Calnex **Paragon-neo**

Calnex
Insight and Innovation

testforce

Solve the timing challenges of 5G

Paragon-neo

Paragon-neo A (PAM4)

Supporting your changing environment

As the world prepares for 5G, the levels of synchronization accuracy and speed of data transfer required are increasing exponentially. In response, the ITU-T is enhancing the G.827x series of standards to cover next-generation accuracy requirements – to ensure that Ethernet systems are robust against varying transmission delays and other effects that can significantly disrupt the precise transfer of timing. These ITU-T standards also form the foundation of timing requirements for new Open Radio Access Networks, and are inherently required for O-RAN compliance.

The Paragon-neo is the latest platform from Calnex, providing PTP and SyncE testing of speeds up to 400GbE (Paragon-neo A (PAM4)) or 100GbE Paragon-neo. It's designed to meet the stringent test requirements of NEMs who are developing, verifying and manufacturing devices against enhanced timing standards such as for ITU-T G.8273.2 Class-C/D Boundary Clocks, O-RAN compliant O-DU and O-RU equipment, and for those designing and deploying 5G networks and systems.

What's more, because high network efficiency and reduced data transmission costs are only possible with highly accurate timing, Paragon-neo offers hardware performance and software test methodologies allowing *sub-nanosecond accuracy* for the entire test system.

To meet the timing challenges of 5G deployments, Calnex is committed to providing the most advanced, precise and reliable test solutions to make sure your devices and systems deliver the high quality network services of the future. In a changing world, it's good to know that some things never change.

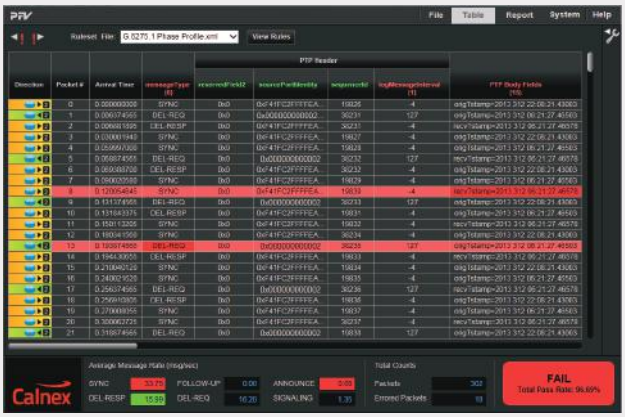
Analyse PTP conformance to standards-based or user-defined profiles, with automatic indication of pass/fail (and reason for non-compliance) and report generation.

Generate SyncE wander and jitter for ITU-T G.8262.1/G.8262 testing, simultaneously measure SyncE wander and PTP Time Error, and control ESMC message generation for testing to ITU-T G.8264.

Emulate PTP clocks to maximise accuracy and repeatability of PTP test, including specific test modes for various DUTs and automatic test selection for ITU-T and O-RAN standards conformance.

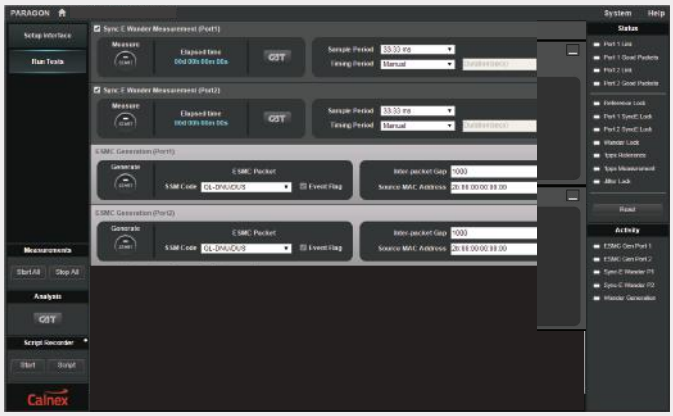
PTP Field Verifier (PFV)

