

The all-in-one field sync tester

for 3G/4G/5G Mobile Backhaul,
Financial Networks and
Power Comms



Platform Highlights

- **PTP, NTP, SyncE and TDM in one box**
 - Allows you to test all legacy and new networks with one box
 - Long-term measurement capability to find intermittent issues
 - Send measurements back to lab/vendor to replay to fix issues
- **Embedded GPS receiver and Rubidium (Rb)**
 - Optional battery for Rb to maintain holdover during transport
 - Highly stable and accurate GPS disciplined Rubidium
- **Fit for the field, fit for the network**
 - Local or remote operation
 - Monitor-mode or Pseudo-slave mode
 - Ethernet for control, USB connectivity for external storage
 - Portable, rugged and easy-to-use
 - Modular, multi-port tester
 - Measurement reports in pdf format

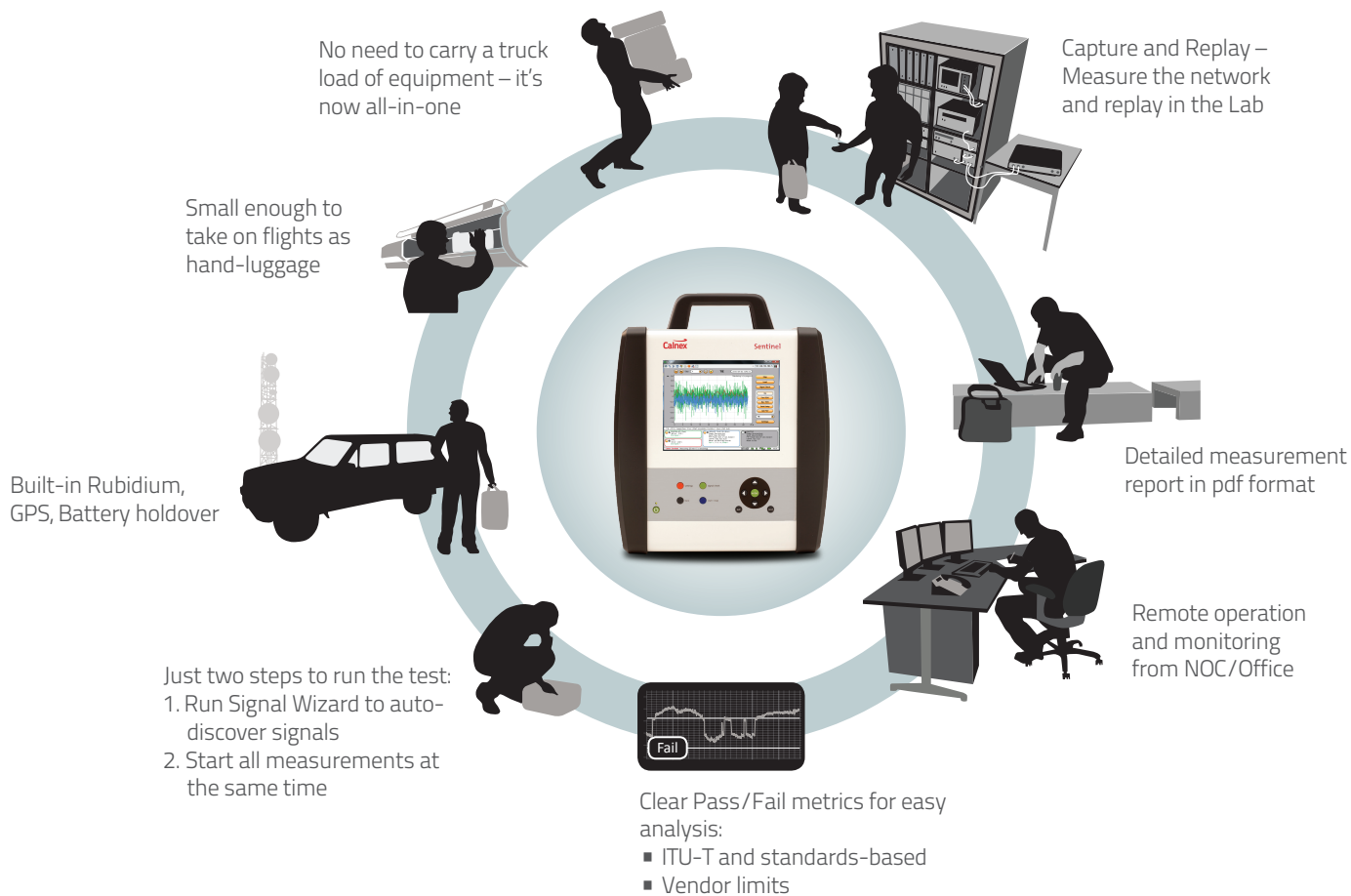
SDH/SONET Network Test

- **Simultaneous measurement of multiple TDM (PDH/SDH/Sonet) signals**
 - Speed up TDM network Sync testing
 - Improve efficiency of debug
- **Standard industry masks per G.811/G.812/G.813/G.823/G.824**

