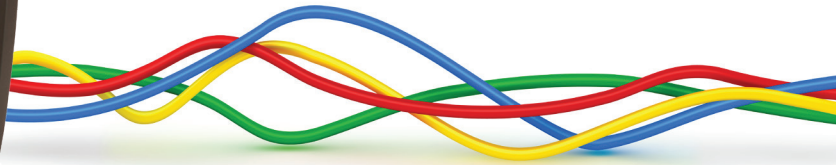Calnex Sentinel

The all-in-one field sync tester

for 4G and 3G 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
  - 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
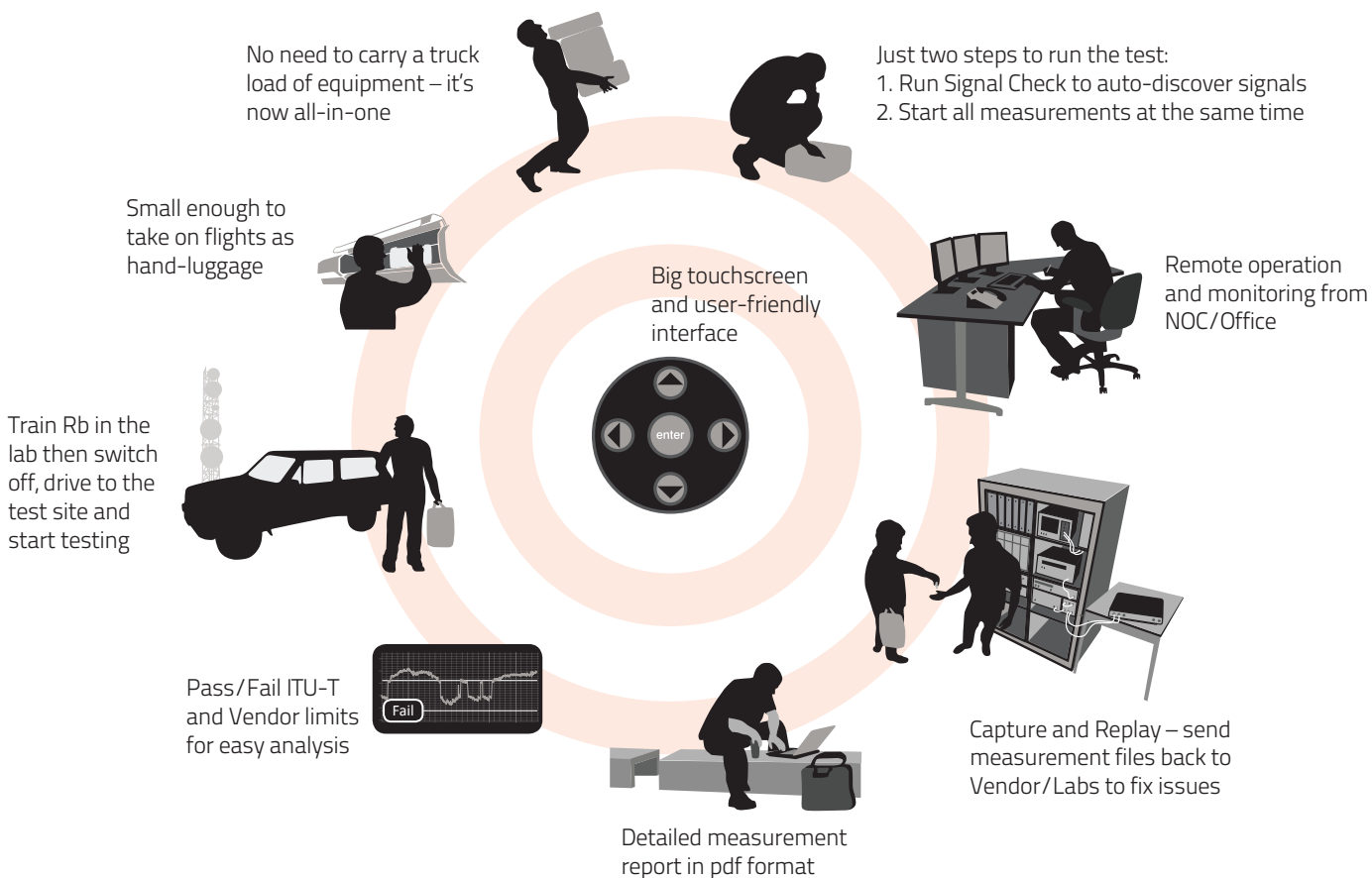 - Measurement reports in pdf format

