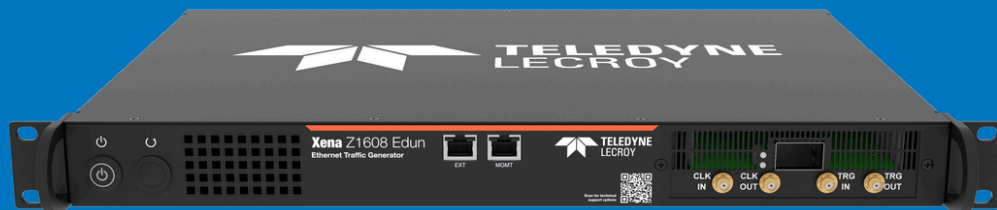


Z1608 Edun

Terabit Ethernet Traffic Generator



Key Features

- Supports 1.6TE, 800GE, 400GE & 200GE speeds using 224G PAM4 SerDes
- Supports 800GE, 400GE, 200GE & 100GE speeds using 112G PAM4 SerDes
- Advanced Physical Layer testing
- Traffic Generation and Analysis
- Quiet & compact chassis suitable for desktop use
- Extensive software package incl. test suites for RFC2544, RFC2889, RFC3918 & Y.1564
- Python-based open-source automation framework (XOA)
- Supports “AI & UE” Solution Track, enabling next-level testing of Ultra Ethernet protocols and features.
- Supports “Advanced Layer 1” Solution track for developers requiring deeper insights into Layer 1 parameters.

The Z1608 Edun traffic generator and analyzer solution can test 5 Ethernet speeds: 1.6T, 800GE, 400GE, 200GE & 100GE - using 224G or 112G SerDes.

The Z1608 Edun is one of the world's first Ethernet traffic generator's capable of testing both 112G and 224G PAM4 SerDes.

Equipped with a high-speed OSFP-1600 IHS or RHS interface the Z1608 can be used with both optical cables, as well as active and passive cables.

The Z1608 Edun is a 1U chassis solution making it the most compact 112G & 224G tester on the market and quiet and lightweight enough for desktop use.

Multiple chassis can be daisy-chained together for multi-port setup, enabling optimal PPM control and latency measurements across multiple chassis'. The chassis stack is managed seamlessly with XM3 and XOA.

Suitable for testing next-gen chips, Ethernet switches, routers, NICs, transceivers & cables, the Z1608 Edun helps developers optimize signal integrity and Bit Error Rate (BER) performance.

Providing the same UI and features as the existing Xena solutions (e.g. Z800 Freya), the Z1608 Edun boasts an extensive list of valuable features and functions for both advanced Layer 1 & Layer 2 testing. The Physical Layer 1 features include insights into advanced PCS and PMA layer testing including dynamic transceiver clock sweep, lane skewing and PRBS pattern generation and statistics.

Z1608 Edun also provides an advanced Signal Integrity View (SIV) feature to provide visual information on signal quality. The Layer 1 features can be combined with an enhanced Traffic Generator with advanced multi-stream support and functionalities such as latency and jitter statistics, modifiers, custom data fields and other features.

Advanced Layer 1 Solution Track enables even more Advanced Layer 1 features on Z1608. Here is more information about Advanced Layer 1 Solution [Track](#)

AI and UE Solution Track enables AI and UE features on Z1608. Here is more information about AI & UE Solution [Track](#)

Advanced test software

Managing the Z1608 Edun is done via XenaManager3, the intuitive multi-user management software for generating and analyzing traffic on all Teledyne LeCroy Xena modules.

Renowned for its ease-of-use, XenaManager3 makes it quick and easy to do performance, QA, functional and benchmark testing.

Xena OpenAutomation (XOA) - our open-source scripting and automation framework - is also included to help automate any available command to the system, with tailored tests, scripting and standardized test methodologies.

Plus there are standalone applications for testing RFC2544, RFC2889, RFC3918 and Y.1564.



NEW!

“AI & UE” and “Advanced Layer 1” Solution Tracks are also available for Z1608 Edun - see separate data sheets for details.

