Spirent FlexE-100

Features & Benefits

- Industry’s highest density dedicated FlexE test solution
- Industry’s first ITU-T G.mtn ready path and section layer test solution
- Industry’s most feature rich SPN and ITU-T G.mtn based network slicing test solution
- 10x100GBASE-R PHY test ports per module
- Up to 63 emulated FlexE clients per FlexE group
- Comprehensive and scalable FlexE client protocol emulation with L2-L7 traffic generation
- Supports bonding up to 500G per port group
- Client MAC rates ranging from 5GbE, 10GbE, nx25GbE, 40GbE, 100GbE in 5GbE increments
- FlexE bonding, sub-rating and channelization testing
- FlexE shim layer calendar functional testing
- FlexE client bandwidth resizing, SPN and ITU-T G.mtn QoS and traffic isolation testing
- FlexE, SPN and ITU-T G.mtn overhead visibility and alarms error status/conditions
- SPN and ITU-T G.mtn network performance, scalability, and stress testing
- SPN and ITU-T G.mtn channel layer OAM testing
- Comprehensive FlexE client level and traffic stream level statistics
- Support for optical and direct attach cable interconnects

Flex Ethernet (FlexE) provides a generic mechanism for supporting a variety of Ethernet MAC rates that may or may not correspond to any existing Ethernet PHY rate. FlexE dissociates the Ethernet rate on the client end from the actual physical interface by introducing a new shim through the IEEE defined MAC and PCS layers. This includes MAC rates that are both greater than (through bonding) and less than (through sub-rate and channelization) the Ethernet PHY rates used to carry FlexE. It provides a hard pipe network slicing solution with calendar-based channelization.

ITU-T G.mtn (interfaces for a metro transport network) is an emerging international standard that defines two new layers (path and section) for metro networks to transport 5G radio access network (RAN) traffic, both centralized (C-RAN) and distributed (D-RAN), over standard Ethernet and FlexE. G.mtn provides an end to end transport network architecture with the ability to meet the most demanding 5G requirements for network slicing, ultra-low latency and high availability.

Spirent FlexE-100 module was developed as a dedicated solution to address 5G transport, SPN (Slicing Packet Network), and ITU-T G.mtn standard testing needs. FlexE-100 delivers the highest port density FlexE 100GBASE-R PHY solution module in the industry. Each of the 10, QSFP28 interface ports can support 5GbE, 10GbE, nx25GbE, 40GbE, 100GbE Client MAC rates.

Data Center and Service Providers—FlexE is a key technology for Service Providers and Data Centers high density requirements to deliver faster network speeds vs emerging ethernet solutions.

5G Transport and SPN—Network slicing is needed to meet diverse bandwidth, latency, security and time synchronization requirements as well as new 5G applications such as AR, IoT, industrial automation, and autonomous vehicles. FlexE provides a hard pipe network slicing solution enabling multiple slices to be created on a physical 5G transport network for different services and applications.

Decouple Transport Dependency—Maximize PHY to Bandwidth flexibility, decouple control and data plane from physical PHY.

Ethernet control in a Data Center environment—Provisioning of Ethernet traffic in a DCI scenario. Evaluate FlexE use cases topologies and network efficiency.

Cost Effective, Feature Rich, High Density FlexE, SPN and ITU-T G.mtn Testing

Spirent FlexE-100 module offers the highest port density and lowest cost of ownership compared to other test modules in its class with following features:

- Realistic network slicing testing with in-service FlexE client creation and deletion, bandwidth resizing, bandwidth oversubscription, and congestion isolation with multiple FlexE clients, and comprehensive and scalable FlexE client protocol emulation with L2-L7 traffic generation
- Complete end to end SPN STL (Slicing Transport Layer), SCL (Slicing Channel Layer) and SPL (Slicing Packet Layer) testing
# Spirent FlexE-100

## QSFP28 Test Module

### Technical Specifications

<table>
<thead>
<tr>
<th>Module</th>
<th>MAC Rate Clients</th>
<th>Maximum ports per slot</th>
<th>Maximum ports per SPT-N12U chassis</th>
<th>Maximum ports per SPT-N4U chassis</th>
</tr>
</thead>
<tbody>
<tr>
<td>FlexE-100</td>
<td>100/50/40/25/10/5G</td>
<td>10</td>
<td>120</td>
<td>20</td>
</tr>
<tr>
<td>MSA Interface</td>
<td>QSFP28</td>
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</table>