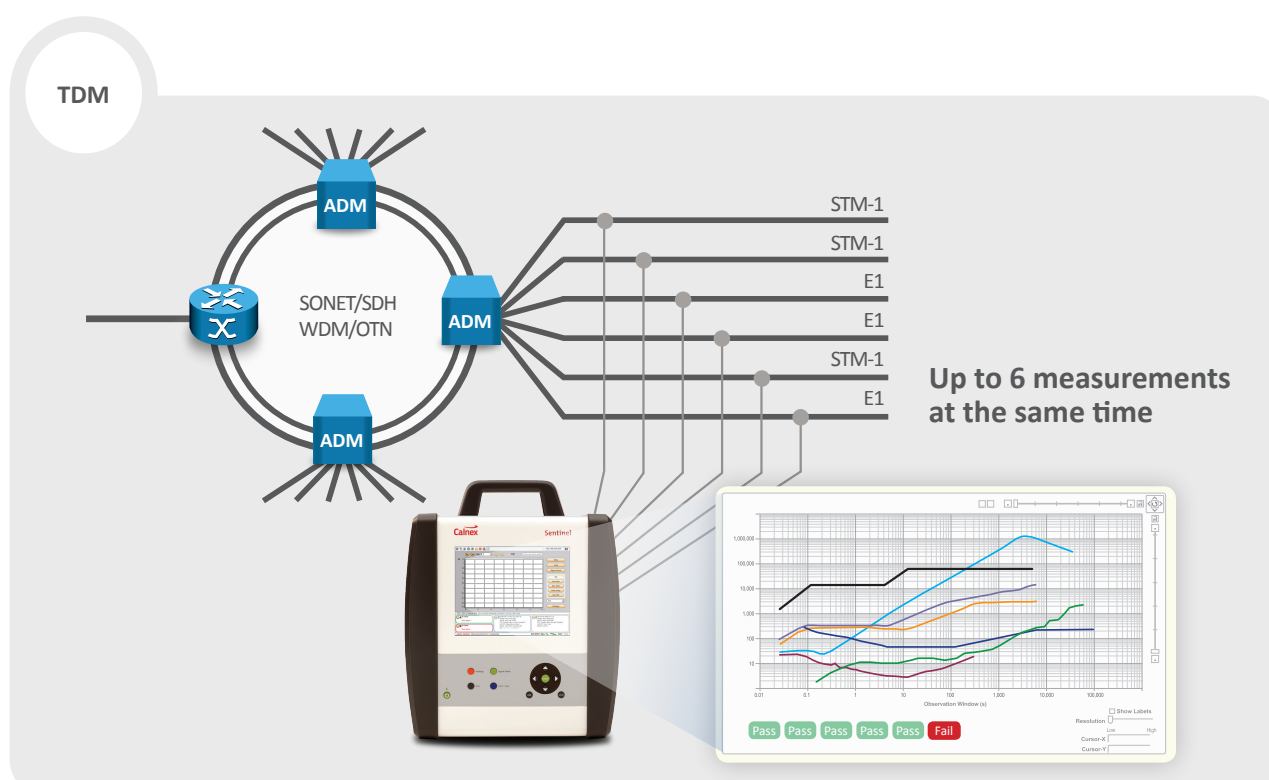
3G/4G/5G Network Test

- **Built-in Pass/Fail limits when measuring the network for**
 - eNode-B/Node-B: Ericsson RBS6000, Huawei 3900/5900, Nokia 9926/Flexi/AirScale, ZTE 8X00 etc.
 - Small cells supporting PTP or NTP
 - Cell-site Routers and PTN (Cisco ASR901, Nokia 7705-SAR, Coriant 860x, Huawei PTN, etc.)
 - Boundary Clocks (BCs) and Transparent Clocks (TCs)
- **Measure ALL parameters at the SAME time**
 - Network Time Error, network PDV, network Wander (SyncE, TDM) and Clock output (frequency and phase)
 - Identifies what the issue is and where it's coming from (network, switch, nodeB etc.)
- **Flexible network connection options**
 - As a Pseudo slave connected to network switches
 - As a network monitor, monitoring live network PDV and Time Error
- **Test networks for Frequency and Phase**
 - ITU-T G.8265.1 for Frequency
 - G.8275.1, G.8275.2 for Time/Phase
- **Standard industry masks and packet metrics**
 - ITU-T G.8261.1/G.8271.1
 - MTIE/TDEV/MAFE/FPP/FPC/TE
- **Test networks with Boundary Clocks and Transparent Clocks**
 - Qualify your existing network – identify how many BCs/TCs are needed
 - Validate network and equipment performance to ITU-T limits
 - Test that the network is suitable for LTE-A and TDD-LTE
 - Pinpoint which BC/TC contributes significant timing error

Lab quality performance in an easy-to-use, portable package



Applications



**LTE-A/
TDD LTE**

PRTC

EPC

T-BC

IP/MPLS or Ethernet Core

T-BC

IP/MPLS or Ethernet Backhaul

Macro eNodeB

PTP Slave

Small Cells

PTP Slave

PTP SyncE

GPS

2Way Dynamic MTIE LF

T1 TE and T4 TE

Frequency

Phase

Fail

Pass

Fail

Fail

Fail

Validate 1.1µs phase accuracy requirement for LTE-A

FDD-LTE/3G

PRC

EPC/RNC

IP/MPLS or Ethernet Core

IP/MPLS or Ethernet Backhaul

Macro Cell

