spectracom

STA-61 and STA-61G

Sync Tester/Analyzer

The STA-61 synchronization tester/analyzer is now known as the Sentinel available from Calnex Solutions. The information in this document is for the convenience of existing STA-61 users.

pendulum

- **Synchronization test platform for Next Generation Networks (NGN)**
- **Embedded time and frequency GPS/ Rubidium reference**
- **Modular multi-input physical sync measurements: 2, 4 or 6 channels simultaneously**
- **Automatic signal / clock identification of most popular telecom clocks, from 1PPS to STM1**
- **Modular multi-input packet sync measurements: Up to 3 gigabit Ethernet ports**
- **SyncE and IEEE1588v2 Packet Delay Variation active probe**
- **Comparison with standard masks**
- **Very accurate built-in Rubidium reference for long term wander measurement**
- **High sensitivity GPS receiver for timing measurement vs UTC**
- **Portable and cost-effective instrument for field applications**
- **User-friendly local or remote operation**

Shown with stand

The Pendulum STA-61 marks a new generation of instruments allowing the user to test and analyze synchronization quality and compliance in various types of networks. Where traditional instruments on the market are designed specifically for SDH/SONET or are dedicated SyncE or PTP testers, the STA-61 can do it all. This is a Sync Tester/Analyzer developed for Next Generation Networks (NGN), incorporating a mix of both traditional SDH/SONET core networks and IP-based backhaul networks.

Portable and Cost-Effective

Lightweight, with a handle and a size that fits as carry-on luggage on aircrafts, the STA-61 is designed to make it easy to bring wherever you want to use it. Place the sync tester/analyzer on a work-bench or use the stand for comfortable viewing when the instrument is placed on the ground. All these functions are packed together in an instrument that is still much less than the price of traditional testers on the market, makes STA-61 the most cost effective solution for field synchronization test.

Truly User-Friendly

Equipped with a large color LCD touch screen, showing metrics graphs in real-time during measurement, combined with on-display pass/fail information, this sync tester/analyzer is truly user-friendly.

All it takes to start measuring is a simple 3 step operation:

1) Connect your signal(s) to test
2) Press SIGNAL CHECK to identify signal type
3) Press START

Within a few minutes anyone could learn how to operate the STA-61.

Modular, Future Proof, Versatile

Sequential testing is no longer necessary if you want to measure wander on several access points in a station, the STA-61 can measure on up to 6 different test points simultaneously for physical sync and up to 3 for packet sync. The physical sync input module measures all standard telecom clocks, including 1PPS, E1/ T1, 10 MHz, STM1, as well as user-defined clocks from 0.5 Hz to 200 MHz. The packet sync input module measures SyncE clock wander extracted from a 10/100 bT and 1 Gigabit Ethernet link and displays/manages SyncE message(s). Through the PDV measurement software option, this module also provides network PDV measurement, including raw PDV, selected packets PDV and related MTIE/TDEV metrics, as well as floor packet metrics.

It is possible to combine physical sync input modules and packet sync input modules, up to a total of 3 modules. The modular design

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makes STA-61 future proof, buy your new sync tester/analyzer today and expand it with more input modules when you need it.

Packet Sync Measurement

STA-61 allows to measure synchronization conformance simultaneously at a packet sync level (based on SyncE and IEEE1588v2 technologies) and at a traditional physical sync level (1PPS, E1, interface) behind a packet synchronized device. Multiple packet sync measurements can be performed, whether it's related to IEEE1588 v2 slave / boundary clock performance qualification or network Packet Delay Variation (PDV) characterization, SyncE wander can be also measured at any node in the network.

STA-61 works as an active probe, meaning it acts in the network as a PTP slave, which can be associated to any visible PTP master in the network, allowing a precise forward and reverse packet delay measurement.

Always Accurate

The STA-61 includes a built-in high performance Rubidium oscillator which allows making sync measurements in places where no accurate frequency/time reference is available. This is key to field commissioning or trouble-shooting operations. In addition, the STA-61G has a built-in high sensitivity GPS receiver which slaves the internal reference to provide a few tens of nanoseconds absolute UTC time accuracy as well as sub10^{-11} frequency accuracy. No external calibration, and no calibration down-time, is needed with the STA-61G.