INTERFACES AND STANDARDS			
Number of module cages/connectors	1 x OSFP-1600		
Interface options	224G SerDes 1 x 1.6TE 2 x 800GE 4 x 400GE 8 x 200GE	Line Code PAM4 PAM4 PAM4 PAM4	IEEE/ETC* 802.3dj 802.3dj 802.3dj 802.3dj
	112G SerDes 1 x 800GE 2 x 400GE 4 x 200GE 8 x 100GE	Line Code PAM4 PAM4 PAM4 PAM4	IEEE/ETC* 802.3df (D2.0) / ETC 802.3ck 802.3dj / 802.3ck 802.3ck
	Power capacity in cage: 42W * ETC = Ethernet Technology Consortium		
I2C RX/TX Transceiver Access Speed	Maximum of 1MHz (actual speed depends on the transceiver module)		
Clock Input/Output	2.048MHz, 10.000MHz, 156.25MHz & 625MHz clock input and output to external equipment via SMA connectors, useful for scope jitter measurements etc.		
Trigger And Sync	In and out for triggers and for sync between two or more Z1608 Eduns (up to 4 units) via SMA connectors		

LAYER 1 FEATURES	
Pattern Generation	- PRBS-7Q, PRBS-9Q, PRBS-10Q, PRBS-11Q, PRBS-13Q, PRBS-15Q, PRBS-20Q, PRBS-23Q, PRBS-31Q, PRBS-49Q, PRBS-58Q, SSPRQ - Statistics: Lock status, PRBS errors, PRBS error rate
Physical Coding Sublayer	PCS virtual lane-to-SerDes mapping configuration
Forward Error Correction (FEC)	RS-FEC KP (544, 514, t=15), IEEE 802.3 Clause 76
FEC Error Injection	- RS-FEC KP (544, 514, t=15), IEEE 802.3 Clause 76 - Configuration: Consecutive, Errored Codewords, Total Codewords Per Cycle, Errored Symbols Per Codeword - Bit error mask modes: Static, Rotate, Increment - Pre-defined profiles: Max. Consecutive Uncorrectable w/o Link Loss, Min. Consecutive Uncorrectable with Link Loss - Loop modes: Single, Continuous, Repeat - Injection statistics: Injected FEC Errors; Total Codewords, Total Uncorrectable Codewords, Total Correctable Codewords, Total Error-Free Codewords, Codeword Error Ratio, and Total Symbol Errors
Physical Medium Attachment Layer	- SM-PMA Symbol multiplexing (Clause 176) - BM-PMA Bit multiplexing (Clause 120)
Reconciliation Sublayer (Local/Remote Fault feature)	- Normal: Acts according to 802.3 standard - Force Local: Port will continuously transmit "Local Fault indication". - Force Remote: Port will continuously transmit "Remote Fault indication". - Disabled: Port does not respond to Local/Remote Fault regardless of what it receives on RX. - Current and latched status of Local and Remote Faults - Counts of Local and Remote Faults
PMA Error Injection	Repeatable error injection periods at PMA layer with millisecond precision.
Link Flap	Single shot or repeatable link-down with millisecond precision.
Equalization Controls	Tx Equalization Control
Signal Integrity Analysis	Advanced Signal Integrity View for PAM4 modulated signal quality analysis
PPM Sweep	- Configurable - linear or step sweep +/- 100 ppm