PTP/NTP Slave

Small Cells

PTP/NTP Slave

PTP
NTP
SyncE

E1/T1/10 MHz
1pps

GPS

Check whether PTP/NTP delivers Sync within specs

Forward PDV

FPP

Frequency

Pass

Calnex Sentinell

Specifications

Clock Module Specifications

Predefined Signal/Clock Types	<ul style="list-style-type: none">▪ 1 pps (PTP slave recovered clock).▪ 8 kHz (frame clock).▪ 64 kHz/64 kbit/s (EO/DSO).▪ 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 clock rate).▪ 34 Mbit/s (E3), 45 Mbits/s (DS3).▪ 155.52 MHz/155 Mbit/s (STM-1/STS-3 clock/data).
User-defined Clock Types	User-defined signal types from 0.5 Hz to 200 MHz in 0.5 Hz steps. Note: symmetrical, unipolar clock signals.
Measurement Ports	<p>Number of Ports: 2 per module.</p> <p>Connector: BNC.</p> <p>Impedance: 75 Ω, VSWR <2:1 or 1 MΩ.</p> <p>Voltage Range: \pm5.00 V.</p> <p>Sensitivity: 60 mVpp.</p> <p>Signal Type: Symmetrical pulse (Clock signal); Unsymmetrical repetitive pulse (Clock signal); HDB3-coded data (Data signal); AMI B8ZS, B3ZS (Data signal).</p> <p>Frequency Measurement Accuracy: 1ns.</p> <p>1pps: constant TE measurement accuracy with reference to GPS \pm/-75ns.</p>
Test Modes (MTIE and TDEV Masks)	<p>Masks can be applied for TIE, MTIE and TDEV graphs.</p> <p>PRC/SSU/SEC: Masks for G.811/G.812/G.813-clocks (ETSI 300 462-3).</p> <p>Networks: According to G.823/G.824/G.8261/G.8261.1</p> <p>SyncE: According to G.8261, G.8262.</p> <p>ANSI-standard: DS1 and OC-N masks.</p> <p>User-defined: Defined by the user.</p>
Graph Display	<p>Display Modes: TIE, MTIE, TDEV.</p> <p>Update Rate: approx. once/10 seconds.</p> <p>Number of Graphs: Up to 6 graphs of the same type can be over-laid on screen. Color coded.</p> <p>Masks on Screen: Up to 6 MTIE and TDEV masks according to selected test mode. Pass/Fail result available for each mask.</p>

