LOKI-100G-3S-1P

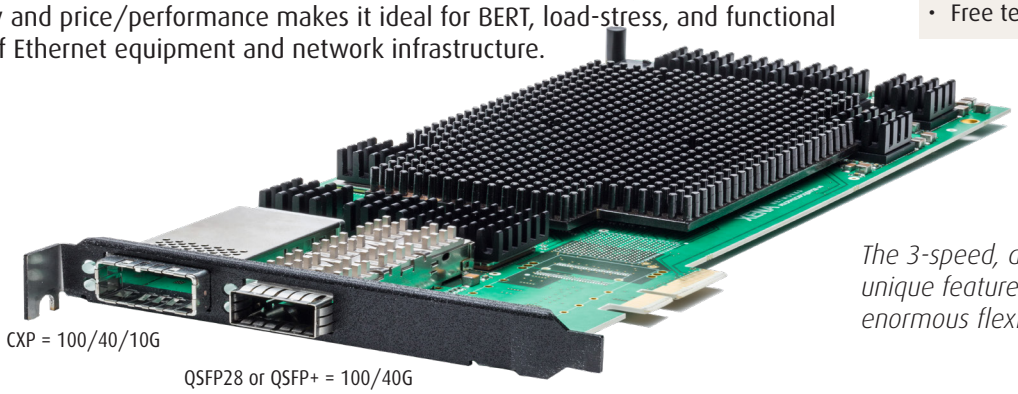
3-speed (100/40/10G) dual-media test module

The Loki-100G-3S-1P is a 3-speed (100/40/10GE) dual-media test module for the ValkyrieCompact and ValkyrieBay chassis (where it fills 2 slots). This cost-optimized test module supports two transceiver form-factors: QSFP28 (CAUI-4), QSFP+ (CAUI), and CXP (CAUI) allowing users to choose either of these transceiver form factors to be active at any time.

When the CXP form-factor is selected, the user can, in addition to a single 100G test port, also use the test module to provide two 40G test ports or eight 10G test ports. This flexibility and price/performance makes it ideal for BERT, load-stress, and functional testing of Ethernet equipment and network infrastructure.

TOP FEATURES

- 3-speed flexibility
- Dual-media value
- Price/performance
- Ease of use
- Unique "eye diagram" feature
- Free software (incl. ValkyrieManager, ValkyrieCLI, Valkyrie2544, Valkyrie1564, Valkyrie3918, and Valkyrie2889)
- Three years' free software updates
- Three years' hardware warranty
- Free tech support product lifetime



CXP = 100/40/10G

QSFP28 or QSFP+ = 100/40G

The 3-speed, dual media format is a unique feature that gives test engineers enormous flexibility.

PORT LEVEL FEATURES

Interface category	CXP QSFP28 QSFP+	• 100G, 40G, and 10G Ethernet • 100G Ethernet • 40G Ethernet
Number of test ports (software configurable)	CXP QSFP28 QSFP+	• 1 x 100G / 2 x 40G / 8 x 10G • 1 x 100G • 1 x 40G
Interface options	CXP QSFP28 QSFP+	• 100GBASE-SR10, 2 x 40GBASE-iSR4 / 8 x 10GBASE-iSR • 100GBASE-SR4 , 100GBASE-LR4, 100GBASE-CWDM4 • 40GBASE-SR4, 40GBASE-LR4, 40GBASE-CR4
Auto Negotiation and Link Training	IEEE 802.3 Clause 73, Auto-negotiation IEEE 802.3 Clause 72, Link training	
Forward Error Correction (FEC)	RS-FEC (Reed Solomon) FEC, IEEE 802.3 Clause 91	
Number of transceiver module cages	1 x CXP, 1 x QSFP28/QSFP+ (one cage can be used at a time)	
Port statistics [1)]	Link state, FCS errors, pause frames, ARP/PING, error injections, training packet All traffic: RX and TX Mbit/s, packets/s, packets, bytes Traffic w/o test payload: RX and TX Mbit/s, packets/s, packets, bytes	
Adjustable Inter Frame Gap (IFG)	Configurable from 16 to 56 bytes, default is 20B (12B IFG + 8B preamble)	
Transmit line rate adjustment	Ability to adjust the effective line rate by forcing idle gaps equivalent to -1000 ppm (increments of 10 ppm)	
Transmit line clock adjustment	From -400 to 400 ppm in steps of 0.001 ppm (shared across all ports)	
ARP/PING	Supported (configurable IP and MAC address per port)	
Field upgradeable	System is fully field upgradeable to product releases (FPGA images and Software)	
Tx disable	Enable/disable of optical laser or copper link	
IGMPv2 multicast join/leave	IGMPv2 continuous multicast join, with configurable repeat interval	
Histogram statistics [1)]	Two real-time histograms per port. Each histogram can measure one of RX/TX packet length, IFG, or Latency distribution for all traffic, a specific stream, or a filter	
Loopback modes	• L1RX2TX – RX-to-TX, transmit byte-by-byte copy of the incoming packet • L2RX2TX – RX-to-TX, swap source and destination MAC addresses (**only at 10G*) • L3RX2TX – RX-to-TX, swap source and destination MAC addresses and IP addresses (**only at 10G*) • TXON2RX – TX-to-RX, packet is also transmitted from the port • TXOFF2RX – TX-to-RX, port's transmitter is idle • Port-to-port – Inline loop mode where all traffic is looped 100% transparent at L1	
Oscillator characteristics	• Initial Accuracy is 3 ppm • Frequency drift over 1st year: +/- 3 ppm (over 15 years: +/- 15 ppm) • Temperature Stability: +/- 20 ppm (Total Stability is +/- 35 ppm)	