Common Mode or Differential Wander Measurements

You can compare all your signals under test to the integrated stable Rubidium atomic clock, or to an external high-stability standard, to show the absolute phase variations of all signals under test relative to the common reference clock. You can also define one of the input signals as the reference for all other input signals (differential TIE). This enables for example comparisons of outgoing vs. incoming sync clock in Network elements, and comparisons between a Grandmaster PTP and one or several PTP-slaves. For in-depth analysis, you can also read out cursor data and perform statistical analysis of your measurement.

Sync Probe Mode

The STA-61 can be used as a sync probe when connected to an IP network for a virtually infinite measurement duration. Thanks to the WanderView™ for STA-61 free companion software, powerful and user-friendly functions like remote control, data acquisition, post-processing, graph display, and report generation are available on a remote PC.

Remote Operation

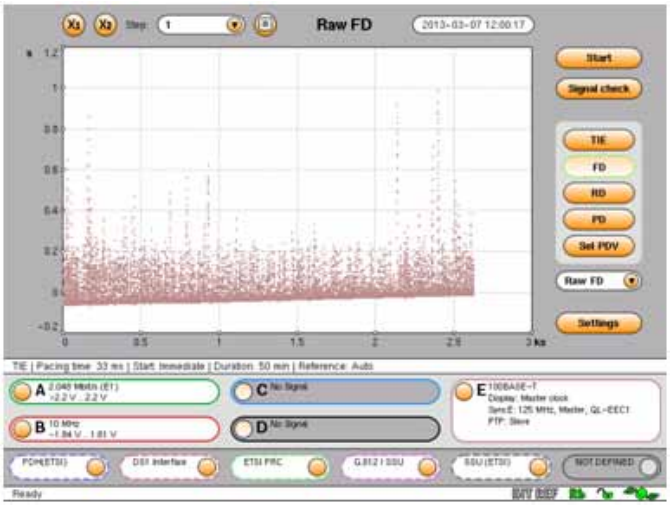
Remote operation of the STA-61 can be facilitated in many ways. The STA-61 has a built-in web server including a VNC server. That means you could monitor and control the STA-61 via Ethernet in a standard VNC client anywhere in the world, running in a PC, or even in a smart phone. You can view the screen and the current measurement progress, and you can control the measurement by clicking the on-screen controls in the remote VNC client. You can also connect to the PC program WanderView™ for STA-61 via Ethernet. From WanderView™ you have full control of the STA-61 including continuous data streaming of measurement data, report generation and advanced post-processing and analysis.

Time & Frequency GPS/Rubidium Reference

STA-61 embeds a high performance time and frequency reference, which benefits from Spectracom know-how in terms of atomic clocks and high performance time-base disciplining. It provides 1PPS, 10 MHz and E1/T1 reference outputs for test cases where a wander free clock must be provided to the device under test.

Examples of Measurement Screens

Raw PDV: Raw PDV can be displayed either as PDV(t), showing the evolution of PDV depending on daytime, or as distribution. Forward and Reverse PDV measurements are available.



Floor Packet Count Display: Floor Packet metrics allow to characterize network ability to support frequency transfer through on IEEE1588, according to G.8261.1. The following graph shows Floor Packet Percentage.

Physical Sync Measurement

Predefined Signal/Clock Types

- 1PPS (PTP slave recovered clock)
- 8 kHz (frame clock)
- 64 kHz /64 kbit/s (E0 / DS0)
- 1.544 MHz /1.544 Mbit/s (T1/DS1 clock/data)
- 2.048 MHz / 2.048 Mbit/s (E1 clock/data)
- 5 MHz /10 MHz (Freq. reference)
- 25 MHz /125 MHz /156.25 MHz (SyncE)
- 34 Mbit/s (E3)
- 45 Mbits/s (DS3)
- 155.52 MHz /155 Mbit/s (STM-1 clock/data)

User-Defined Clock Types

User defined signal types from 0.5 Hz to 200 MHz in 1Hz steps. Note: The signal under test must be a symmetrical, unipolar clock-type signal

Measurement Modes

Common Mode: Signals measured against the selected frequency reference (internal or external)
Differential: One input signal is selected as reference, and all other signals are measured against this reference input.
Absolute TIE: 1PPS from DUT is measured against absolute 1PPS internal time reference, when GPS is locked (also called TOD measurement)

Test Modes (MTIE and TDEV Masks)

Masks can be applied for MTIE and TDEV graphs.
Draft: No mask
PRC/SSU/SEC: Masks for G811/G812/G813-clocks (ETS 300 462-3)
Networks: According to G.823/G.824
SyncE: According to G.8261, G8262
ANSI-standard: DS1 and OC-N masks
User-defined: Defined by the user