**FlexE Client MAC Rates**: 100G, 40G, nX 25G, 10G, 5G configurable in 5GbE increments

**User reservation**: Per QSFP28 port

**Test Port speed config**: 2 groups (5 QSFP28 cages per group = 500G) ability to bond 500G per group

**FlexE Calendar**
- Tx/Rx calendar status
- PHY selection, Group number, enable disable
- Edit PHY/Group numbers
- Calendar A/B switch
- Tx/Rx Client ID status and modifier

**FlexE Overhead Alarms/Status**
- PHY status indicators
- Overhead error injection
- Group ID status
- Local PCS Fault
- Loss of OH Lock
- Loss of Multiframe lock
- Remote PHY Fault
- Group number mismatch
- PHY number mismatch
- PHY number invalid
- PHY map mismatch
- Calendar configuration mismatch
- Active Calendar Mismatch
- Active Calendar Changed
- Calendar switch mismatch
- FlexE Group level OAM

**FlexE PHY’s**
- 2 available port groups, each port group supports maximum 5 QSFP28 PHY’s
- Up to 63 Clients per FlexE Group
- Tx C, Tx CR, Rx CA
- PHY status: OH Detect, CH Lock, MF Lock, Remote PHY Fault
- Rx C, Rx CR, Tx CA
- Client MAC rates ranging from 5GbE, 10GbE, nx25GbE, 40GbE, 100GbE in 5GbE increments for maximum flexibility of mixed client types

**Transmit / receive streams per FlexE group**: 8K transmit streams and 16K receive streams per FlexE group, shared by all emulated FlexE clients

**Stream blocks per FlexE group**: 64 stream blocks per FlexE group, shared by all emulated FlexE clients

**Route Insertion Table (RIT) Entries**: 8K route insertion table (RIT) entries per FlexE group, shared by all emulated FlexE clients

**VFDs and Variable Fields**: 4 VFD per stream

**Scheduler Mode Support**: FlexE group based (rate per FlexE group), FlexE client based (rate per FlexE client), stream based (rate per stream), burst, timed

**Frame length range and controls**: 100% line rate for frames of 64-16383 bytes controlled by fixed, increment, decrement, random and IMIX modes

**Transmit clock adjustment**: 2.5 ns Tx timestamp resolution with intra-chassis and inter-chassis synchronization
## Technical Specifications

### Spirent FlexE-100 (cont’d)

| Capture buffer size | 1MB capture buffer per FlexE group, shared by all emulated FlexE clients  
| Capture software includes sophisticated trigger and filtering controls |

### FlexE client level statistics

- 1MB capture buffer per FlexE group, shared by all emulated FlexE clients  
- Capture software includes sophisticated trigger and filtering controls  
- TX/RX frames  
- TX/RX bytes  
- L1 TX/RX bps rate  
- Drop count  
- TX/RX sig frames  
- TX/RX FCS frames  
- RX OOS frames

### Stream level statistics

- TX/RX frames  
- TX/RX bytes  
- L1 TX/RX bps rate  
- RX OOS frames  
- Min/Max/Ave Latency  
- Min/Max/Ave Jitter

### Histograms

- FlexE group level and FlexE client level histogram modes for latency, jitter, interarrival time, frame length, sequence run length and sequence difference check

### Module weight

- 2.5 kg, 5.45 lbs.

### Operating temperature range

- Supported for 41° to 95° F (5° to 35° C) ambient temperature. 20% to 80% relative humidity

### Max power draw per module

- Maximum of 420W per slot

## Layer 1 Functionality

### QSFP28 Interconnects

- Optical, Copper

### Layer-1 FlexE Debug Tools & Features

- PCS lane to Virtual lane mapping  
- Block Lock, Synced, MF Error, MF length Error, MF Request Error status  
- Frame Error and BIP Error counts  
- PCS status per PHY  
- PCS status align/align error, misaligned

## SPN and ITU-T G.mtn Channel Layer OAM Emulation

### Performance and Scalability

- Validate DUT channel layer OAM performance and scalability with large number of emulated FlexE clients