100/40GE FRAMED PRBS AND PCS LAYERS

Payload Test pattern	PRBS 2^31
Error Injection	Manual single shot bit-errors or bursts, automatic continuous error injection

Frame size and header	Fixed size from 56 to 9200 bytes, any layer 2/3/4 frame header
Alarms	Pattern loss, bit-error rate threshold
Error analysis	bit-errors: seconds, count, rate mismatch '0' / '1': seconds, count, rate logging and analysis of bit-error event timing
PCS virtual lane configuration	User defined skew insertion per Tx virtual lane, and user defined virtual lane to SerDes mapping for testing of the Rx PCS virtual lane re-order function.
PCS virtual lane statistics	Relative virtual lane skew measurement (up to 2048 bits), sync header and PCS lane marker error counters, indicators for loss of sync header and lane marker, BIP8 errors

TRANSMIT ENGINES

Number of transmit streams per port	64 (wire-speed)
	Each stream can generate millions of traffic flows through the use of field modifiers
Test payload insertion per stream	Wire-speed packet generation with timestamps, sequence numbers, and data integrity signature optionally inserted into each packet.
Stream statistics [1)]	TX Mbit/s, packets/s, packets, bytes, FCS error, Pause
Bandwidth profiles	Burst size and density can be specified. Uniform and bursty bandwidth profile streams can be interleaved
Field modifiers	16-bit header field modifiers with inc, dec, or random mode. Each modifier has configurable bit-mask, repetition, min, max, and step parameters. 2 modifiers per stream
Packet length controls	Fixed, random, butterfly, and incrementing packet length distributions from 56 to 9200 bytes
Packet payloads	Repeated user specified 1 to 18B pattern, a 8-bit incrementing pattern
Error generation	Undersize length (56B min) and oversize length (9200 max.) packet lengths, injection of sequence, misorder, payload integrity, and FCS errors
TX packet header support and RX autodecodes	Ethernet, Ethernet II, VLAN, ARP, IPv4, IPv6, UDP, TCP, LLC, SNAP, GTP, ICMP, RTP, RTCP, STP, MPLS, PBB, or fully specified by user
Packet scheduling modes	• Normal (stream interleaved mode) – standard scheduling mode, precise rates, minor variation in packet inter-frame gap. • Strict Uniform – new scheduling mode, with 100% uniform packet inter-frame gap, minor deviation from configured rates. • Sequential packet scheduling (sequential stream scheduling). 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. The user specifies time from start of one burst group till start of next burst group.

RECEIVE ENGINE

Number of traceable Rx streams per port	480 (wire-speed)
Automatic detection of test payload for received packets	Real-time reporting of statistics and latency, loss, payload integrity, sequence error, and misorder error checking
Jitter measurement	Jitter (Packet Delay Variation) measurements compliant to MEF10 standard with 8 ns accuracy Jitter can be measured on up to 32 streams
Stream statistics [1)]	• RX Mbit/s, packets/s, packets, bytes. • Loss, payload integrity errors, sequence errors, misorder errors • Min latency, max latency, average latency • Min jitter, max jitter, average jitter
Latency measurements accuracy	±64 ns
Latency measurement resolution	8 ns *(Latency measurements can calibrate and remove latency from transceiver modules)*
Number of filters:	• 4 x 64-bit user-definable match-term patterns with mask, and offset • 4 x frame length comparator terms (longer, shorter) • 4 x user-defined filters expressed from AND/OR'ing of the match and length terms.
Filter statistics [1)]	Per filter: RX Mbit/s, packets/s, packets, bytes.

