Calnex Sentinel

The all-in-one field sync tester

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

Calnex
Insight and Innovation

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
  - Easy calibration – 'Calibrate-Once' or 'Continuous Auto-calibration'

- **Fit for the field, fit for the network**
  - Local or remote operation
  - Monitor-mode or Pseudo-slave mode
  - Web and Ethernet for control, USB connectivity for external storage
  - Portable, rugged and easy-to-use
  - Modular, multi-port tester
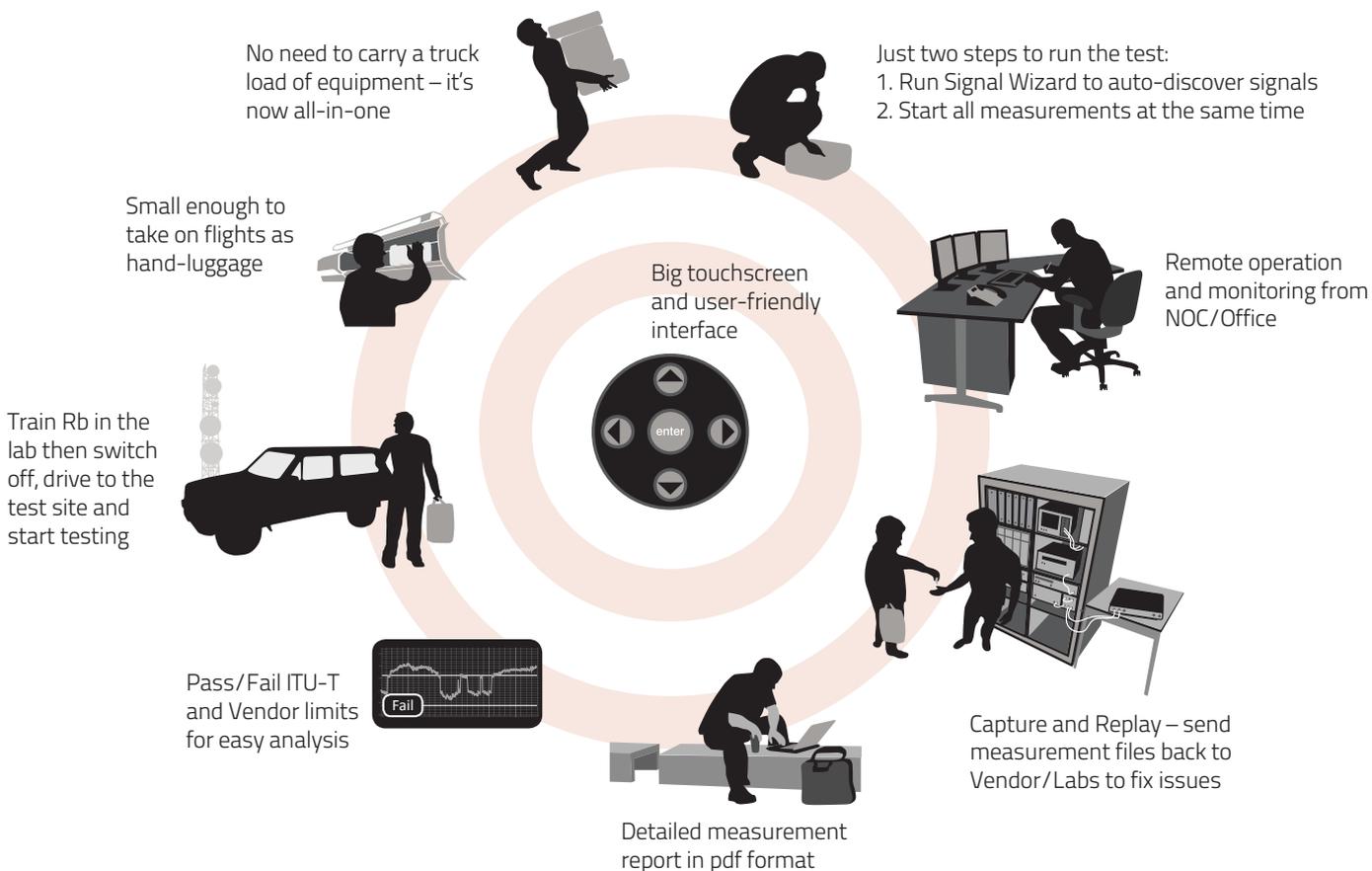 - Measurement reports in pdf format