Time Interval Error (TIE)

Reference Clock: Built-in Rubidium reference or ext. reference input 1, 5 or 10 MHz
Resolution: 200 ps rms
Sample Rate: up to 100 Sa/s depending on number of parallel measurements
Internal Data Storage: up to 5M TIE values
External Data Storage: on USB memory stick
Start/Stop: via START/STOP key.
Signal Check Parameters: Signal type (Clock, Data or Unknown); Frequency (for clock signals); Pulse width (for data signals); Voltage peak-peak (min. 120 mVp-p)

Graph Display

Display Modes: TIE, MTIE, TDEV, ADEV, FDEV, RTIE, MRTIE
Update Rate: approx. once/second
Number of Graphs: Up to 6 graphs of the same type can be over-laid on screen. Color coded.
Masks on Screen: Up to 6 MTIE, MRTIE and TDEV masks according to selected test mode. Pass/Fail result available for each mask
Display: Color TFT, 8.4", 800x600 pixels, resistive touchscreen

Physical Sync Input Module

Number of Channels: 2 per module
Connector: BNC
Frequency: 1PPS/2s to 200 MHz
Impedance: 75 ohm, VSWR <2:1 or 1M ohm
Voltage Range: ±5.00 V
Sensitivity: 60 mVpp
Signal Type:

- Symmetrical pulse (Clock signal)
- Unsymmetrical repetitive pulse (Clock signal)
- HDB3-coded data (Data signal)
- AMI B8ZS, B3ZS (Data signal)

Packet Sync Measurement

Synchronous Ethernet

- SyncE clock extraction from Gigabit Ethernet interface
- Conformance to G.8261 & G.8262 masks (MTIE/TDEV) measurement
- Additional metrics display : FDEV, ADEV, MRTIE
- Extract and display ESMC message (SSM)
- Generate ESMC, and ESMC change pattern

IEEE1588v2 Packet Delay Variation

PDV measurement applying to forward or reverse packet delay direction

- Raw PDV (vs time, distribution graphs)
- Selected Packet PDV (vs time)
  - Cluster / band packet selection
- MTIE, TDEV applied to Selected Packet PDV
- Conformance to MTIE/TDEV masks
- MATIE, MAFE
- Floor Packet metrics (FPP, FPC)

Packet Sync Input Module

Interfaces

- **Number of channels:** 1 per module
- **Connector:** RJ45 for 10/100/1000 bT, SFP for optical gigabit Ethernet
- **IEEE1588v2** protocol supported as active probe
- Layer 3 (IP/UDP), IPv4
- Any rate up to 128 p/s
- Multicast / Unicast
- End to End
- ±4 ns resolution timestamp, better than 1 ns accuracy

Common Features

Internal Time Base Stability (hold-over)

Stability Versus Temperature:
20° to 26°C: $<1x10^{-11}$ (typ.)
0° to 50°C: $<1x10^{-10}$
Ageing Rate: 24h: $<5.10^{-11}$ per month
Warm-up Stability: 12 min to $<1x10^{-9}$

Calibration

Principle: Closed Case Calibration with automatic adjustment of the Rubidium timebase, using Cs-based, or GPS-controlled Rb-based, 2.048, 5 or 10 MHz reference
Calibration Uncertainty: $<2x10^{-12}$ + Cal. Ref. Freq. Uncertainty

GPS-disciplining of Internal Timebase - Model STA-61G Only

Built-in GPS Module: 12 channels, TRAIM GPS receiver, high sensitivity
Time Accuracy to UTC: ±25 ns at 1σ after 24 hours lock
Frequency Accuracy: 2.10^{-12} averaged over 24 hours
GPS Disciplining Modes: Always disciplining, always in holdover, disciplining only between measurements

External References

Frequency Reference Input (standard)

Input Frequency: 10 MHz, 5MHz or 1MHz
Voltage Range: 0.1 Vrms to 5 Vrms
Impedance: approx. 50 ohm

External 1PPS Timing Input (STA-61G)

Voltage Range: TTL in 50 ohm
Required Accuracy: ± 100 ns to UTC

GPS Timing Reference (STA-61G)

Antenna Input: N-type connector
DC-feed: +5V on center pin to active GPS antenna

Output References

Reference Frequency Output

Ref. Frequency: 10 MHz sine-wave
Output Levels: 1Vrms in 50 ohm
Impedance: approx. 50 ohm