### OAM service control

- Enable and disable channel layer OAM on individual FlexE client

### OAM service operation

- FlexE client channel layer OAM insertion and extraction using idle blocks

### OAM with fixed time interval

- Sending and receiving channel layer OAM messages at user configurable fixed block or time interval

### Event triggered OAM

- Event triggered and on demand channel layer OAM messages

### Multi code block OAM

- Sequence numbers in multi code block channel layer OAM messages

### CRC validation

- CRC generation and validation for channel layer OAM messages

### OAM priority scheduling

- Channel layer OAM packet scheduling with different priorities

### OAM function control

- Enable and disable individual channel layer OAM function per FlexE client

### Basic code block function

- Channel layer OAM BAS (basic code block) functions such as REI, RDI, CS_LF, CS_RF, BIP

### APS

- Channel layer OAM APS (automatic protection switching) function

### Connectivity verification

- Channel layer OAM CV (connectivity verification) function

### Client signal

- Channel layer OAM CS (client signal) function

### Delay measurement

- Channel layer OAM one way and two-way DM (delay measurement) function
Technical Specifications

FlexE Client Protocol Emulation

Routing and Switching
- RSVP-TE, Fast Reroute, LDP, L2VPN (PWE3, LDP Signaled VPLS, BGP Signaled VPLS, VPWS), L3VPN, 6VPE, 6PE, EVPN/PBB-EVPN, Multicast VPN Rosen Draft, NG Multicast VPN, mLDP, P2MP-TE, LSP Ping, MPLS-TP, MPLS-TP Y1731 OAM

MPLS
- MPLS RSVP-TE, Fast Reroute, LDP, L2VPN, L3VPN, 6VPE, 6PE, EVPN/PBB-EVPN, Multicast VPN Rosen Draft, NG Multicast VPN, mLDP, P2MP-TE, LSP Ping, MPLS-TP, MPLS-TP Y1731 OAM

Data Center
- VXLAN, EVPN, LLDP/DCBX, FC/FCoE, TRILL, Shortest Path Bridging, OTV, Cisco OpFlex, VEA

Software Defined Networking
- Segment Routing, SR-TE, SRv6, BGP Link State, PCEP, VXLAN, EVPN, Openflow, Openflow Switching Emulation, OVSDB, BGP FlowSpec

Carrier Ethernet
- EOAM, Link OAM, 802.1ag CFM, Y.1731, PBB, PBB-TE, IEEE 1588v2/PTP, Synchronous Ethernet, TWAMP

Broadband Access
- ANCP, PPPoXv4/v6, DHCPv4/v6 Server/Client/Relay Agent, L2TPv2, L2TPv3, PPPoL2TPv2, PPPoL2TPv3, IPv6 Autoconfiguration, IGMPv1/v2/v3, MLDv1/v2, 802.1X

5G Fronthaul
- eCPRI, NGFI/RoE, xRAN, CPRI over RoE

Ordering Information

Test Modules

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<thead>
<tr>
<th>Test Modules</th>
<th>Spirent Application</th>
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<tr>
<td>FlexE-100</td>
<td>Spirent TestCenter</td>
</tr>
<tr>
<td>SPT-N12U-110</td>
<td>Avalanche Commander</td>
</tr>
<tr>
<td>SPT-N12U-220</td>
<td></td>
</tr>
<tr>
<td>SPT-N4U-110</td>
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<tr>
<td>SPT-N4U-220</td>
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</table>

Spirent Chassis

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<thead>
<tr>
<th>Spirent Chassis</th>
<th>Hardware Description</th>
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</thead>
<tbody>
<tr>
<td>SPT-N12U-110</td>
<td>Spirent N12U chassis and controller with 110VAC power supplies</td>
</tr>
<tr>
<td>SPT-N12U-220</td>
<td>Spirent N12U chassis and controller with 220VAC power supplies</td>
</tr>
<tr>
<td>SPT-N4U-110</td>
<td>Spirent N4U chassis and controller with 110VAC power supplies</td>
</tr>
<tr>
<td>SPT-N4U-220</td>
<td>Spirent N4U chassis and controller with 220VAC power supplies</td>
</tr>
</tbody>
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Contact Us

For more information, call your Spirent sales representative or visit us on the web at www.spirent.com/ContactSpirent.

www.spirent.com

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