SDH/Sonet Network Test

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

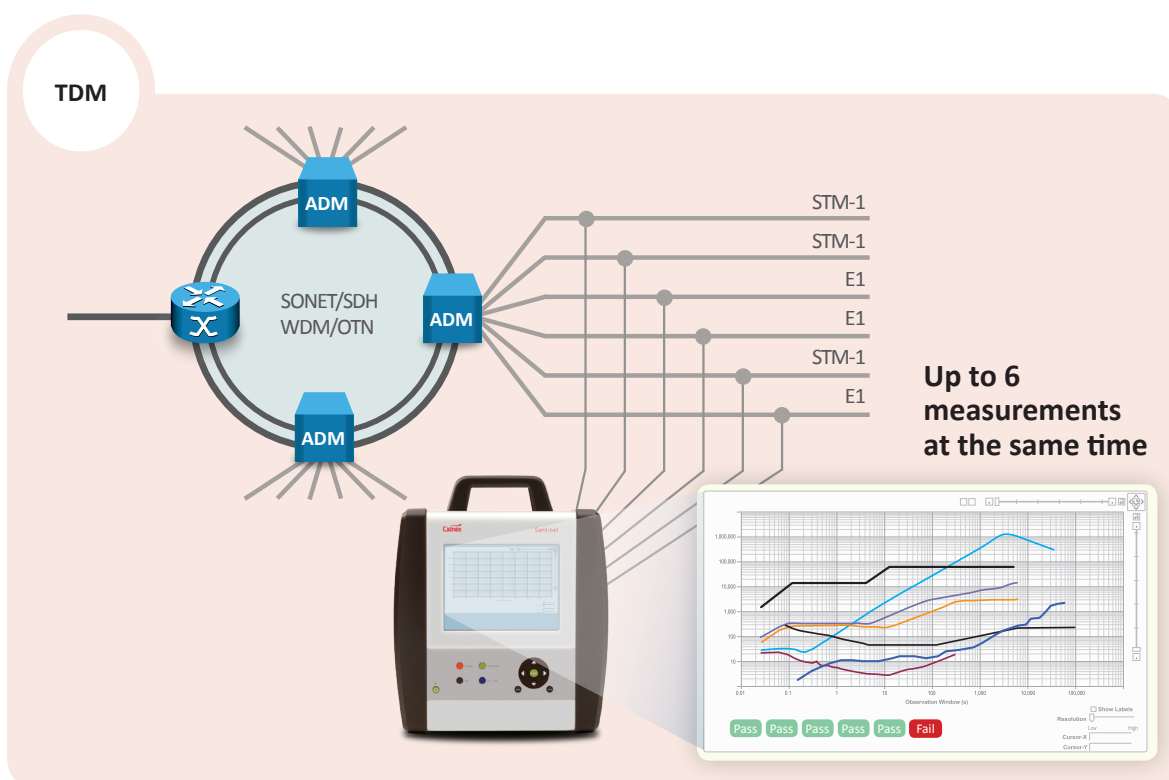- **Standard industry masks per G.811/G.812/G.813/G.823/G.824**

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 & 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
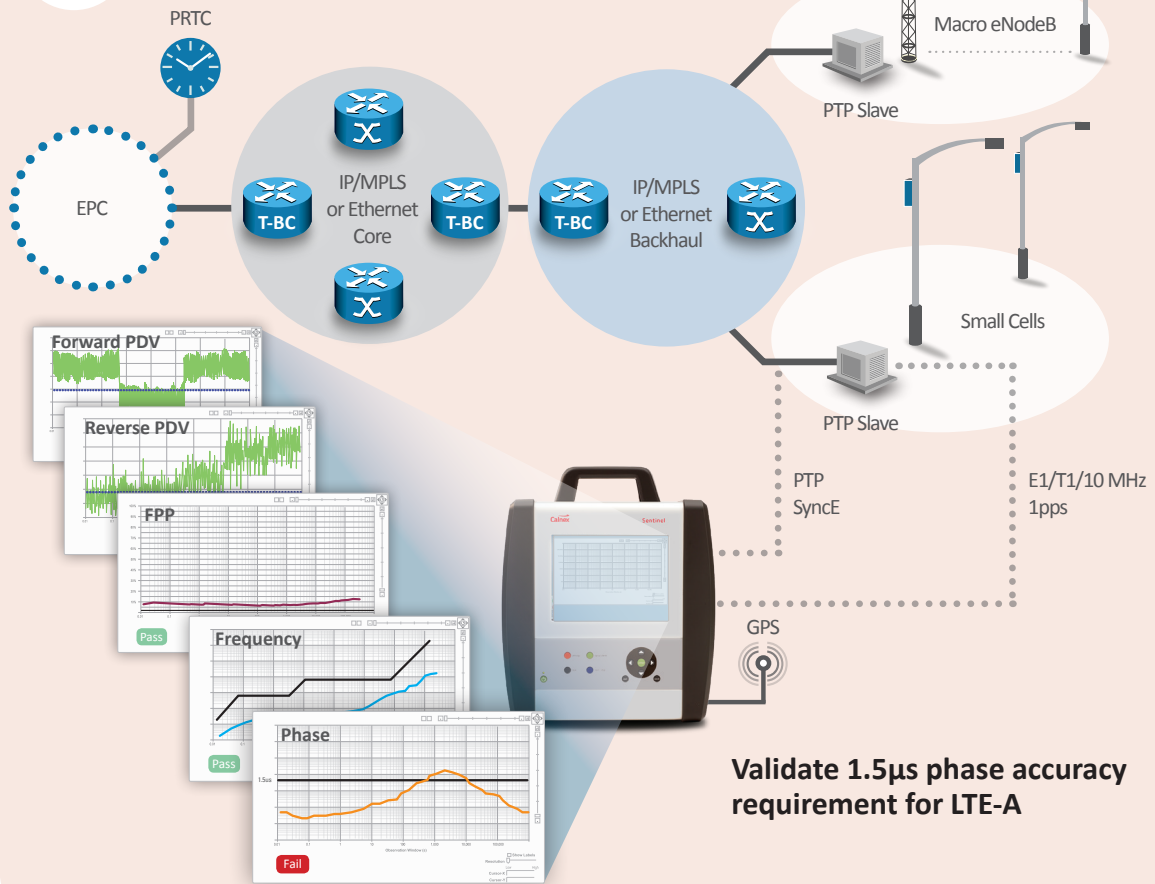 - Pinpoint which BC/TC contributes significant timing error

