Data Sheet

Spirent **Paragon-X and Paragon-100G**

Ethernet Sync and OAM

All the measurements you need in one box

As Ethernet sweeps in to address the huge capacity expansion requirements for mobile backhaul it brings with it completely new methods of synchronization. Today, network performance depends on proving overall synchronization quality and probing its underlying packet-layer and physical-layer mechanisms.

Complete analysis of mobile backhaul devices and networks

For Technologies up to 10Gbps the Paragon-X offers direct insight to actual device and service behavior, the Calnex Paragon products are the definitive one-box testers for Sync-E, 1588v2 PTP and NTP synchronisation mechanisms, as well as E1/ T1/ToD sync interfaces and Ethernet OAM. Moreover, the Paragon-X brings together all the measurements you need for the design and verification of Ethernet backhaul synchronisation devices and networks. With the Paragon-X, proving synchronisation performance and quality is now seamless and effortless.

The Paragon-100G is the industry's first 100G SyncE test solution. It precisely measures frequency and phase synchronization in accordance with G.8262 (SyncE) and IEEE 1588 (PTP) standards, and supports wander testing at 40GbE and 100GbE speeds.

Paragon-X

Paragon-100

Features & Benefits

Ethernet OAM performance

- Prove Connectivity Fault Management (CFM) and Performance Monitoring (PM) for Y.1731, 802.1ag and 802.3ah
- Add latency, jitter, errors, dropped packets to prove OAM implementation
- Verify G.8031 Ethernet Linear Protection and G.8032 Ethernet Ring Protection
- Support for thousands of MEGs

Sync-E performance

- Measure Sync-E Jitter and Wander to G.8262
- MTIE/TDEV Pass/Fail evaluation
- One nanosecond accuracy
- ESMC (SSM) message testing and verifying G.8264
- Full hybrid Sync-E/PTP test suite

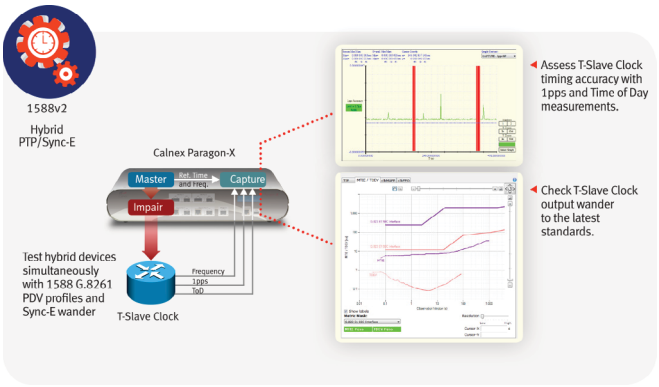
1588v2 & CES performance

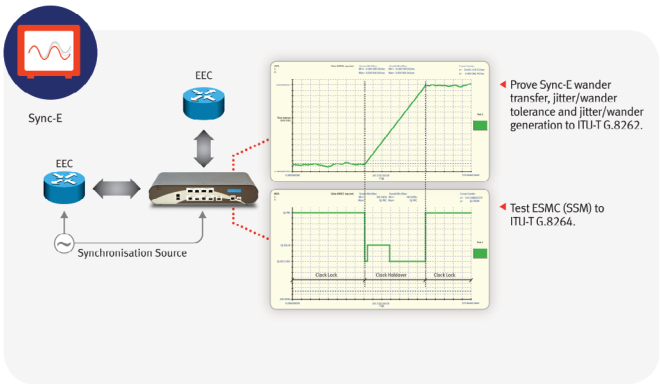
- One-box testing for Master Clock, Slave Clock, Boundary Clock and Transparent Clock devices
- Emulate two PTP masters for BMCA and G.8265 conformance test
- Capture and replay PDV stress profiles
- Run G.8261 and and MEF-18 test cases

