Calnex **Sentinel**

100M / 1G / 10G / Over-the-Air

Calnex
Insight and Innovation

The all-in-one field sync tester

For 3G/4G/5G Mobile Backhaul, E911/Critical Infrastructure, Datacenters, Financial Networks and Power Comms

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

Simultaneous Measurements

- 1 pps/frequency
- PTP/SyncE
- Over-the-Air (4G LTE TE)
- NTP (PDV + 2wayTE)

Protocol Check
Analyze PTP protocol compliance to ITU-T Standards (G.8265.1/ G.8275.1/G.8275.2)

Clear Pass/Fail metrics for easy analysis

- ITU-T, standards-based, vendor limits
- Detailed measurement report in PDF format

Easy Test Setup

1. Run health check to auto discover signals and check PTP protocol compliance
2. Start all measurements at the same time

Capture and Replay
Measure the network and send measurements back to the lab/vendor to replay and fix issues

Remote Operation
Monitor from NOC/Office

Embedded GNSS Receiver and Rubidium (Rb)
Highly stable and precise GNSS disciplined Rb

Platform Highlights

- **PTP, NTP, SyncE and TDM in one box**
- **Measure ALL parameters at the SAME time:**
  - Network Time Error, network PDV, network Wander (SyncE, TDM) and clock output (frequency and phase)
  - Identify 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
- **Long-term measurement capability to find intermittent issues**
- **Ethernet for control, USB connectivity for external storage**

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:

- 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)

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/G.8271.2
- MTIE/TDEV/MAFE/FPP/FPC/TE/pktSelected2WayTE

Test networks with Boundary Clocks and Transparent Clocks:

- Qualify your existing network – identify how many BCs/TCs you need
- 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

Ideal for pre-deployment, troubleshooting, and post-deployment maintenance
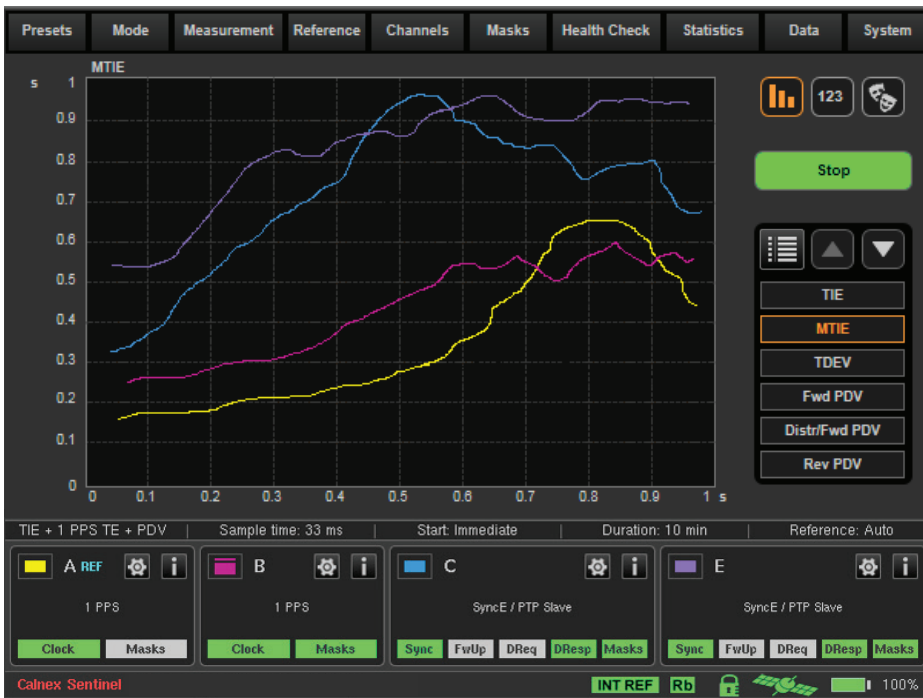
Advanced capabilities and intuitive operation means engineers at all skill levels can use Sentinel with total confidence.

