Ospirent™

Spirent fX2

10/1G Dual-Speed Test Modules

The Spirent fX2 10/1G Ethernet dual-speed test modules combine Spirent's industry-leading Layer 2–3 traffic generation and analysis with powerful network emulation and application layer protocols for emulating a wide range of device types, users and protocols. These modules deliver the highest performance per dollar for Layer 2–3 testing. Reduced power consumption and the ability to use a single module throughout the test lifecycle result in lower CapEx and OpEx costs. These modules are ideal for functional, conformance and performance testing of data center and service provider network infrastructure as well as evolving SDN and NFV technologies.

The Spirent fX2 module is available in several port count and speed variations to match your test needs and budget. Dual speed modules are available for 10/1G operation from a single port.

Applications

- **SDN and Data Center**—Validate forwarding performance and functional capabilities of Software Define Networks (SDN) with ultra-low latency and high port density. Supports key technologies like VXLAN, OpenFlow, and FCoE
- **Device Benchmarking**—Test using IETF RFC 2544, RFC 2889 and RFC 3918 methodologies with easy test setup using dynamically bound traffic and automated wizards
- **Core and Edge Routers & Switches**—Verify scale, reliability, performance of Layer 2 & 3 services including data, multicast and video delivered via unicast routing, multicast routing, switching and MPLS VPN technologies
- **Carrier Ethernet**—Verify scale, reliability, performance of Ethernet services delivered via Ethernet OAM, MPLS-TP, VPLS, PWE3 Psuedowires, bridged Ethernet, packet transport protocols or combinations of these technologies
- **Subscriber Emulation**—Verify setup & teardown of thousands of access subscribers using different services over various tunneling technologies (VLAN, L2GRE, MPLS, VPNs, VPLS, etc.) under normal or exceptional traffic conditions
- **Functional, Conformance and Performance Testing**—Validate features, conformance to standards and measure system performance. Multiple port count versions meet your density and cost needs

The Spirent fX2 10/1G Ethernet dual-speed test modules deliver the highest density and lowest total cost of ownership in its class.

Spirent's Layer 2–3 traffic generation and analysis is combined with powerful network emulation and application traffic to deliver the perfect blend of realism, scalability and performance required to test today's networks.

Now with MACsec supported.

Features & Benefits

- High-density 16-port 10G with dual speed 10G/1G modes supported that offers a highly scalable test platform

- 10/1G Ethernet versions are the only high-density dual-speed modules of their type

  – Ports are software controlled for operation in 10G mode or 1G mode and are individually reservable

- Uses SFP+/SFP form-factor for more flexible 10G and 1G interconnect options

- Low total cost of ownership compared to other test modules in its class.

  – Excellent price-performance ratio that delivers faster time-to-market by combining leading-edge technical innovation with Spirent's extensive testing experience

  – Intelligent power control to shut down unused test modules and allows faster boot time to bring capacity back on-line quickly (software update expected 2H'15)

  – More total throughput than the competition for a given power footprint

  – Enhanced chassis software license value—Two to four times the device or end-user emulation per chassis with no increase in software costs

  – Topology emulation lowers Capex by eliminating the need for multiple DUTs in multi-protocol tests

  – Intelligent results get answers in a fraction of the test time required by competitive products

  – Faster boot and firmware upgrade times mean less downtime in continuous running 24x7 regression test beds

- Spirent TestCenter's industry-leading Layer 2–3 feature set.

  – "Hardened" system already proven for testing from a single port up to 2,100 ports

  – Stress ASIC and backplane designs with live traffic changes. The number of emulated devices, the traffic they emanate and the rate at which they send it can all be changed "on the fly" making for more realistic tests and faster troubleshooting

  – Best-in-industry for measuring ultra-low sub-microsecond latencies with 10ns precision and 2.5ns resolution

- 19 different scheduling algorithms available for finding the right traffic to emulate the real-world or tax the device's ability to handle any traffic pattern—from micro-bursts to carefully timed sequences of "killer" frames.

- fX2 modules support Spirent TestCenter's deep analysis system.

  – Port counts, rates, errors and protocol summaries provide a high-level view for quick drill-down to specific issues

  – Broadest set of per stream metrics with simultaneous control and data plane results allows most tests to be run in a single pass

  – Real-time traffic filters allow analysis down to specific fields. Multiple metrics can be simultaneously collected and instantly analyzed

  – Dynamic views feature multi-metric extraction, sorting and operation in real-time or post test

  – Full packet capture enables timing, sequencing, and content analysis for individual packets. Powerful filters ensure the capture buffer is filled with relevant data