Ethernet Module Specifications

Synchronous Ethernet	<ul style="list-style-type: none">▪ SyncE clock measurement.▪ Conformance to G.8261 and G.8262 masks (MTIE/TDEV).▪ Extract and display ESMC message (SSM).▪ Generate and change ESMC.
PTP (1588)	<ul style="list-style-type: none">▪ Network 2-way TE, Forward (Sync) PDV, Reverse (DelReq) PDV and Network Delay.▪ Raw PDV (vs time and distribution graphs).▪ Selected Packet PDV (vs time and distribution graphs).▪ Cluster/band packet selection.▪ Pseudo-Slave Mode or Monitor Mode.▪ Layer 2 Multicast.▪ Layer 3 (UDP/IPv4, UDP/IPv6) Multicast/Unicast.▪ 5 ns resolution timestamp▪ Captured PDVs can be replayed on Calnex Paragon-X for troubleshooting.
NTP	<ul style="list-style-type: none">▪ Raw PDV (vs time and distribution graphs).▪ 5 ns resolution timestamp▪ Captured PDVs can be replayed on Calnex Paragon-X for troubleshooting.
Measurement Ports	<p>Number of Ports: 1 per module.</p> <p>Connector: RJ45 for 10/100/1000 Base-T, SFP (SFPs not supplied) 100 M/1 GbE.</p>

Platform Specifications

Reference Clock	Built-in Rubidium reference or external reference input 1 MHz, 5 MHz 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 32G.
External Data Storage	On USB memory stick.
Start/Stop	Via START/STOP key.
Signal Wizard Parameters	Signal type (Clock, Data or Unknown); Frequency (for clock signals); Pulse width (for data signals); Voltage peak-peak (min. 120 mVp-p).
Display	Colour TFT, 8.4", 800 x 600 pixels, resistive touchscreen.

Platform Specifications (continued)