- Simultaneous sync measurements including PTP 2WayTE/PDV + SyncE + Clock measurements (frequency + 1 pps TE)

- Supports G.8265.1, G.8275.1, G.8275.2 and default PTP profiles

- In-depth PTP protocol capture and analysis

- Measure multiple GM's simultaneously

- Time Error analysis – 2WayTE, pktSelected2WayTE, 1 pps, cTE, dTE (LF/MTIE/TDEV)

- PDV analysis – FPP, MAFE, MATIE, Packet Distribution

- SyncE Wander (MTIE/TDEV) and SyncE ESMC QL analysis

- NTP PDV + 2WayTE analysis (NTP Pseudo Client)

- Extensive analysis of PDV/TE/Clock metrics (using CAT) with report generation
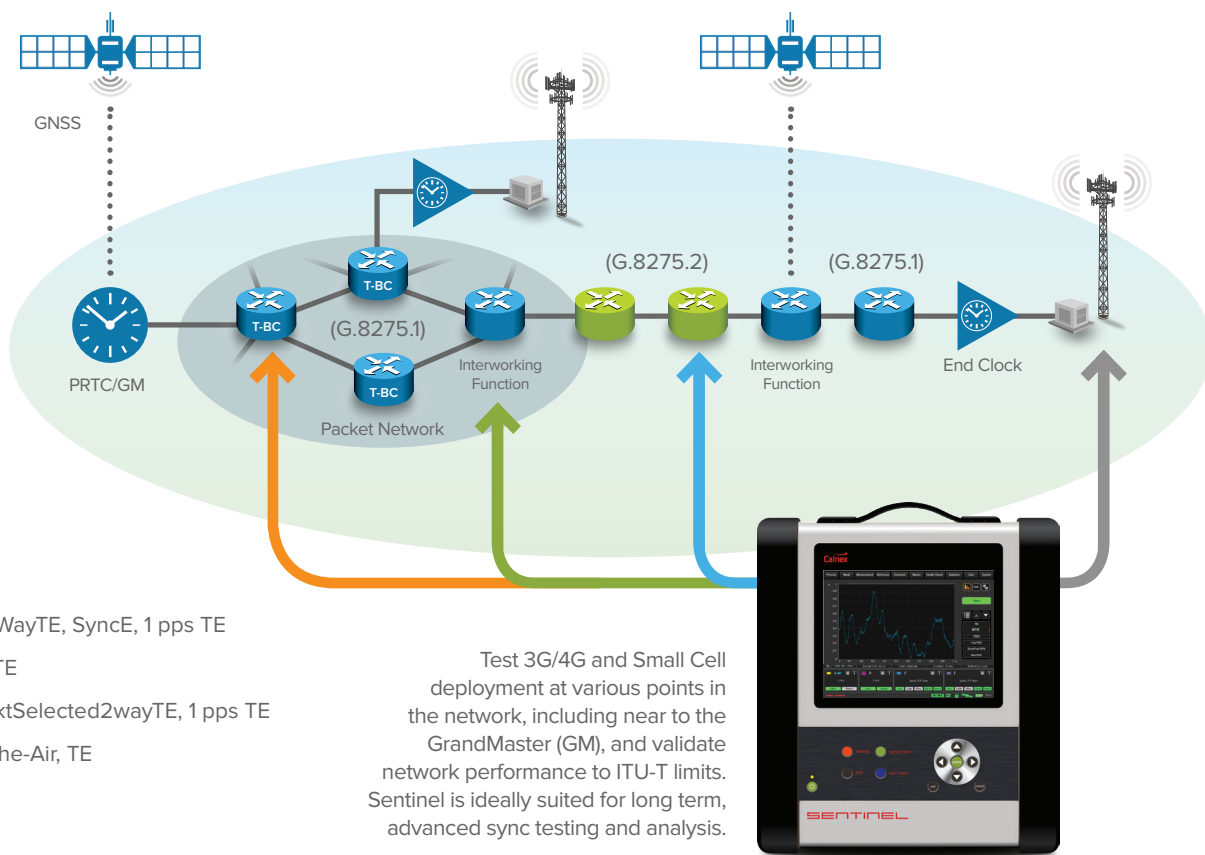
CAT

The Calnex Analysis Tool (CAT) provides powerful insight into network and device performance. All your measurement results are now in one place, and you can view multiple graphs simultaneously for easier correlation of your results.