Spirent Paragon-X and Paragon-100G

Ethernet Sync and OAM

Applications





Paragon-100G Product Specification	
Sync-E	
Wander Measurement	ITU-T G.8262. Wander Generation, Wander Transfer, Wander Tolerance, Phase Transient, built-in frequency offset plus sinusoidal, MTIE and TDEV wander generation
Wander Analysis	• Built-in (CAT) software including industry-standard ITU-T Pass/Fail Masks with clear Pass/Fail indication • ITU-T Masks: G.813, G.823, G.824, G.8261, G.8262, G.8263, G.8261.1, GR.1244 • Clock Wander Measurements: TIE, MTIE, TDEV, clock MAFE, clock FFO
ESMC (SSM) Features	• Decode ESMC messages to ITU-T G.8264 and graph/plot Quality Level (QL) changes graphically (bi-directional). QLs: PRS, PRC, INV3, SSU-A/ TNC, INV5, INV6, ST2, SSU-B,INV9, EEC2/ST3, EEC1/SEC, SMC, ST3E, PROV, STU/UKN, DNU/DUS • Overwrite ESMC Message to change QL status • Support for industry-standard tool, Wireshark and integrated decode using Tshark
ESMC Generation	• Generate ESMC (SSM) packets per ITU-T G.8264 • QLs: PRS, PRC, INV3, SSU-A/ TNC, INV5, INV6, ST2, SSU-B,INV9, EEC2/ST3, EEC1/SEC, SMC, ST3E, PROV, STU/UKN, DNU/DUS • Generate ESMC Messages, change QL value and measure impact on Wander
SyncE Master	Accuracy traceable to Reference source (refer to Reference Clocks)

Paragon-100G Product Specification (cont.)		
Product		
Optical Interfaces	• Ethernet (optical CXP, CFP2 and QSFP+ modules not supplied) • 100GbE: CXP (SR10) – 2 slots (optional)	• 100GbE: CFP2 (LR4/SR4) – 2 slots (optional)* • 40GbE: QSFP+ (LR4/SR4) – 2 slots (optional)
External Reference Clocks	• Lock internal timing reference to external reference. Reference Lock soft LED indication • External reference inputs: 64 kHz, 2.048 MHz, 10 MHz, T1 BITS clock (1.544 Mb/s), E1 MTS (2.048 Mb/s), SyncE	
Internal Reference Clock	Frequency Stability over Temp: +/-1.5 x 10-7	
Clock Ref. Output Ports	2 x 10 MHz/2.048 MHz Reference Outputs (BNC)	
Clock Measurement1	• 1000BT, 100BT Electrical - RJ45, 1GbE Optical (SFP required) • E1 (2.048 Mb/s), 10 MHz, 2.048 MHz – BNC (unbalanced)	• E1 (2.048 Mb/s), T1 (1.544 Mb/s) – RJ48 (balanced)
Phase Measurement1	• 1 pps – BNC (unbalanced)	• 1 pps – RJ (balanced)
1 pps + ToD Ref. Input1	• 1 pps unbalanced Input (BNC), 1 pps balanced Input + ToD (RJ48C)	• ToD Format: CCSA, CISCO, NTP, NMEA format
1 pps + ToD Ref. Output1	1 pps unbalanced Output (BNC), 1 pps balanced Output + ToD (RJ48C)	
General		
PC/Mac or Tablet Control Interface	Web-based GUI approach 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.	
TCP/IP Settings	TCP Port, IP Address and Gateway settable	
Remote Control	• Scripting via TCL, Perl and Python	• Automatic Script Recorder for TCL, Perl and Python
Indicator/LEDs	• Power On	• 40 GbE QSFP+, 100 GbE CXP, 100 GbE CFP2 (if appropriate option fitted) – Integral LEDs
GPS Rubidium Reference	• PRS/Stratum1 (GPS locked): typical 1 x 10-12	• Outputs: 10 MHz, 1 pps and NMEA ToD