SDH/Sonet Network Test

- **Simultaneous measurement of multiple TDM (PDH/SDH/Sonet) signals**
  - Speed up TDM network Sync testing
  - Improve efficiency of debug

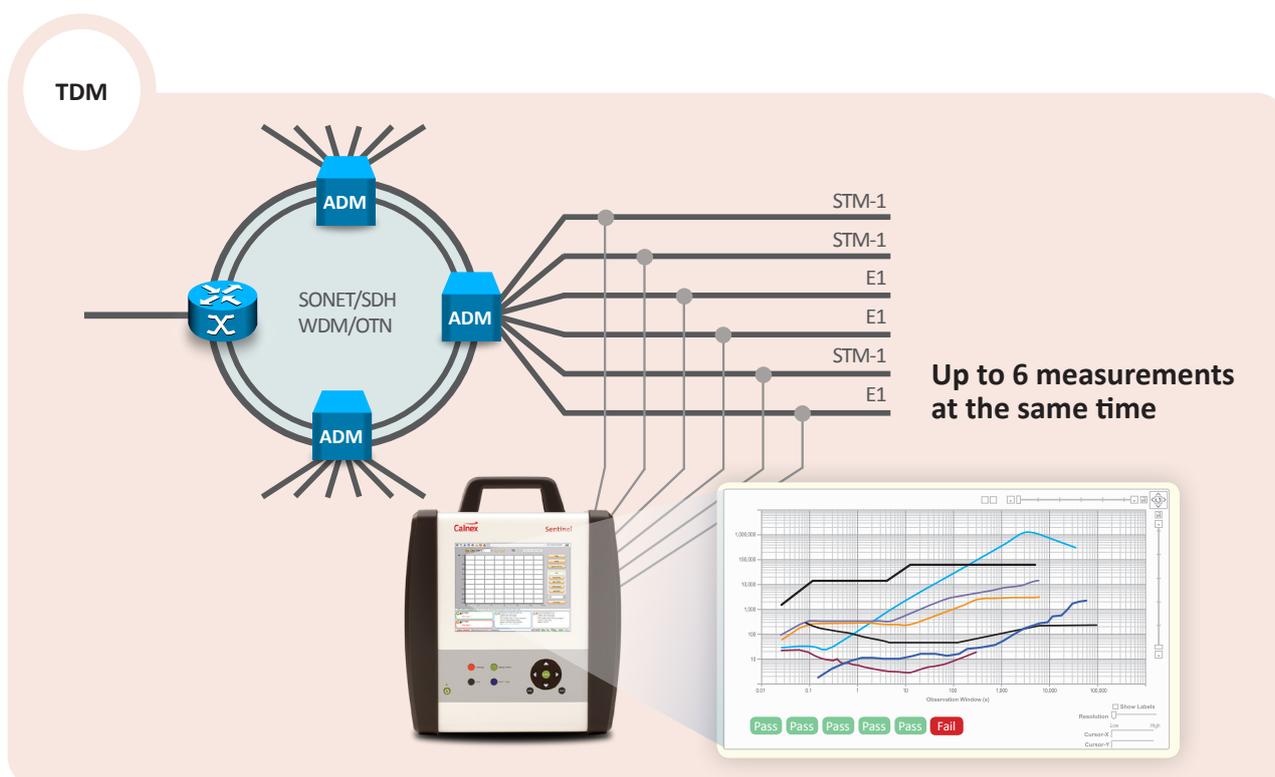- **Standard industry masks per G.811/G.812/G.813/G.823/G.824**

4G/LTE/3G Network Test

- **Built-in Pass/Fail limits when measuring the network for**
  - Node-B: Ericsson RBS6000, Huawei 3900, NSN Flexi, etc.
  - eNodeB: Huawei, ZTE, Ericsson, AlcatelLucent, NSN, etc.
  - Small cells supporting PTP or NTP
  - Cell-site Routers and PTN (Cisco ASR901, ALu 7705-SAR, Tellabs 860x, Huawei PTN, etc.)
  - Boundary Clocks (BCs) and Transparent Clocks (TCs)