- Enhanced graphics makes it easy to evaluate ITU-T metrics such as Time Error (cTE, dTE), MTIE and TDEV against ITU-T masks

- Customisable multi-graph window lets you rapidly select measurements and channels for detailed analysis

- One button generation of reports in PDF format: Pass/Fail statistics and details of failures

- Share captures and results with vendors for fast, efficient and accurate troubleshooting

Keep up with network evolution and deliver the fast, stable service your customers demand

GNSS

(G.8275.2)

(G.8275.1)

T-BC

T-BC

(G.8275.1)

T-BC

PRTC/GM

Packet Network

Interworking Function

Interworking Function

End Clock

PTP 2WayTE, SyncE, 1 pps TE

1 pps TE

PTP pktSelected2wayTE, 1 pps TE

Over-the-Air, TE

Test 3G/4G and Small Cell deployment at various points in the network, including near to the GrandMaster (GM), and validate network performance to ITU-T limits. Sentinel is ideally suited for long term, advanced sync testing and analysis.
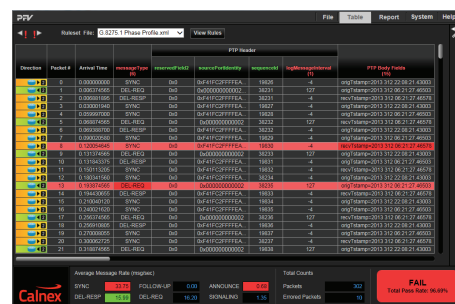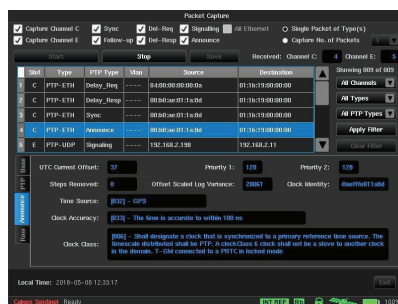
Protocol and Signal Analysis

- Selectable ITU-T and IEEE profiles
- Automatic detection of signals present
- Checks that Master/Slave addresses are correct
- Checks Domain is correctly set
- Checks signalling messages are received in Unicast mode
- Checks Sync, Del-Req, Del-Resp and Announce messages have been received

Packet Capture and Decode

Capture and decode Signalling, Sync, Del-Req, Del-Resp and Announce messages to help identify:

- Configuration issues – such as mismatch domain number configured for Master and Slave
- Protocol Implementation issues – such as the log interval of Del-Resp does not reflect the real packet rate as expected in multicast mode
- Protocol Signalling issues – such as signalling messages do not repeat after the negotiated contract period
- Capture and decode Announce messages – provides detailed information about the PTP GM which is fundamental to build up the Master-Slave clock hierarchy

PTP Protocol Analysis

Analyze PTP protocol for conformance to standards or user-defined profiles with the PTP Field Verifier (PFV).

- Automatic Pass/Fail indication – check captured PTP messages against a pre-defined set of rules, with clear Pass/Fail alerts
- Check transmitted PTP messages for compliance with ITU-T, IEEE and user-defined standards and rules – areas of non-conformance immediately visible
- Flexible XML rules allow full customisation of pass criteria
- Full report generation capability