1PPS Output

Source: Internal Rubidium oscillator
Output Logic Levels: TTL levels in 50 ohm

E1/T1 Output Module

Connector: Clock: BNC; Data: Isolated BNC
Frequency: 2.048/1.544 MHz
Output Level: Acc. to G703:10; ±1.2 V ±10% in 75 ohm

Interfaces

USB Device Port

Connector: Std USB type B
USB Version: 2.0

USB Host Port

Connector: Std USB type A
Max Supply Current: 400 mA
USB Version: 2.0

Ethernet

Communication Port: RJ45, 10/100 Base-T
Protocol: DHCP, HTTP, FTP, VNC

WanderView™ for STA-61

The STA-61 companion software provides full remote operation over IP networks.
Operating System: Windows 2000/XP/Vista/Windows 7, 32 or 64 bit OS
Instrument Settings: All local instrument settings can be controlled
Data Transfer: TIE-values in real-time transfer; stored TIE values; measurement settings; Instrument id

- Continuous data streaming acquisition on remote PC, allowing unlimited measurement duration coupled with continuous connection
- Dump mode data transfer at the end of mesurement, if connection is not continuously available

Stored File Format: CSV, for easy export to other programs, like Time Monitor, Stable 32 or MS-Excel
Metrics: MTIE, RTIE, MRTIE, TDEV, ADEV, MADEV, FDEV; all calculated functions are displayed in own graph windows
Analysis: Cursor readouts, cursor delta, zooming in graphs, mean value, max value, min value, peak-peak value, std dev in any graph, either on full data set or data between cursors

Custom Mask Editor: User defined MTIE, MRTIE, and TDEV masks
Event Log: On screen log of measurement start/stop, duration, alarms, loss of data, loss of communication link, etc. Log can be saved as text file.
Multiple Graphs: Up to 6 measurements can be overlaid in the same graph for easy comparison
Multiple Masks: Up to 6 masks can be overlaid in the same graph, with pass/fail indication
Report Generation: Printable, custom designed measurement report in pdf format
Security: Password secured access to STA-61

Environmental Data

Temperature: *Operating:* 0°C to 40°C
Storage: -20°C to 70°C
Safety: EN 61010-1:2010; EN 62133; CSA C22.2 No 61010-1-04, UL 61010-1:2004
EMC: EN61326-1:2006; CE

Power Supply

Line Voltage: 100 to 240 Vrms ±10%, 47 Hz to 63 Hz, <60 W
Optional Battery Backup: 5 hours autonomy for rubidium only, to maintain internal timebase accuracy during transport

Mechanical Data

The cabinet is suitable for field use, and can be operated on a bench (lying down) or on a floor (standing up). The cabinet is shock resistant, using bumpers.
Dimensions (w x h x d):
320 x 388 x 126 mm (12.6" x 15.3" x 5")
Weight: Net <6 kg (13 lb); Shipping <7 kg (15 lb)

Ordering Information

STA-61G Sync Tester/Analyzer with built-in GPS receiver. Multi-channel synchronization tester/analyzer. Needs one or more input module options (Option 610, Option 611).

STA-61GB Sync Tester/Analyzer with built-in GPS receiver and internal battery backup, multi-channel synchronization tester/analyzer. Needs one or more input module options (Option 610, Option 611).

Included with Shipment: User manual on CD, line power cord, Calibration certificate, 1-year warranty[1]

Built-in Options

Option 610: Physical sync input module 1PPS/E1/T1, any clock up to 200 MHz Up to 3 per unit
Option 611: Packet sync input module SyncE / ESMC testing on gigabitEthernet (up to 3 per unit)
Option 620: IEEE1588 PDV measurement software (only one license required by unit)
Option 630: Internal battery backup for rubidium

Optional Accessories

Option 01: GPS antenna (STA-61G)
Option 01/50: GPS antenna mounting kit (STA-61G)
Option 02: GPS antenna cable, 20m (STA-61G)
Option 27/61: Heavy Duty Hard Transport Case
Option 75 : 120 ohms balanced RJ45 to 75 ohms unbalanced BNC impedance converter (balun)
Option 90/61: Calibration certificate with protocol – Rubidium timebase
Option 95/03: Extended warranty to 3 years
OM-61: Printed User Manual

[1]The warranty period may vary dependent on country.

STA-61 side panels

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Specifications subject to change or improvement without notice.
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