Stability Versus Temperature:	Internal Time Base Stability (holdover)
	20° to 26°C: $<1 \times 10^{-11}$ (typ.)
	0° to 50°C: $<1 \times 10^{-10}$
	Ageing Rate: 24 hr: $<5 \times 10^{-11}$ per month. Warm-up Stability: 12 min to $<1 \times 10^{-9}$
GPS-disciplining	
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 (std)	Input Frequency: 10 MHz, 5 MHz or 1 MHz. Voltage Range: 0.1 Vrms to 5 Vrms. Impedance: approx. 50 Ω .
External 1 pps Timing Input	Voltage Range: 0 V to 0.8 V (Low), 2 V to 3.3 V (High) into 50 Ω . Required Accuracy: ± 100 ns to UTC.
GPS Timing Reference	Antenna Input: N-type connector. DC-feed: +5 V on center pin to active GPS antenna.
Output References	
Reference Frequency Output	Ref. Frequency: 10 MHz sine-wave. Output Levels: 1 Vrms in 50 Ω . Impedance: approx. 50 Ω .
1 pps Output	Source: Internal Rubidium oscillator. Output Logic Levels: TTL levels in 50 Ω .
E1/T1 Output	Connector: Clock: BNC. Data: Isolated BNC. Frequency: 2.048/1.544 MHz, 2.048/1.544 Mb/s. Output Level: Acc. to G.703 ± 1.2 V $\pm 10\%$ in 75 Ω .
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, FTP, VNC.
Remote Operation	Remote operation via VNC. 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. Report Generation: Printable, custom-designed measurement report in pdf format. Security: Password secured access.
Environmental Data	
Temperature	Operating: 0°C to 40°C. (30°C when charging Rb backup-battery.)
Safety	EN 61010-1: 2010.
EMC	EN 61326: 2013.
Power Supply	Line Voltage: 100 to 240 Vrms $\pm 10\%$, 50 Hz to 60 Hz, <100 W.
Optional Battery Backup	3 hours autonomy for Rubidium only to maintain internal timebase accuracy during transport.
Mechanical Data	
Dimensions (w x h x d)	Fold-out stand.
	Shock resistant cabinet.
Weight	320 x 388 x 126 mm (12.6" x 15.3" x 5").
	Net <7 kg (15 lb); Shipping with transport case <16 kg (35 lb).

Ordering Information

Calnex Sentinel Sync Analyzer with built-in GPS receiver. Needs one or more input modules (Option 610, Option 611).

Included with shipment: User manual on USB, CAT tool, line power cord, GPS antenna, antenna cable (20 m), hard transport case, 1-year warranty and support.

Configurable Options

- Option 610: Clock module 1 pps/E1/T1, any clock from 0.5 Hz up to 200 MHz with 0.5 Hz step (up to 3 per unit).
- Option 611: Packet module (PTP/NTP/SyncE). Includes SyncE/ESMC testing 100 M and 1 GbE (up to 3 per unit).
Please note: two Packet modules are required for PTP and NTP measurement in monitor mode.
- Option 620: PTP and NTP PDV measurement software (one license per main unit).
- Option 630: Internal battery backup for Rubidium.

Optional Accessories

- Option 812: One year extension of product warranty.
- Option 813: Two years extension of product warranty.
- Option 75: 120 Ω balanced RJ45 to 75 Ω unbalanced BNC impedance converter (balun).
- Option 133: External 1pps/ToD/frequency converter accessory.
- Option 511: Carry-on bag for Sentinel.

Related Products



Calnex Paragon-X

- Test PTP (1588), SyncE, NTP, CES and OAM up to 10GbE
- Stress-test equipment with real network profiles from field tests to debug network issues
- Prove PTP (1588), SyncE, CES, Pseudowire, NTP, etc. implementations to ITU-T G.8261 etc.
- Test PTP Ordinary Clocks, Boundary Clocks and Transparent Clocks
- Measure Time of Day (ToD), Phase and Frequency



Calnex Paragon-t

- Speed up test time and reduce test complexity with multi-clock measurements
- Measure multiple outputs from a chain of Boundary Clocks and Slave Clocks
- 4 x Frequency (SyncE/E1/T1/2.048 M/10 M Wander) measurements
- 4 x Phase (1pps accuracy) measurements
- 4 x ToD display measurements



Calnex Paragon-100G

- Precisely measure frequency and phase synchronization from 100Base-T to 100GbE in accordance with ITU-T G.8262 (SyncE) and IEEE 1588 (PTP) standards
- Prove 100GbE, 40GbE and 25GbE SyncE Jitter and Wander performance to ITU-T standards
- Evaluate MTIE/TDEV pass/fail results to ITU-T G.8262 masks
- Check ESMC (SSM) messaging to ITU-T G.8264
- Web-based GUI

Calnex Solutions is a global leader in Test and Measurement solutions for next-generation telecom networks. Our products help to prove new technologies for Mobile Backhaul and Carrier Ethernet networks.

For more information on the Calnex Sentinel and Calnex Paragon platform, and to take advantage of Calnex's extensive experience in Packet Sync and OAM testing technologies, contact Calnex Solutions today:

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