Technical information				
fX2 Module Specifications				
Maximum port density	Speed	Maximum ports per slot	Maximum ports per STP-N12U chassis	Maximum ports per SPT-N4U chassis
fX2-10G-S16 supports dual speed 10/1G	10/1G	16	192	32
Media support See accessory table below for part numbers	• 10GBASE-CR (with Clause 73 Auto-Negotiation and Link Training) • Direct Attach Copper Cable • 10GBASE-SR • 10GBASE-LR • 1000BASE-SX • 1000BASE-LX • 1000BASE-T			
Line clocking and packet time stamping – fX2 modules get their transmit line clocking and time-stamping from the control modules on the SPT-N12U and SPT-N4U.	• Stratum-3 rated oscillator is the default time source. Transmit line clock is at the precise nominal Ethernet rate +/- < 1 PPM on initial shipment. Accurate to +/- 4.6 PPM over 15 years of operation. • Frame time stamp resolution of 2.5ns • GPS and CDMA-based external time sources are supported • IEEE 1588v2 and NTP packet-based external time sources are supported • TIA/EIA-95B-based external time sources are supported			
Inter-module and inter-chassis time synchronization	Modules in the same chassis are phase-locked to the timing source of the control module. For modules in separate chassis: • Spirent-patented self-calibrating inter-chassis timing chain using dedicated port on chassis control module delivers precise synchronization +/- 20ns • Synchronized via external GPS or CDMA network • Using IEEE 1588 or NTP packet-based approaches • With TIA/EIA-95B timing inputs			
Transmit clock adjustment	**10/1G:** +/- 102 PPM in 1 PPM increments per 4 ports (1–4, 5–8, 9–12)			
Port CPU	High-performance, server-class, stackable multi-core CPU			
Processor resource aggregation (user-defined aggregation)	TBD			
User reservation	Per 10G or 10/1G port			
Module weight	Q5 versions: 2.65 kg. S8 versions: 2.05 kg			
Module predicted MTBF	Q5 versions = 35,133 hours, S8 versions = 56,330 hours, hours of continuous operation			
Operating temperature range	• Q5 modules supported for 59° to 86° F (15° to 30° C) ambient temperature • All other fX2 modules are supported for 59° to 95° F (15° to 35° C) ambient temperature • 20% to 80% relative humidity			
Max power draw per module	Maximum of 430 W per slot			

Technical Information

Spirent TestCenter Layer 2–3 Traffic Generation

Transmit streams per port (arbitrary values)	64K
Stream block definitions per port	512 stream block definitions each capable of generating multiple streams
Frame templates per port	256 unique frame templates can be transmitted from each port
Transmit statistics per port	• Nearly 50 transmit stats per port reported in real time • Stats include Layer 1, Layer 2 and Layer 3 counters and rates and include counts for frames generated with CRC errors and checksum errors
Transmit statistics per stream	Tx frame count and rate—all Tx statistics accurate even with random frame sizes and rates.
Error and fault generation	Link Fault Signaling and streamblock FCS error and IP checksum errors
Variable Field Definition (VFD) per port	256 VFD indices per port each with 6 VFDs
VFDs per stream	6 VFDs per stream
Route Insertion Table (RIT) entries per port	8M 4-byte entries for dynamic label or random IP/MAC address assignments
RIT or list VFD entries per stream	8 RIT insertions or List VFD insertions per stream
Frame length range	100% line rate for frames of 58–16383 bytes. Sub-line rate for frames from 33–57 bytes.
Frame length controls	Fixed, increment, decrement, random, automatic based on user frame, IMIX w/ weighting for 4 nodes
Frame rate minimum and maximum at wire rate	1 every 3.43s to 102% of line rate
Scheduler mode support	**Port Based:** Traffic scheduling handled at the port level **Rate Based:** Key parameters determined at the port level with division among the individual stream blocks **Priority Based:** Scheduling determined at the stream block level using user-assigned priorities. Precise scheduling of CBR and bursty traffic for QoS testing. **Manual Mode:** Manual control of stream sequence.
Priority flow control	• Generator supports up to 8 queues for responding to PFC Pause frames • Queue support can be integrated with DCBX emulation for automatic setup • PFC Pause frames can be sent manually for DUT response testing or triggered automatically based on configurable received traffic behavior

Spirent TestCenter Layer 2–3 traffic analysis

Trackable streams per port	128K
Statistics per stream	Over 40 real-time measurements per stream—includes standard frame and packet counters and rates and advanced sequence checking, RFC 4689 jitter, latency, FCS errors and checksum errors. • **Advanced sequencing**: In-order, lost, reordered, late and duplicate • **Latency**: Avg, min, max and short-term avg; first/last frame arrival timestamp • **Data integrity**: IP checksum, TCP/UDP checksum, frame CRC, embedded CRC and PRBS bit errors
Statistics per port	• Over 50 transmit stats per port reported in real time. Stats include Layer 1, Layer 2 and Layer 3+ counters and rates and include received FCS, checksum, and PRBS errors and rates. Also available are per-priority level PFC counters and six user-defined (pattern match) counters. • Protocol port counters available for tracking key protocol messages and state information for Routing and MPLS, Carrier Ethernet, GRE, ARP and PFC control plane.