- **Measure ALL parameters at the SAME time**
  - 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

- **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
  - MTIE/TDEV/MAFE/FPP/FPC

- **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
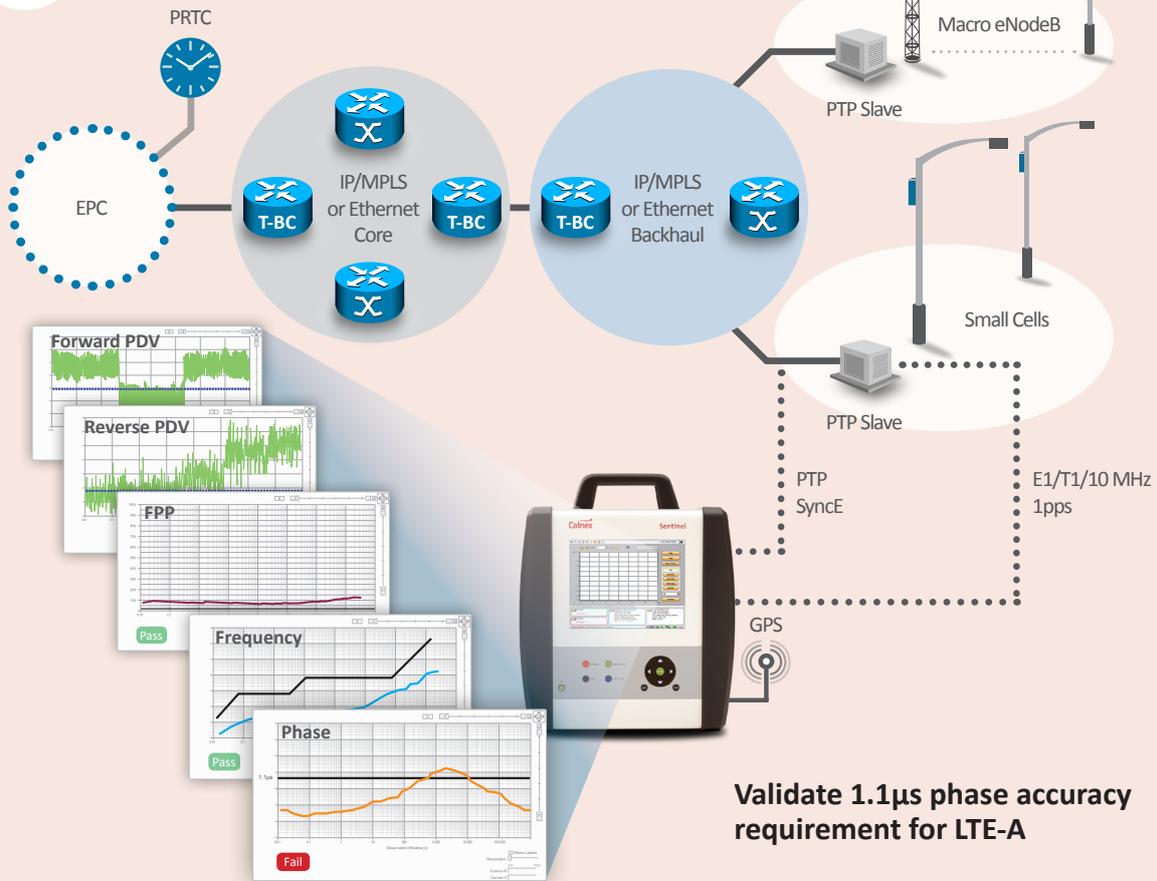 - Pinpoint which BC/TC contributes significant timing error