*Note: *100GbE SR4 is a future release*

Paragon-X Product Specifications		
1588v2 (option 201) and CES (option 202)		
	1588v2	CES
Packet Sync rates	Any packet rate	T1, E1, T3, E3 or Any
Protocols	IEEE-1588 (2008)	SAToP, CESoPSN, TDMoIP
Header capture and alarms	MessageType, TransportSpecific, VersionPTP, MessageLength, Flags, CorrectionField, SourcePortIdentity, SequenceID (errors highlighted), ControlField, LogMessageInterval, OriginTimestamp.	• L,R,M,FRG, Length and Sequence number (errors highlighted) • L,R,M Alarm Injection
Graphs displayed	Inter-Packet (SYNC, DELAY_REQ, DELAY_RESP, pDELAY_REQ, pDELAY_RESP, FOLLOW-UP, ALL), Sync PDV (Master-to-Slave PDV), Delay_Req PDV (Slave-to-Master PDV), Slave Clock Wander (T3), Follow-up PDV, Delay_Resp PDV, PDelay_Req PDV, PDelay_Resp PDV, Asymmetry Variation, RTD Variation—Include or Exclude Correction Factor in PDV Calculation, Delay Distribution Curve/Histogram	TIE vs Nominal, TIE vs Measured Average, Delay vs Packet Count, Inter-packet Time (vs Time and vs Packet Count) Delay Distribution Curve/Histogram
Standards	G.8261 (Test Cases 1 – 17), G.8273.2 and MEF-18	
PDV editor suite	• Edit any PDV file from the Graphs • Profile Edits: Extract, Repeat, Copy, Paste (Replace or Insert); Modulate, Scale (%), Banding (Deplete or Concentrate); Adjust Delay Floor	
Measurement accuracy	5ns	
Metrics	ITU-T metrics will be implemente as ratified incl. MTIE, MAFE, ZTIE, PktMTIE, etc.	
Master/slave emulation (option 250)	• Emulate up to two 1588v2 masters with full parametric control and PDV/protocol anomaly addition. Each master can have up to 8 attached slaves. • Emulate one 1588v2 slave • Calculate and display: slave wander, 1pps/ToD accuracy, TC correction field accuracy, BC time error	
Master/Slave Scale emulation and Load testing (Spirent BPK-1155A, BPK-1180, BPK-1001)	• Load testing Boundary clocks, Transparent clocks and Hybrid clocks (1588 + SyncE) • Multiple Masters and 100s of slaves with live traffic	

Paragon-X Product Specifications (cont.)	
Sync-E (options 213, 207, 208, 223)	
Jitter/Wander measurement	To ITU-T G.8262 and O.174 - Jitter/Wander Generation, Wander Transfer, Jitter/Wander Tolerance, Phase Transient Built-in frequency offset plus sinusoidal, MTIE and TDEV wander generation
MTIE/TDEV analysis	Built-in software with ITU-T Masks and Pass/Fail indication
Sync-E master	Accuracy traceable to Reference source used (refer Reference Clocks)
Measurement accuracy	1ns
ESMC (SSM) features to G.8264, G.781, etc.	• Decode ESMC messages to ITU-T G.8264 and plot Quality Level (QL) changes graphically (bi-directional) QLs: PRS, PRC, INV3, SSU-A/TNC, INV5, INV6, ST2, SSU-B, INV9, EEC2/ST3, EEC1/SEC, SMC, ST3E, PROV, STU/UKN, DNU/DUS • Overwrite ESMC Message to change QL status • Support for ESMC Decode and Sync-E in 1588 mode (for concurrent Sync-E and 1588v2 implementations) • Integrated decode using industry-standard tool, Wireshark
ESMC generation	• Generate ESMC (SSM) packets per ITU-T G.8264 • QLs: PRS, PRC, INV3, SSU-A/TNC, INV5, INV6, ST2, SSU-B, INV9, EEC2/ST3, EEC1/SEC, SMC, ST3E, PROV, STU/UKN, DNU/DUS Generate ESMC Messages, change QL value and measure impact on Wander
Capture and decode	Packet Number, Arrival Time, Ethernet Destination Address, Ethernet Source Address OAM Message Type, MEP ID, RDI, Period fps. TransID, TxFCf, RxFCf, TxFCb. Tx Timestamp(f), Rx Timestamp(f), Tx Timestamp(b), Rx Timestamp(b), Maintenance Domain Length, Maintenance Domain Name, Short MA Name Format, Short MA Name Length, Short MA Name, Time To Live, Origin MAC, Target MAC, Relay Action, OUI, TLV Offset, TLVs
Round-trip delay	Based on DMM/DMR messages. Displayed in table and graph. MEF and ITU-T delay methods supported
View filtering	MAC addresses and OAM Message types
Standards supported	ITU-T Y.1731, IEEE 802.1ag, IEEE 802.3ah, ITU-T G.8031, ITU-T G.8032
Message filters for corruption and delay	CCM, LBM, LBR, LTM, LTR, AIS, LCK, TST, APS, MCC, LMM, LMR, 1DM, DMM, DMR, EXM, EXR, VSM, VSR Any combination of above messages. CCM at 1s and 3.33ms both supported
Impairments and delay	Lost, Misordered, Repeated, Errored, AIS/LCK/RDI Generation, Fixed Delay, Variable Delay