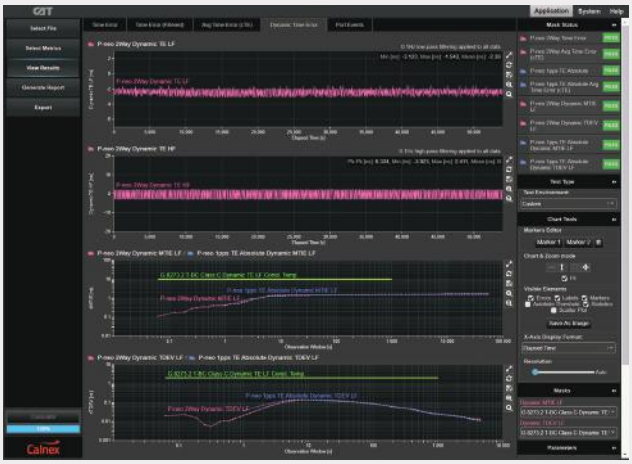
- Analyze PTP protocol for conformance to standards or user-defined profiles.
- Automatic pass/fail indication – check captured PTP messages against a pre-defined set of rules, with clear pass/fail alerts.



Conformance Test Application

- Start testing in seconds – just two clicks to configure crucial standards-defined test sequences.
- Automatically generates PTP and ESMC messages, Time Error and SyncE impairments, and applies filters, metrics and masks.

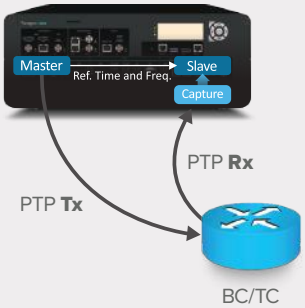




- Analyze the Time Error (TE) of, for example, Class-C/D T-Boundary Clocks or Class-B PRTC/Master Clocks.
- Apply standards-defined Time Error impairments.
- Combine with SyncE and ESMC for complex tests such as Phase Noise Response to SyncE Transient.

PTP Applications

Test hybrid devices simultaneously with PTP Time Error/ SyncE wander and measure output packet timing, recovered clocks and SyncE wander with unbeatable test accuracy and repeatability.



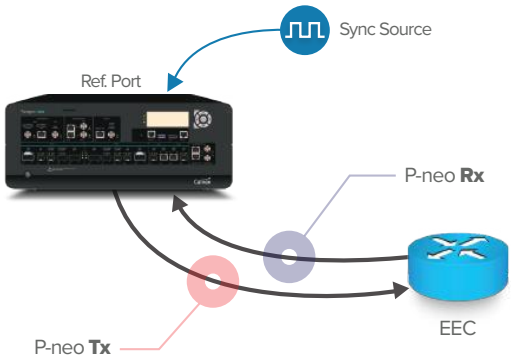
Application	Standard
Boundary Clock Testing	ITU-T G.8273.2
Transparent Clock Testing	ITU-T G.8273.3
PTS and APTS Clock Testing	ITU-T G.8273.4
Master Clock Testing	ITU-T G.8272/8272.1
O-DU and O-RU Testing	O-RAN.WG4.CONF.0

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. Plus, with enhanced graphics, it's easy to evaluate metrics such as MTIE and TDEV against ITU-T and O-RAN masks.

SyncE Applications – ITU-T G.8262.1/G.8262 (Jitter and Wander)

The Paragon-neo supports full SyncE testing to ITU-T G.8262.1/G.8262 including Wander Tolerance, Wander Transfer, Wander (Noise) generation, Pull-in, Hold-in and Pull-out ranges, Frequency Accuracy and Phase Transient, plus Jitter Tolerance and Jitter Generation.



Application	P-neo **Tx**	P-neo **Rx**
SyncE Jitter Generation	Jitter free	Measure Jitter
SyncE Jitter Tolerance	Apply Jitter	Check Test Packets
SyncE Wander (noise) Generation	Wander free	Measure Wander
SyncE Wander (noise) Tolerance	Apply Wander	Check ESMC
SyncE Wander (noise) Transfer	Apply Wander	Measure Wander
SyncE Short Term Phase Transient	Break line or set ESMC QL=DNU	SyncE TIE, MTIE

PTP Performance Summary

- Capture and decode PTP packets for analysis and Time Error testing
- PTP clock emulation, plus the Paragon-neo's unique conformance test application, removes uncertainty and maximizes test repeatability – essential for validating new, high-accuracy 5G network devices
- Automatic test of PTP profile compliance for simple and reliable verification against standards-based or user-defined profile configurations

