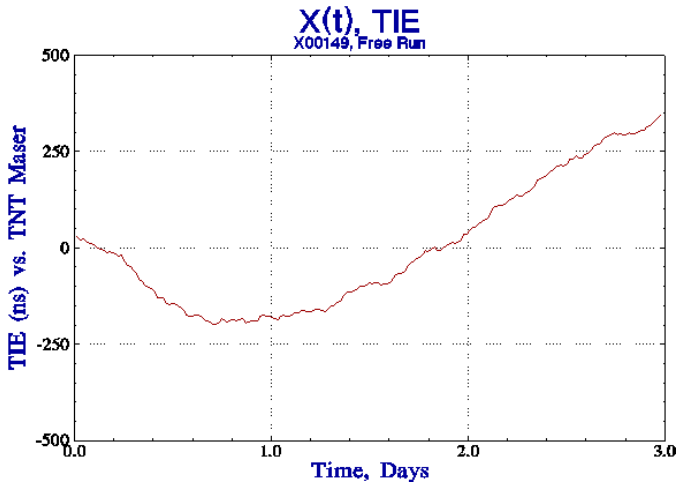


Figure 4 – Smart SynClock+® Holdover Performance

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.

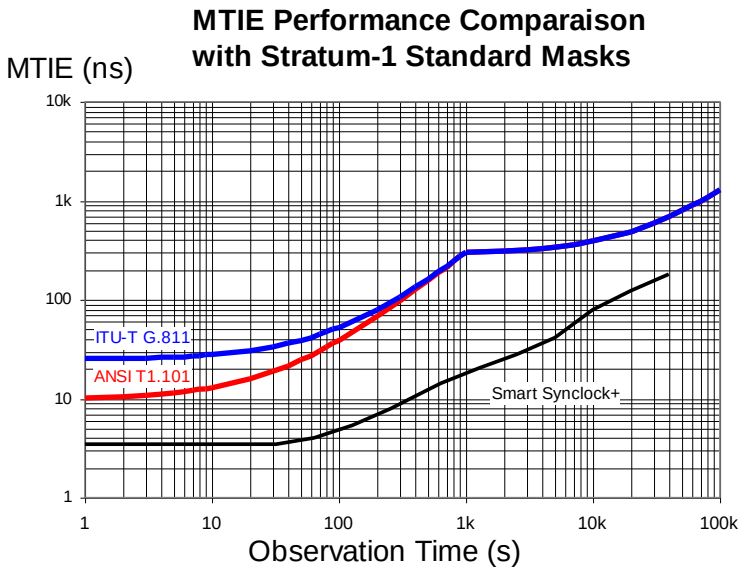


Figure 5 – Smart SynClock+® Holdover Performance vs. Stratum-1 Standard Masks

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

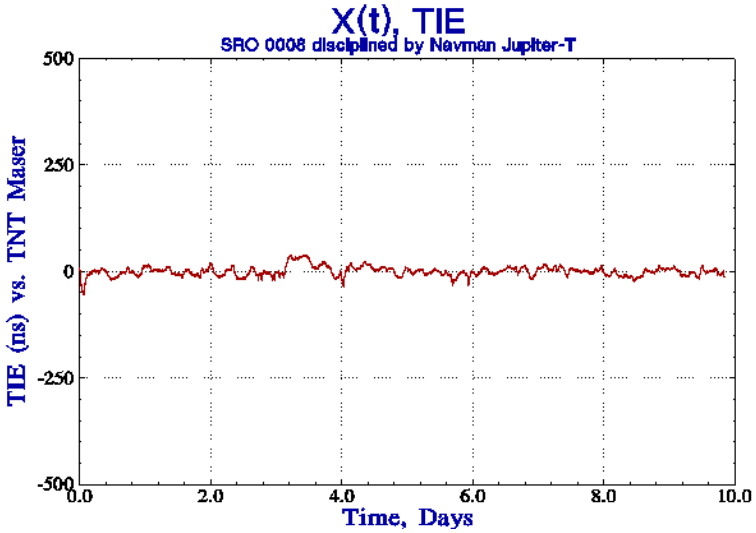


Figure 6 – Smart GPS/SynClock+® Tracking Performance

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.

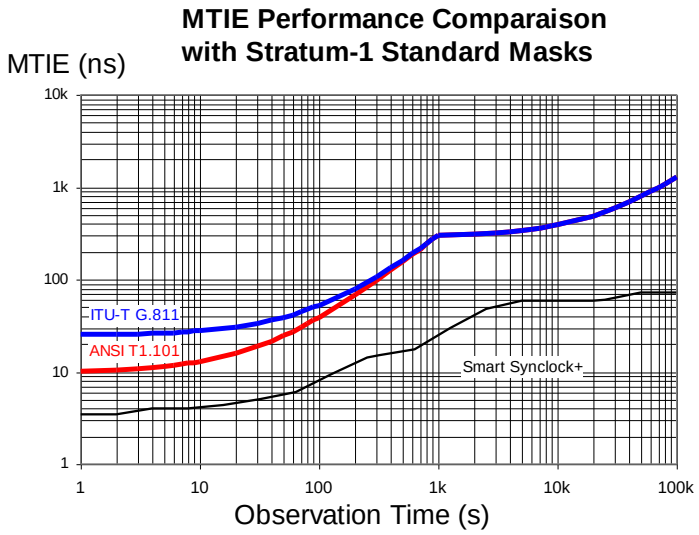


Figure 7 - Smart SynClock+® GPS Tracking Performance vs. Stratum-1 Standard Masks

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.