Now measure sync from the radio signal — and from your car
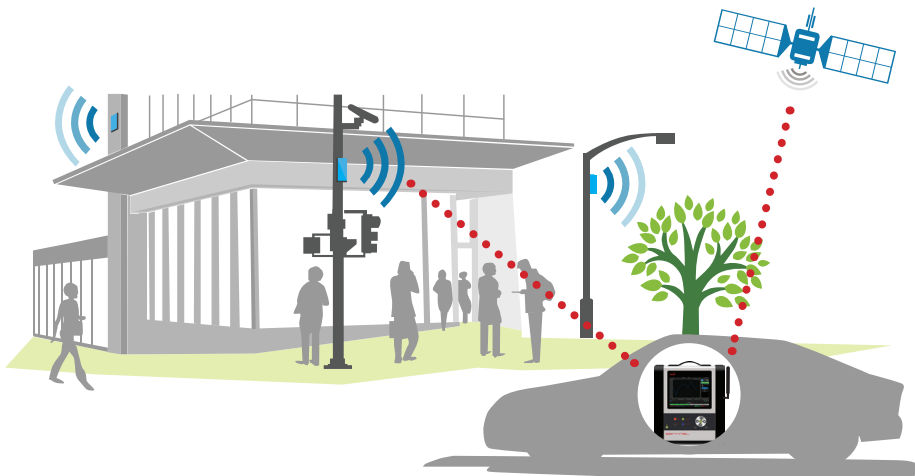
Time Error Over-the-Air

How do you know if your Small Cells conform to 3GPP standards? With TDD and FDD systems implementing newer LTE features such as eICIC and CoMP, measuring the sync accuracy of a Small Cell/eNodeB is crucial. It's also quite a challenge, particularly when these network devices often lack a physical 1 pps output.

However, with Sentinel's non-invasive Over-the-Air test capability you can now measure, with precision, the Time Error between Small Cells/EnodeBs and Sentinel's reference to ensure they meet the 3GPP's ≤3 μs phase alignment limit.
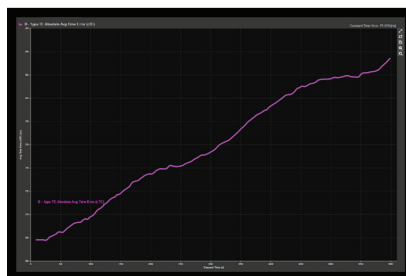
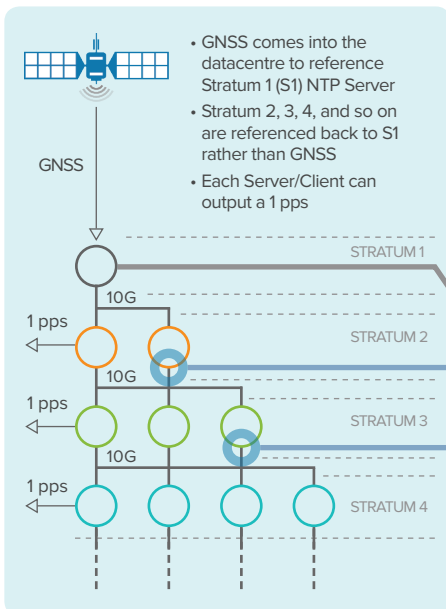**Evaluate OTA measurements using the CAT, including**
- Time Error
- Frequency accuracy

PTP and NTP timing for datacenters

How do you ensure your datacenter is synchronized? Datacenters are evolving to cope with the global demand of connectivity and cloud storage, playing a huge part in the future of 5G. And PTP and NTP are key synchronization technologies that are critical in the performance of a datacenter.

High line rates and dedicated IPv6 networks are the new normal and the very nature of a datacenter is becoming ever more critical. Testing sync within datacenters will have some challenges — no GNSS within the building, therefore no measurement reference, while NTP requirements can be beyond legacy implementations making it difficult to prove time/phase accuracy.

Sentinel can test NTP/PTP 2way TE without access to GNSS. Plus, should you need to move Sentinel around the datacenter, simply take a reference from a GM/Stratum 1 Server to discipline the PRS-10 Rb and test in holdover mode.