TRANSMIT ENGINES

Traffic Generation	• Wire-speed multi-stream traffic generation • Up to 256 hardware streams per port (64 streams in 224G modes) • Each stream can generate millions of traffic flows using field modifier
Transmit line clock adjustment	• From -100 to 100 ppm in steps of 1 ppm (shared across all ports)
Oscillator Characteristics	• Initial Accuracy is +/- 1 ppm • Frequency drift over 1st year: +/- 2 ppm in total (over 20 years: +/- 3 ppm in total) • Temperature Stability: +/- 0,5 ppm
Transmit Control	• Support adjustment of the effective line rate by forcing idle gaps equivalent to -1000 ppm (increments of 10 ppm) • Configurable Inter-Frame Gap (IFG) from 16 to 63 bytes, default is 20B (12B IFG + 8B preamble) • Support optical laser or copper link enable/disable
Loopback Modes	• L1 RX-to-TX: Any received packet is bounced back through TX • TX(on)-to-RX: Packet goes out of TX but also internally direct to RX • TX(off)-to-TX: Packet goes directly to RX (No link sync needed) • Port-to-Port: Any received packet goes out through the neighbor port
Port Transmit Scheduling Modes	• Normal (stream interleaved mode): Default scheduling mode, precise rates, minor variation in packet inter-frame gap. • Uniform: With 100% uniform packet inter-frame gap, minor deviation from configured rates is available. • Sequential: Streams are scheduled continuously in sequential order, with configurable number of packets per stream. • Burst: Packets in a stream are organized in bursts. Bursts from active streams form a burst group is available. The user specifies time from start of one burst group till start of next burst group.
Stream Profile	• Packet Length: Fixed; Incrementing, Random, Butterfly. Minimum 56 bytes, maximum 16K bytes. • Packet Payload: Incrementing 8-bit, custom pattern (up to 18B repeated) • Burst Traffic with configurable Burst Size, and Burst Density • Flow Control: PFC support for both VLAN tagged and untagged traffic
Stream Header Types	Ethernet, VLAN, ARP, IPv4, IPv6, UDP, TCP, LLC, SNAP, GTP, ICMP, RTP, RTCP, STP, SCTP, MacCtrl, MPLS, PBB, FCoE, FC, IGMPv2, GRE, GTP, VxLAN, NVGRE, DHCPv4, Geneve, eCPRI, RoE, PWE, PFC, Custom.
Stream Modifiers	• Maximum 8 x 24-bit modifiers per stream (2 in 224G modes) • Maximum 4 x 32-bit modifiers per stream (1 in 224G modes) • 24-bit/32-bit header field modifiers with incremental, decremental, or random mode. • Each modifier has configurable bit-mask, repetition, min, max, and step parameters.

TRANSMIT ENGINES, CONT.

Layer 2 Error Injection	• Undersize (56 bytes min), and oversize (12288 bytes max.) packet lengths • FCS Error, Sequence Error, Misordering Error, Payload Integrity Error, Test Payload Error
Multicast	• Support for IPv4 • Up to 8 multicast group addresses • IGMPv2: Join (with configurable repeat interval), Leave All-Devices, Leave, General Query, Group Query • IGMPv3: Exclude (with configurable repeat interval), Include, Change-to-Exclude, Change-to-Include, Multi-group record support
ARP/NDP/Ping	• Auto address resolution • Auto reply to request per port and per stream
LLDP	• Configurable LLDP operation mode, timers, and TLVs • Support mandatory and optional TLV types • Display received LLDP information
Transmit Statistics	• Per-stream: bits/s, bytes/s, packets/s, packets, bytes • Per-port: ARP, NDP, Ping, requests and replies • Per-port injected errors: FCS Error, Sequence Error, Misordering Error, Payload Integrity Error, Test Payload Error • Two real-time histograms per port: TX Packet Length, IFG, or latency distribution for all traffic, a specific stream, or a filter
Packet scheduling modes	• Normal (stream interleaved mode): standard scheduling mode, precise rates, minor variation in packet inter-frame gap. • Strict Uniform: with 100% uniform packet inter-frame gap, minor deviation from configured rates is available. • Sequential packet scheduling (sequential stream scheduling) is available. Streams are scheduled continuously in sequential order, with configurable number of packets per stream. • Burst packets in a stream are organized in bursts. Bursts from active streams form a burst group is available. The user specifies time from start of one burst group till start of next burst group.