CAPTURE

Capture criteria	All traffic, stream, FCS errors, filter match, or traffic without test payloads
Capture start/stop triggers	Capture start and stop trigger: none, FCS error, filter match
Capture limit per packet	16 – 9200 bytes
Wire-speed capture buffer per port	256 kB for 100G 128 kB for 40G
Low speed capture buffer per port (10Mbit/s speed)	4096 packets (any size)

ADVANCED PHY FEATURES

Transmit Equalization Controls	• Tx Transmit Equalization Controls Pre-emphasis • Tx Attenuation • Tx Post-emphasis Signal Integrity Analysis Graphical "eye" diagram • Rx Optional Auto-Tune of PHY 25Gbps Rx SerDes
Signal Integrity Analysis	• Graphical "eye" diagram • Horizontal bathtub curve estimation • Vertical bathtub curve estimation • Bit Error Rate (BER) estimation
100G 803.bj Clause 91 Reed-Solomon Forward Error Correction (CL91 RS-FEC)	Optional

1) Counter size: 64 bits

UNIQUE EYE DIAGRAM

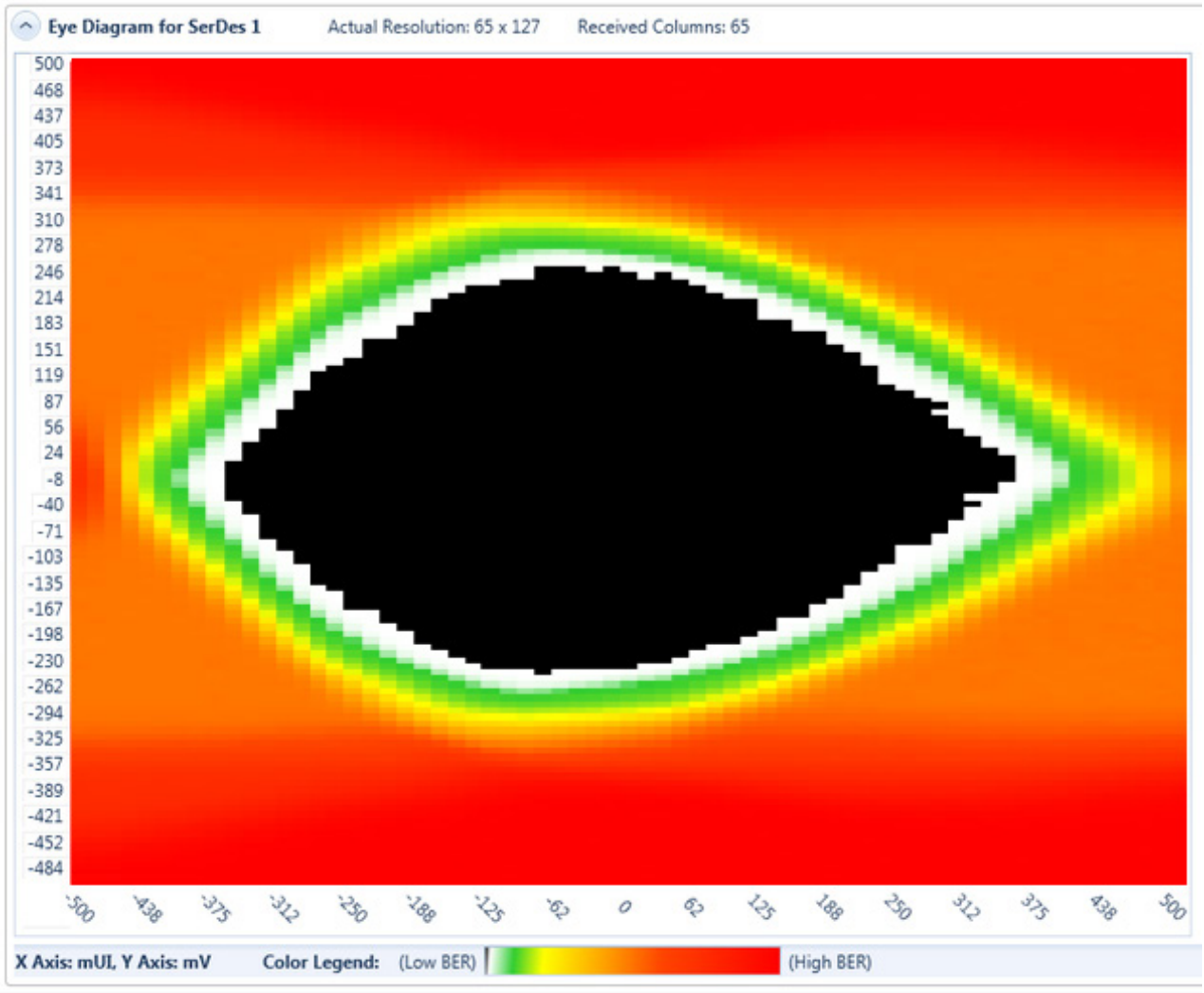
The Loki-100G-3S-1P includes a unique feature for analyzing signal quality called the "eye diagram". When using QSFP28 ports on the Loki-100G-3S-1P, an additional panel called "Advanced PHY Features" will appear in the main Resource Properties tab of ValkyrieManager. This panel controls and monitors the four receive SerDes associated with the 4x10G or 4x25G link at the physical level. It also creates bit-error-rate (BER) eye diagrams, estimates the link BER from the vertical and horizontal BER bathtub curves and controls the PHY tuning in the transmit and the receive directions.