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

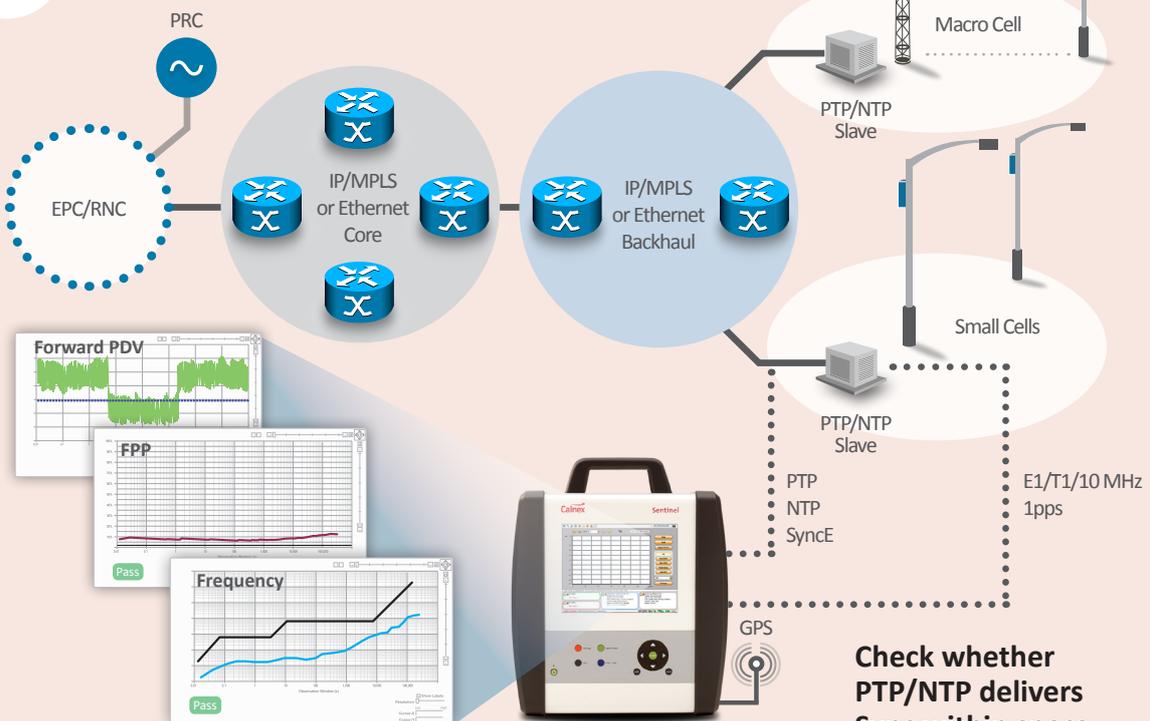No need to carry a truck load of equipment – it's now all-in-one

Just two steps to run the test:
1. Run Signal Wizard to auto-discover signals
2. Start all measurements at the same time

Small enough to take on flights as hand-luggage

Remote operation and monitoring from NOC/Office

Big touchscreen and user-friendly interface

enter

Train Rb in the lab then switch off, drive to the test site and start testing

Capture and Replay – send measurement files back to Vendor/Labs to fix issues

Pass/Fail ITU-T and Vendor limits for easy analysis

Fail

Detailed measurement report in pdf format

Applications

TDM

ADM

SONET/SDH WDM/OTN

ADM

ADM

STM-1
STM-1
E1
E1
STM-1
E1

Calnex Sentinel

Up to 6 measurements at the same time

Pass Pass Pass Pass Pass Fail

LTE-A/ TDD LTE

PRTC

EPC

IP/MPLS or Ethernet Core

T-BC

T-BC

T-BC

IP/MPLS or Ethernet Backhaul

Macro eNodeB

PTP Slave

Small Cells

PTP Slave

PTP
SyncE

E1/T1/10 MHz
1pps

GPS

Forward PDV

Reverse PDV

FPP

Frequency — Pass

Phase — Fail

Pass

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

Forward PDV

FPP — Pass

Frequency — Pass

Check whether PTP/NTP delivers Sync within specs

Clock Module Specifications

Predefined Signal/Clock Types	▪ 1 pps (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 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	**Number of Ports:** 2 per module. **Connector:** BNC. **Impedance:** 75 Ω, VSWR <2:1 or 1 MΩ. **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).
Test Modes (MTIE and TDEV Masks)	Masks can be applied for TIE, MTIE and TDEV graphs. **1 pps:** Time Error limit (e.g. ±1.5 µs). **PRC/SSU/SEC:** Masks for G.811/G.812/G.813-clocks (ETSI 300 462-3). **Networks:** According to G.823/G.824/G.8261/G.8261.1 **SyncE:** According to G.8261, G.8262 **ANSI-standard:** DS1 and OC-N masks. **User-defined:** Defined by the user.
Graph Display	**Display Modes:** TIE, MTIE, TDEV, ADEV, FDEV, RTIE, MRTIE. **Update Rate:** approx. once/10 seconds. **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.