RECEIVE ENGINE	
Traffic Receive Capability	Number Of Traceable Rx Streams Per Port : 2016 (64 RX streams in 224G modes) (wire-speed)
Receive Statistics	• Per-stream: bits/s, bytes/s, packets/s, packets, bytes • Per-stream: Packet Loss, Misordered, Payload Errors • Per-stream: Latency and jitter with minimum, maximum and average • Per-port: ARP, NDP, Ping, with requests and replies • Per-port injected errors: FCS Error, Sequence Error, Misordering Error, Payload Integrity Error, Test Payload Error • Two real-time histograms per port: RX Packet Length, IFG, or latency distribution for all traffic, a specific stream, or a filter • Filter statistics: bits/s, bytes/s, packets/s, packets, bytes
Latency Measurement	• Latency can be measured on up to 256 streams (64 RX streams in 224G modes) • Accuracy: ± 16 ns • Resolution: 1 ns (Latency measurements can get calibrated and remove latency from transceiver modules) • Measurement modes: Last-to-last, last-to-first, first-to-last, first-to-first
Jitter Measurement	• Jitter can be measured on up to 256 streams (64 streams in 224G modes) • Jitter (Packet Delay Variation) measurements compliant to MEF10 standard with 1ns accuracy.
Traffic Filter	• 6 x 64-bit configurable match-term patterns with mask, and offset (2 filters in 224G modes) • 6 x frame length comparator terms (longer, shorter) (2 filters in 224G modes) • 6 x configurable filters expressed in logical expressions of the match and length terms (2 filters in 224G modes)
Filter statistics	Per filter: • RX Mbit/s • Packets/s • Packets • Bytes
Capture	• Start Trigger Criteria: FCS errors, filter match, payload error, manual • Stop Trigger Criteria: FCS errors, filter match, payload error, manual, buffer full • Capture Limit Per Packet: 16 – 16383 bytes • Wire-Speed Capture Buffer Per Port: 64 kB • Low Speed Capture Buffer Per Port (10 Mbits/s): 4096 packets (any size) • Packet header auto decode

SPECIFICATIONS	
Physical Format	• 1 rack unit (RU) high with 1 module slots • 1" (H) x 19" (W) x 16.3"(D) (4.8 x 48.26 x 41.4 cm) • 19" rack mount (EIA compatible) • Cooling with variable fan speed based on temperature of system and inserted medium • Front to rear airflow
Weight	16.1 lbs (7.3 kg)
Environmental	• Operating Temperature: 10 to 30°C • Storage Temperature: -40 to 70°C • Humidity: 8% to 90% non-condensing
Noise	Typical. TBD dBa
Power	• AC Voltage: 100-240V • Frequency: 50-60Hz • Max. Power: 600W
Regulatory	• FCC (US) • CE (Europe)
User interface	• Chassis power on/off • Management RJ45 Ethernet (100/1000M BASE-T) • Management interface address: IPv4 and IPv6, static or DHCP • XenaManager (XM3), Xena OpenAutomation (XOA) and XOA CLI • Xena2544, Xena2889, Xena3918, Xena1564
Transceiver management interface	Z1608 Edun provides visibility and control over the complete management interface of the OSFP module inserted into the Z1608 via CMIS.
Connector Insertions	Z1608 Edun modules are provided with high-quality 224Gbps-capable electrical OSFP connectors for optimal signal integrity and performance. These OSFP connectors support a minimum of 1000 cycles (insertions) where optimal signal integrity is guaranteed.

Ordering Information

Product Description	Product Code
• Z1608 Edun OSFP-1600 IHS cage 1.6TE 8-speed 112 & 224G PAM4 SerDes test module - long reach • Z1608 Edun OSFP-1600 RHS cage 1.6TE 8-speed 112 & 224G PAM4 SerDes test module - long reach	C-Edun-1600G-4S-1P-OSFP C-Edun-1600G-4S-1P-OSFP-RHS
• Solution Track for Advanced Layer 1 features on Edun-1600G-4S-1P-OSFP & Edun-1600G-4S-1P-OSFP-RHS • Solution Track for AI & UE features on Edun-1600G-4S-1P-OSFP & Edun-1600G-4S-1P-OSFP-RHS	ST-Edun-1600G-4S-1P-OSFP-L1 ST-Edun-1600G-4S-1P-OSFP-AI



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