Paragon-X Product Specifications (continued)	
Header overwrite	Ethernet Header or OAM Header – overwrite any bit (first 128 bytes) with Hex or Binary value or Invert
Multi-MEG mode	Capture information for 1000s of MEGs including Eth Dest, Eth Src, SVID, CVID, MEL, MEP ID, OAM Message Count, AIS, RDI, CCM, CCM fps, etc.
Physical Interfaces–Ethernet	• 100M Electrical, 100M Optical (SGMII)* • 1G Electrical (optional), 1G Optical (optional) - SFP • 10G Optical (optional) – XFP or SFP+ (LAN-PHY)
Reference clocks	Lock internal timing reference to external reference. Reference Lock soft LED indication External reference inputs: 64kHz, 2.048MHz, 10 MHz; T1 BITS clock; E1 MTS, Sync-E, GPS Internal reference Stratum-3, + 4.6 ppm
PC control interface	Any standard PC or laptop running Windows XP, Vista or 7. RJ45 LAN connection to Instrument
TCP/IP settings	TCP Port, IP Address and Gateway settable
Automatic flow-selection in multi-flow environment	Automatic detection of OAM (MEGs), 1588v2, CES and other flows and filter setup using FlowWizard Filter: (1 to 64 bytes): • Setup messages for capture and replay • Select OAM type within a MEG flow • Select 1588v2 Message type(s) or groups Integrated decode using industry-standard tool, Wireshark
Packet capture memory	Capture complete packet and display contents. The filters can specify the packet types to be captured Internal (2Gb) or External (via USB)
Graph manipulation	Zoom in (X and Y), Zoom out (X and Y), Marker 1, Marker 2, Min/Max display in nanoseconds
Impairments – delay	
Fixed delay	6µs to 10s
Variable delays	• Gaussian, Gamma • User Defined – stored PDV profiles or captures from networks • G.8261 and MEF-18 Test Cases • Sawtooth – Systematic, Beating (F) and Beating (S) • Step Function • Latency Ramp
1588v2 delays applied to	Packet Sending Time, Correction Field or Both
Impairments - corruption	Misordered, Lost, Repeated or Errored Packets
Control	Single, Burst (1 to 10000), Duration (0.1s to 10s), Rate (0.00001% to 99.99999%), Ratio (1E-7 to 9E-1) or Constant
Overwrite header	Any bytes with any value in first 128 bytes
Switch simulation–independently set	• Latency • Buffer Depth (1 byte to 256k bytes) • Bandwidth (0% to 100%)
Timing measurements	E1/T1 Wander – TIE, MTIE, TDEV analysis with ITU-T masks - sample rate 0.1Hz to 100Hz 1pps accuracy – recovered slave clock 1pps vs reference
Simultaneous measurements	1588v2/CES PDV & IPG, E1/T1/2.048MHz TIE/MTIE/TDEV, 1pps Wander/Accuracy
Remote control	Scripting via TCL
Operation & regulatory	Temperature 5-50° C, Humidity 0-95%, CE and EMC (incl. EN-61010, EN-61326, etc.) certified, Voltage 85- 246VAC, 100-240VAC (Nominal) @ 50/60Hz
GPS antenna, receiver and rubidium reference	• PRS/Stratum 1 (GPS-locked): typical 1E-12 • Outputs: 10MHz, 1pps

About Spirent Communications

Spirent Communications (LSE: SPT) is a global leader with deep expertise and decades of experience in testing, assurance, analytics and security, serving developers, service providers, and enterprise networks.

We help bring clarity to increasingly complex technological and business challenges.

Spirent's customers have made a promise to their customers to deliver superior performance. Spirent assures that those promises are fulfilled.

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