Ethernet Module Specifications

Synchronous Ethernet	▪ SyncE clock measurement. ▪ Conformance to G.8261 and G.8262 masks (MTIE/TDEV). ▪ Additional metrics display: FDEV, ADEV, MRTIE. ▪ Extract and display ESMC message (SSM). ▪ Generate and change ESMC.
PTP (1588)	▪ 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 or Monitor Mode. ▪ Layer 2 Multicast. ▪ Layer 3 (IPv4/UDP) Multicast/Unicast. ▪ 5 ns resolution timestamp, better than 1 ns accuracy. ▪ Captured PDVs can be replayed on Calnex Paragon-X for troubleshooting.
NTP	▪ Forward (Server) PDV in Monitor mode. ▪ Raw PDV (vs time and distribution graphs). ▪ 5 ns resolution timestamp, better than 1 ns accuracy. ▪ Captured PDVs can be replayed on Calnex Paragon-X for troubleshooting.
Measurement Ports	**Number of Ports:** 1 per module. **Connector:** RJ45 for 10/100/1000 bT, SFP (SFPs not supplied) 100 M/1 GbE.

Platform Specifications

Reference Clock	Built-in Rubidium reference or external 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 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.

Internal Time Base Stability (holdover)

Stability Versus Temperature:	20° to 26°C: <1 x 10^{-11} (typ.) 0° to 50°C: <1 x 10^{-10} **Ageing Rate:** 24 hr: < 5 x 10^{-11} per month. **Warm-up Stability:** 12 min to <1 x 10^{-9}
Calibration	**Principle:** Closed Case Calibration with automatic adjustment of the Rubidium timebase, using Cs-based, or GPS-controlled Rb-based, or built-in GPS reference.
Calibration Uncertainty	<2 x 10^{-12} + Cal. Ref. Freq. Uncertainty.

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 x 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 ±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, HTTP, 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:** 2011, CAT II, Pollution degree 2, Measuring category I, CSA C22.2 No 61010-1-04, UL 6010-1:2004
EMC	EN61326 (1997) + A1 (1998), CE.
Power Supply	**Line Voltage:** 100 to 240 Vrms ±10%, 50 Hz to 60 Hz, <100 W.
Optional Battery Backup	5 hours autonomy for Rubidium only to maintain internal timebase accuracy during transport.

Mechanical Data

	Fold-out stand. Shock resistant cabinet.
Dimensions (w x h x d)	320 x 388 x 126 mm (12.6" x 15.3" x 5").
Weight	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, calibration certificate, 1-year warranty and support.

Configurable Options

- Option 610: Clock module 1 pps/E1/T1, any clock up to 200 MHz (up to 3 per unit).
- Option 611: Ethernet module (PTP/NTP/SyncE). Includes SyncE/ESMC testing 100 M and 1 GbE (up to 3 per unit).
- 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 warranty extension.
- Option 813: Two years warranty extension.
- Option 75: 120 Ω balanced RJ45 to 75 Ω unbalanced BNC impedance converter (balun).

Related Products

Calnex Paragon-X

- Test PTP, SyncE, NTP, CES and OAM up to 10 G
- Stress-test equipment with real network profiles from field-tests to debug network issues
- Prove PTP, 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 (1 pps accuracy) measurements
- 4 x ToD display measurements

Calnex Paragon-m

- All capture and measurement features of Paragon-X
- PTP and NTP PDV and Standards and Vendor Metrics (Pass/Fail evaluation)
- SyncE Wander measurement to ITU-T limits
- Clock measurements – 1 pps, ToD, E1/T1, including MTIE/TDEV to ITU-T limits
- Thru-mode network capture and analysis

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 Paragon platform, and to take advantage of Calnex's extensive experience in Packet Sync and OAM testing technologies, contact Calnex Solutions today:

tel: +44 (0) 1506 671 416
email: info@calnexsol.com

calnexsol.com

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