SyncE Performance Summary

- Prove SyncE 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
- Check ESMC (SSM) messaging to ITU-T G.8264
- Test SyncE jitter performance to ITU-T G.8262.1/G.8262

Specifications

	Product
Optical Interfaces (all optional)	100MbE: SFP 1GbE: SFP 10GbE: SFP+ 25GbE: SFP28 40GbE: QSFP+ 50GbE: QSFP28 100GbE: QSFP28 50GbE (PAM4): SFP56 (Paragon-neo A only) 100GbE (PAM4): QSFP28 (Paragon-neo A only) 200GbE (PAM4): QSFP56 (Paragon-neo A only) 400GbE (PAM4): QSFP-DD (Paragon-neo A only)
Electrical Interfaces	1000/100 BASE-T: RJ45
External Reference Clocks	Lock internal timing reference to external reference. External reference inputs: 64 kHz, 2.048 MHz, 10 MHz, T1 BITS clock (1.544 Mb/s), E1 MTS (2.048 Mb/s).
Internal Reference Clock	Frequency stability over temperature – better than $\pm 1 \times 10^{-9}$. Short term phase stability – better than 500 ps.
Clock Reference Output Ports	2 x 10 MHz/2.048 MHz Reference Outputs (BNC).
Phase Measurement	1PPS – BNC (unbalanced). 1PPS – RJ (balanced).
Frequency measurement	BNC (unbalanced) RJ48 (balanced)
1 PPS + ToD Reference Input	1PPS Unbalanced Input (BNC), 1 pps Balanced Input + ToD (RJ48C). ToD format: CCSA, ITU-T, NMEA.
1 PPS + ToD Reference Output	1PPS Unbalanced Output (BNC), 1 pps Balanced Output + ToD (RJ48C). ToD format: CCSA, ITU-T, NMEA.
	PTP
Standards	IEEE 1588-2008 G.8273.2 including Class-C and Class-D devices. G.8272 including Class-B devices. All relevant G.826x/827x standards.
PTP Time Error Measurement Accuracy	Better than 1 ns for NRZ Optical interfaces.* Better than 5 ns for PAM4 optical interfaces and electrical interfaces.†
timeTransmitter/timeReciever Emulation	Emulate PTP timeTransmitter with full parametric control. Emulate PTP timeReceiver. Add Time Error patterns e.g. G.8273.2, G.8271.1, G.8271.2, G.8261, user-defined.
Time Error Metrics	Built-in (CAT) software including industry-standard ITU-T pass/fail masks with clear pass/fail indication. Time Error (2Way and 1Way) – packet selection and filtering as per ITU-T specifications cTE, dTE, etc.
PTP Packet Analysis	Decode and display PTP Fields with PFV. (Additional options with full PFV licence: Display pass/fail to standards-based or user-defined rules; report generation capability.)
	SyncE
Jitter/Wander Measurement	ITU-T G.8262.1, G.8262 and O.174. Jitter/Wander Generation, Wander Transfer, Jitter/Wander Tolerance, Phase Transient, built-in frequency offset plus generation of sinusoidal, MTIE and TDEV Wander.
Wander Analysis	Built-in (CAT) software including industry-standard ITU-T pass/fail Masks with clear pass/fail indication. ITU-T Masks: G.8261, G.8262, G.8262.1, G.8261.1 Wander Measurements: TIE, MTIE, TDEV, clock FFO.
ESMC (SSM) Features	Decode ESMC messages to ITU-T G.8264 and graph/plot Quality Level (QL) changes graphically (bi-directional). Generate ESMC (SSM) packets as per ITU-T G.8264. Enhanced SSM fully supported.
Phase Wander Measurement Resolution	250ps
	General
PC/Mac or Tablet Control Interface	Web-based GUI with built-in controller enables use of any PC or Android Tablet with any browser with screen resolution of 1024 x 768 pixels. RJ 45 LAN connection to instrument.
Workflow	Graphical test-case driven workflow with real-time status and results. Stimulus/Response test configuration tool. Detailed configuration options also available.
Remote Control	Scripting via TCL, Perl and Python. Automatic Script Recorder for TCL, Perl and Python. Compatible with Calnex Test Sequencer (CTS) for creation/use of specific or user-defined test plans.

* Except 100MbE (5 ns)
† Except 1GbE (15 ns)

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