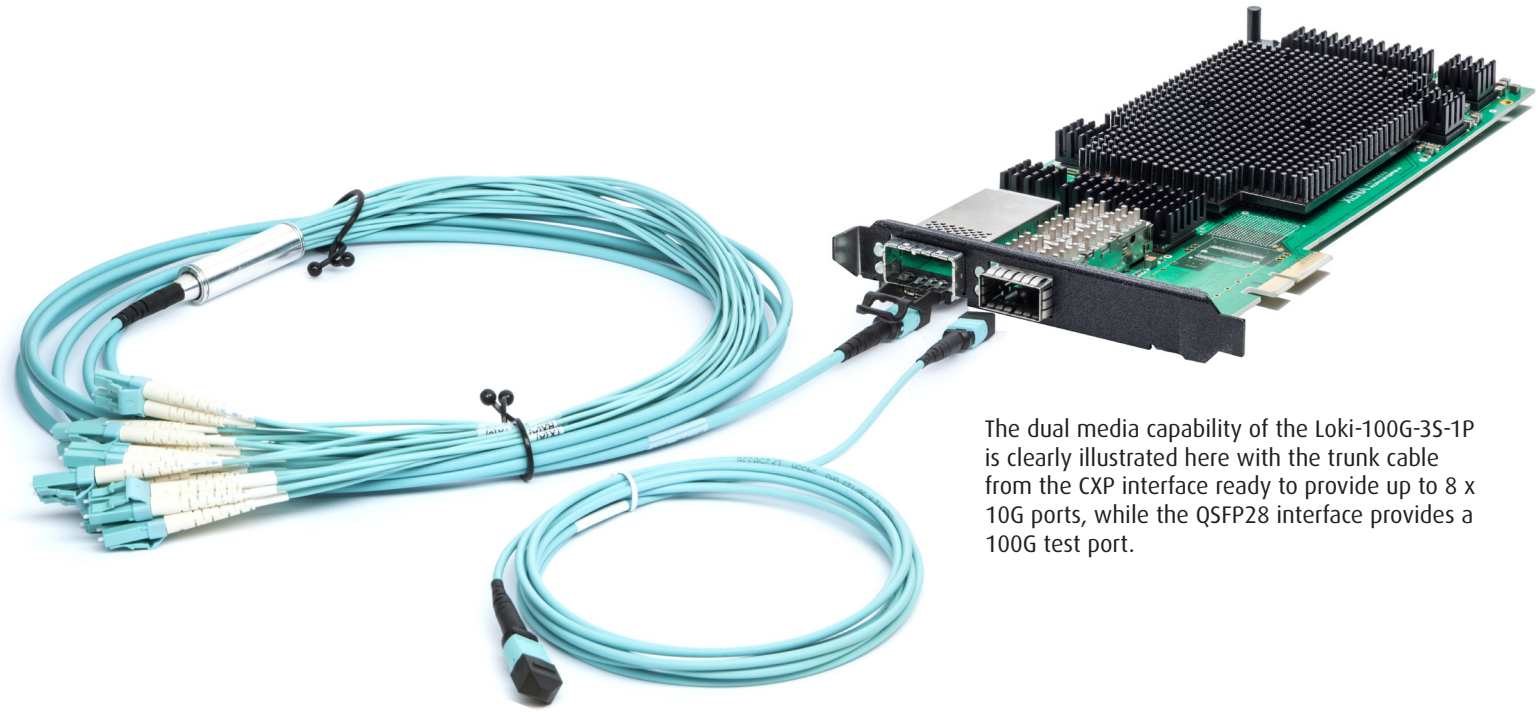
How it works
The BER eye-diagram provides a direct visual representation of the signal quality after RX equalization. The eye-diagram is formed by changing the time dimension (sampling delay) and the amplitude dimension (0/1 threshold) of the sampling point of the PHY step-by-step. For each sampling point (x,y), 1 million bits are measured, the number of bit-errors are counted and a simple division gives the BER. The result is the BER eye-diagram (see below).