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 Check to auto-discover signals
2. Start all measurements at the same time

Small enough to take on flights as hand-luggage

Big touchscreen and user-friendly interface

enter

Remote operation and monitoring from NOC/Office

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

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

SONET/SDH WDM/OTN

ADM

ADM

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

Forward PDV

Reverse PDV

FPP

Pass

Frequency

Pass

Phase

1.5μs

Fail

PTP
SyncE

E1/T1/10 MHz
1pps

GPS

Validate 1.5μs 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

Forward PDV

FPP

Pass

Frequency

Pass

PTP
NTP
SyncE

E1/T1/10 MHz
1pps

GPS

Check whether PTP/NTP delivers Sync within specs

Clock Module Specifications

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 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 1 Hz steps. Note: (symmetrical, unipolar clock signals)
Measurement Ports	**Number of Ports:** 2 per module **Connector:** BNC **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)
Test Modes **(MTIE and TDEV Masks)**	Masks can be applied for TIE, MTIE and TDEV graphs. **1pps:** Time Error limit (e.g. ±1.5 µs) **PRC/SSU/SEC:** Masks for G811/G812/G813-clocks (ETSI 300 462-3) **Networks:** According to G.823/G.824/G.8261/G.8261.1 **SyncE:** According to G.8261, G8262 **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/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

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
IEEE1588v2 PTP	- 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 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) 100M/1GbE

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 Check Parameters	Signal type (Clock, Data or Unknown); Frequency (for clock signals); Pulse width (for data signals); Voltage peak-peak (min. 120 mVp-p)
Display	Color TFT, 8.4", 800x600 pixels, resistive touchscreen

Internal Time Base Stability (holdover)

Stability Versus Temperature:	20° to 26°C: <1x10^{-11} (typ.) 0° 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 Rb-based, or built-in GPS reference
Calibration Uncertainty	<2x10^{-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	2x10^{-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 ohm
External 1pps Timing Input	**Voltage Range:** 0V to 0.8V (Low), 2V to 3.3V (High) into 50 ohm **Required Accuracy:** ± 100 ns to UTC
GPS Timing Reference	**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
Remote Operation	Remote operation via VNC (open browser and enter IP address) **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 to STA-61

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%, 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 chassis 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), with transport case <9kg (20 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 CD, line power cord, GPS antenna, antenna cable (20m), hard transport case, calibration certificate, 1-year warranty and support.

Built-in Options

- Option 610: Clock module 1PPS/E1/T1, any clock up to 200 MHz (up to 3 per unit).
- Option 611: Ethernet module (PTP/NTP/SyncE). Includes SyncE/ESMC testing 100M and 1GbE (up to 3 per unit).
- Option 620: IEEE1588v2 and NTP PDV measurement software (one license per main unit).
- Option 630: Internal battery backup for Rubidium.

Optional Accessories

- Option 802: One year warranty extension.
- Option 803: Two years' warranty extension.
- Option 75: 120 ohms balanced RJ45 to 75 ohms unbalanced BNC impedance converter (balun).

Related Products

Calnex Paragon-X

- Test 1588v2 PTP, SyncE, NTP, CES and OAM up to 10G
- Stress-test equipment with real-network profiles from field-tests to debug network issues
- Prove 1588v2 (PTP), Sync-E, CES, Pseudowire, NTP, etc. implementations to ITU-T G.8261 etc.
- Test 1588v2 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 (BCs) and Slave Clocks
- 4 x Frequency (SyncE/E1/T1/2.048M/10M Wander) measurements
- 4 x Phase (1pps accuracy) measurements
- 4 x ToD display measurements

Calnex Paragon-m

- All Capture and Measure features of Paragon-X
- 1588v2 and NTP PDV and Standards and Vendor Metrics (Pass/Fail evaluation)
- Sync-E Wander measurement to ITU-T limits
- Clock measurements – 1pps, 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 product family, and to take advantage of Calnex's extensive experience in Packet Sync and OAM testing technologies, contact Calnex Solutions today:

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