STA-61 and STA-61G
Sync Tester/Analyzer

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 (EO / DS0)
• 1.544 MHz / 1.544 Mbit/s (T1/D1 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 Mbit/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 1 MHz 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

Predefined Signal/Clock Types
• 34 Mbit/s (E3)
• 25 MHz / 125 MHz / 156.25 MHz (SyncE)
• 5 MHz / 10 MHz (Freq. reference)
• 2.048 MHz / 2.048 Mbit/s (E1 clock/data)
• 64 kHz / 64 kbit/s (EO / DS0)
• 1.544 MHz / 1.544 Mbit/s (T1/D1 clock/data)

SANI-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 5MIN TIE values
External Data Storage: on USB memory stick

Start/Stop: via START/STOP key.

Common Features
Internal Time Base Stability (hold-over):
Stability Versus Temperature:
20°C to 25°C: ±1x10^-11 (typ.)
0°C to 50°C: ±1x10^-10
Ageing Rate: 24h: ±5x10^-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 Rs-based, 2.048, 5 or 10 MHz reference

Calibration Uncertainty: ±2x10^-12 + Cal. Ref. Freq. Uncertainty

GPS-disciplining of Internal Timebase - Model STA-610 Only
Built-in GPS Modules: 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

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

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 Systems: 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 measurement, 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, MRTE, 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.
Technical Specifications: STA-61

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

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

1The warranty period may vary dependent on country.

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