- GNSS comes into the datacentre to reference Stratum 1 (S1) NTP Server
- Stratum 2, 3, 4, and so on are referenced back to S1 rather than GNSS
- Each Server/Client can output a 1 pps

GNSS

STRATUM 1

10G

1 pps Reference from Stratum 1

1 pps

STRATUM 2

10G

NTP (1G/10G) + 1 pps measurement

1 pps

STRATUM 3

10G

NTP (1G/10G) + 1 pps measurement

1 pps

STRATUM 4

All measurements can be made simultaneously:
- 2 x packet ports (2 x independent Pseudo NTP Clients or PTP Slaves)
- 2 x clock ports (2 x independent 1 pps measurements)
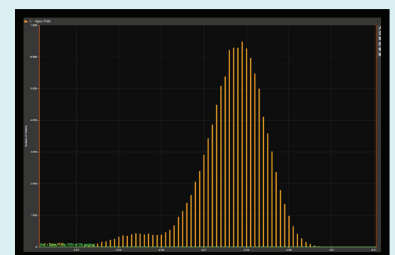
Use the CAT for a clearer picture . . .
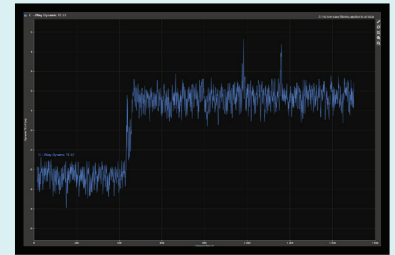
LTE-A/TDD LTE
- PTP/1 pps MaxITEI
- PTP/1 pps dTE
- pktSelected2wayTE (APTS/PTS)

LTE-FDD/3G
- PDV FPP
- 16 ppb frequency wander
- MTIE/TDEV

Financial/Power Networks
- NTP PDV distribution
- NTP 2wayTE

SyncE
- E1/T1 wander
- MTIE/TDEV
- ESMC

TDM/Legacy
- E1/T1 wander
- MTIE/TDEV
- SSM

Ordering Information

Calnex Sentinel Sync Analyzer with built-in GNSS receiver. Needs minimum of one measurement option (module/port).

Included with shipment: Calnex Analysis Tool (CAT), GNSS antenna, antenna cable (20 m), hard transport case, user manual on USB, line power cord, 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.
- Option 615: 100M/1G packet port (PTP/NTP/SyncE). Can order maximum of 2 x Opt. 615. Includes SyncE/ESMC analysis for 100M/1G optical and electrical rates.
- Option 616: 100M/1G/10G packet port (PTP/NTP/SyncE). Can order maximum of 2 x Opt. 616. Includes SyncE/ESMC analysis for 100M/1G/10G optical and electrical rates.
- Option 620: PTP and NTP PDV measurement software (one license per instrument).
- Option 630: Internal battery backup for Rubidium.
- Option 700: Over-the-Air (OTA) Time Error measurement module.

Optional Accessories

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

Related Products

Tempo and Tempo-c

- Provides canned tests for quick testing
- Test PTP, SyncE and legacy networks
- Verify Ethernet performance in either loop-back or peer-to-peer mode
- Simulate realistic traffic conditions
- Rugged and lightweight (<2 kg)

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
- Complete standards compliance testing to ITU-T G.826x/827x
- Test PTP Ordinary Clocks, Boundary Clocks and Transparent Clocks
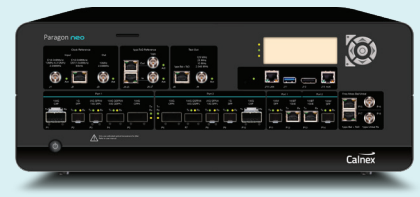
Calnex Paragon-neo

- Delivers high accuracy sub-nanosecond timing measurements at rates up to 100GbE
- Capture and decode PTP packets for analysis and Time Error testing
- Prove SyncE jitter and wander performance to ITU-T G.8262.1/G.8262
- Evaluate MTIE/TDEV pass/fail results to ITU-T G.8262.1/G.8262 masks
- Control ESMC (SSM) message generation for testing to ITU-T G.8264

Calnex Solutions is a global leader in Test and Measurement solutions for next-generation telecom networks. For more information on the Calnex test equipment, 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