The color map shows the measured bit-error rate for each point going from 1 million (maximum red) to zero (black). The color scale is logarithmic. Higher resolutions give a clearer diagram and higher values of X and Y will also give a higher precision in the vertical and horizontal bathtub curve estimations, respectively.

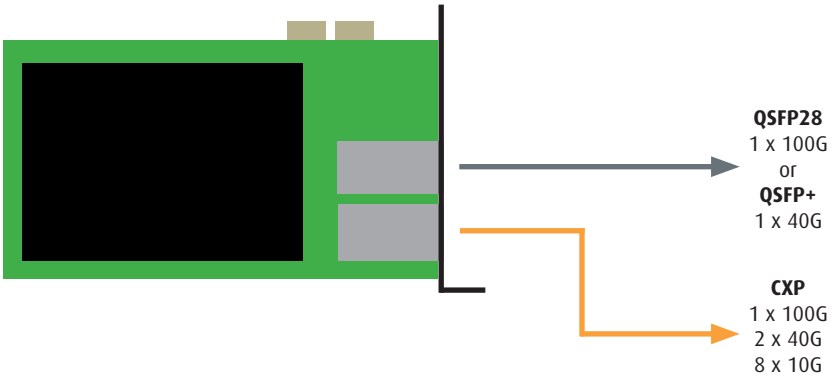
What it shows
The eye-data table provides an estimate of several parameters of the eye, including width, height and jitter. Future releases will also include link BER estimates based on the horizontal and vertical bathtub curves.

Common Parameters	
Width	Estimated eye-width in mUI
Height	Estimated eye-height in mV
Horizontal Bathtub Parameters	
HSlope left	Left slope of the horizontal bathtub curve
HSlope right	Right slope of the horizontal bathtub curve
Y-intercept left	Intersection with the Y-axis on the left side
Y-intercept right	Intersection with the Y-axis on the right side
R-squared fit left	Quality assessment of the estimation. Max = 100.
R-squared fit right	Quality assessment of the estimation. Max = 100.
Est RJrms left	Estimated random jitter (rms) - left side
Est RJrms right	Estimated random jitter (rms) - right side
Est DJpp	Estimated deterministic jitter
Vertical Bathtub Parameters	
VSlope bottom	Bottom slope of the vertical bathtub curve
VSlope top	Top slope of the vertical bathtub curve
X-intercept bottom	Intersection with the bottom X-axis
X-intercept top	Intersection with the top X-axis
R-squared fit bottom	Quality assessment of the estimation. Max = 100
R-squared fit top	Quality assessment of the estimation. Max = 100
Est RJrms bottom	Estimated random jitter (rms) - bottom
Est RJrms top	stimated random jitter (rms) - top





The dual media capability of the Loki-100G-3S-1P is clearly illustrated here with the trunk cable from the CXP interface ready to provide up to 8 x 10G ports, while the QSFP28 interface provides a 100G test port.



SPECIFICATIONS

Dimensions

1U ValkyrieCompact
- W: 19″ (48.26 cm)
- H: 1.75″ (4.45 cm)
- D: 9.8″ (25 cm)
- Weight: 10 lbs (4.5 kg)

4U ValkyrieBay (2 slots)
- W: 19″ (48.26 cm)
- H: 7″ (17.78 cm)
- D: 19.7″ (50 cm)
- Weight: 36.4 lbs (16.5 kg)

Power
- AC Voltage: 100-240V
- Frequency: 50-60Hz
- Max. Power: 90W (ValkyrieCompact) / 120W (ValkyrieBay)
- Max. Current: 0.8A with 120V supply, and 0.4A with 240V supply

Regulatory
- FCC (US), CE (Europe)

Environmental
- Operating Temperature: 10 to 35° C
- Storage Temperature: -40 to 70° C
- Humidity: 8% to 90% non-condensing

Max. Noise
- ValkyrieCompact: 49 dBa
- ValkyrieBay: 58.5 dBa

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