Technical Information	
Spirent TestCenter Layer 2–3 traffic analysis (Cont'd)	
User-defined statistics per port	Six user-defined statistics (count and rate for each) specified by regular expression (using AND, OR and NOT) consisting of byte pattern and offset match and/or frame length range match.
Analyzer real-time filtering—Identify, display and filter by user-configurable protocol field values and ranges.	• Four 16-bit and one 32-bit analyzer filters available per-port for real-time stream analysis of test signature and non-test signature traffic • Filters can be placed over protocol fields with masks and ranges to isolate specific types of traffic and by quality of service values such as: – Transmit stream ID, IPv4/v6 SA/DA, MAC SA/DA, IP TOS/DiffServ, TCP/UDP port, VLAN ID, VLAN priority, MPLS label, MPLS exp plus more
Capture buffer size	256MB per port in 10G mode

Capture buffer controls—Spirent TestCenter's unique capture capability allows maximum effectiveness when debugging hard to find hardware or protocol problems.	• Several modes of operation that include:
	  – Filter by protocol fields, filter by byte offset and range; store slices or full-frames; store signature or all frames; store tx/rx control plane with data plane; real-time mode for control plane traffic; wrap or stop buffer at end
	• User-defined pattern definitions can logically combine 8 filters of up to 32 total bytes
	• Patterns can be applied to start, filter (quality) or stop capture
	• In addition to user-patterns, filtering, starting, and stopping capture contains the following pre-defined events:
	  – FCS, PRBS, IPv4 checksum, TCP/UDP/IGMP checksum, and sequence errors; undersize, oversize, jumbo, and user-defined frame length; IPv4, IPv6, TCP, UDP and IGMP packets; test signature present and test stream ID match
	  – Each event can be independently set to ignore, include or exclude

Priority flow control	• Per-priority measurements for Xon response time • PFC transmit time and post-PFC receive time
Latency modes	Benchmark tests support LIFO, LILO, FIFO or FILO latency calculation methods
High-resolution sampling—High-resolution sampling and charting available for selected port or stream-block counters. Allows detailed analysis of events happening at the millisecond level (e.g., fail-over and re-route performance analysis)	• Available on any receive port or streamblock frame/bit/byte counter or rate • 1000 samples available at intervals of 1–100ms • Sample trigger set by relational operator of user-defined value of sampled statistic • User-defined trigger location within buffer
Histograms	Port-level histograms
Spirent TestCenter protocol emulation	
Spirent TestCenter protocols available as separately licensed packages. Below is a sample list of supported protocols. Contact Spirent for a full list of capabilities and packages.	
Enterprise and data center switch protocol support	• **OpenFlow 1.3/1.0**: OpenFlow switch and controller emulation and switch conformance testing • **Routing, multicast, and bridging**: All major IPv4 and IPv6 unicast and multicast routing protocols, IGMPv1/v2/v3, MLDv1/v2, LACP, STP, RSTP and MSTP • **Data center**: DCBX, FCoE, FIP, 802.1Qbb
Service provider protocol support	• **SDN/NFV**: PCE and Segment Routing • **Routing and MPLS**: All major IPv4 and IPv6 unicast and multicast routing protocols, RSVP-TE, LDP, VPLS-LDP, VPLS-BGP, BGP/MPLS-VPN, Fast Re-route, EVPN, mVPN, P2MP-TE, BFD, TWAMP and PWE3 (RFC4447) • **Access**: ANCP, PPPoE, DHCP, L2TP, IGMPv1/v2/v3, MLDv1/v2, DHCPv6 and PPPoEv6 • **Carrier Ethernet and bridging**: LACP, STP, RSTP and MSTP, 802.1ag CFM, Y.1731, PBB, PBB-TE, Link OAM • **Mobile Backhaul**: MPLS-TP, 1588v2 and Synchronous Ethernet as supported protocols
Automotive applications	• **1588v2 and 8021:** Secure traffic with MACsec on FX2-1G and 10G for in-vehicle network automotive applications.

About Spirent

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.

For more information visit: www.spirent.com

Ordering Information	
Test Modules	
Description	Part Number
Spirent fX2 10/1G SFP+ 16-ports	FX2-10G-S16
Accessories for SFP+ Interfaces	
Optical transceiver SFP+ MSA, 10GbE, 10GBASE-SR, MMF	ACC-6050A
Optical transceiver SFP+ MSA, 10GbE, 10GBASE-LR, SMF	ACC-6051A
Optical transceiver, SFP+ dual-rate, 10 G-1 G, 850NM, MMF	ACC-6081A
Optical transceiver SFP+ dual-rate, 10 G-1 G, 1310NM, SMF	ACC-6082A
Copper transceiver, SFP, 1000BASE-T RJ-45	ACC-6092A
Copper transceiver 10GBASE-T SFP+, RJ45 connector, 30M	ACC-7001A
Copper transceiver MULTIGIG SFP+, RJ-45, 30M Note: 100M/1G/2.5G*/5G*/10G (* 2.5G and 5G operations require relevant licenses	ACC-7103A
MACsec software on FX2	AUTO-SWO-MACsec-FX2
Spirent Chassis	
Spirent N12U chassis and controller with 110 V AC power supplies	SPT-N12U-110
Spirent N12U chassis and controller with 220 V AC power supplies	SPT-N12U-220
Spirent N4U chassis and controller with 110 V AC power supplies	SPT-N4U-110
Spirent N4U chassis and controller with 220 V AC power supplies	SPT-N4U-220

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