Test TSN-enabled networks, cabling, devices and systems with a solution emulating a realistic and deterministic environment that speeds up product development and improves quality.

Spirent’s TSN solution can emulate TSN and non-TSN capable end-points allowing creation of realistic network environment with multiple connections, domains and different traffic profiles.

**Solutions**
- Conformance testing (TTworkbench application)
- AVB Conformance Test Suites based on Avnu test plan
- TSN Conformance Test Suites
- Performance & functional testing
- Spirent TestCenter application
- Support across all of the Spirent TestCenter platforms

The Spirent Time-Sensitive Networking (TSN) Test Solutions offer the complete set of tools to achieve conformance and performance testing in a single hardware platform over variety of interfaces and speeds.

**Applications**
TSN test solutions allow Automotive, Industrial, Networking, and Pro AV system and equipment manufacturers, as well as silicon manufacturers to ensure functionality and performance objectives in the following areas:
- R&D testing involving technology feasibility studies and performance modeling
- Device and protocol functional testing
- Conformance and certification testing
- Device, sub-system, or services performance characterization, scalability and availability
- Stress testing requiring higher device and traffic emulation scaling capability as well as higher physical interface connection
- Negative testing to characterize the system resilience

**Features & Benefits**
- Full TSN emulation of multiple talker or listeners on each port
- A comprehensive set of TSN standards supported (please refer to the TSN Standard Coverage table on next page)
- **True Preemption** support allowing creation and scheduling of real preempted segments along with Express traffic at line rate
- Standard specific wizards and result view allow easy to use and quick configuration and analysis possible
- Mixed TSN and non-TSN traffic generation capability on each port
- Highly scalable test topology with precise and consistent timing across the ports regardless of the scale
- TSN specific metrics and statistics measurements
- Highly accurate and precise timing measurements
- Verification of precise synchronization and presentation time
- Support for different Ethernet media types and speeds (10M to 400G)
- Real-time capture and analysis capabilities
- Full protocol decode in Wireshark
Spirent TSN Test Solutions
Conformance and Performance Testing

Realism

- Realistic stateful protocol emulation to exercise protocol state machines
- Realistic emulation of a TSN or a mixed (TSN and non-TSN capable) Ethernet network with multiple connections, endpoints, domains and different traffic profiles

Productivity

- Intelligent Results™ allow users to quickly confirm positive results and identify problematic areas
- Real-time traffic and protocol controls enable the tester to validate and troubleshoot problems by altering the test configuration while the test is running
- Real-time results views allow the user to see how the network responds to changes in specific test conditions without having to stop the test and save the results

<table>
<thead>
<tr>
<th>TSN Standard</th>
<th>Support for Port Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>dX/pX</td>
</tr>
<tr>
<td>IEEE 802.1AS-Rev Timing and Synchronization for Time-Sensitive Applications</td>
<td>✓</td>
</tr>
<tr>
<td>IEEE 802.1Qat Stream Reservation Protocol (SRP)</td>
<td>✓</td>
</tr>
<tr>
<td>IEEE 802.1Qav Forwarding and Queuing for Time-Sensitive Streams (FQTSS)-Credit Based Shaping</td>
<td>✓</td>
</tr>
<tr>
<td>IEEE 802.1Qb Enhancements for Scheduled Traffic-Time Aware Shaping</td>
<td>✓</td>
</tr>
<tr>
<td>IEEE 802.1Qc Asynchronous Traffic Shaping</td>
<td>✓</td>
</tr>
<tr>
<td>IEEE 802.1Qc Cyclic Queuing and Forwarding</td>
<td>✓</td>
</tr>
<tr>
<td>IEEE 1722 Layer 2 AVB Transport</td>
<td>✓</td>
</tr>
<tr>
<td>IEEE 1733 Layer 3 AVB Transport</td>
<td>✓</td>
</tr>
<tr>
<td>IEEE 802.1Qc Per-Stream Filtering and Policing</td>
<td>✓</td>
</tr>
<tr>
<td>IEEE 802.3br Interspersing Express Traffic</td>
<td>✓</td>
</tr>
<tr>
<td>IEEE 802.1Qbu Frame preemption</td>
<td>✓</td>
</tr>
<tr>
<td>IEEE 802.1CB Seamless Redundancy</td>
<td>✓</td>
</tr>
</tbody>
</table>

IEEE 802.1AS-Rev
- Timing and Synchronization for Time-Sensitive Applications
- Supported

IEEE 802.1Qat
- Stream Reservation Protocol (SRP)
- Supported

IEEE 802.1Qav
- Forwarding and Queuing for Time-Sensitive Streams (FQTSS)-Credit Based Shaping
- Supported

IEEE 802.1Qb
- Enhancements for Scheduled Traffic-Time Aware Shaping
- Supported

IEEE 802.1Qc
- Asynchronous Traffic Shaping
- Supported

IEEE 802.1Qc
- Cyclic Queuing and Forwarding
- Supported

IEEE 1722
- Layer 2 AVB Transport
- Supported

IEEE 1733
- Layer 3 AVB Transport
- Supported

IEEE 802.1Qc
- Per-Stream Filtering and Policing
- Supported

IEEE 802.3br
- Interspersing Express Traffic
- Supported

IEEE 802.1Qbu
- Frame preemption
- Supported

IEEE 802.1CB
- Seamless Redundancy
- Supported

IEEE 802.1AS-Rev
- IEEE 802.1AS-Rev Timing and Synchronization for Time-Sensitive Applications
- Supported

IEEE 802.1Qat
- IEEE 802.1Qat Stream Reservation Protocol (SRP)
- Supported

IEEE 802.1Qav
- IEEE 802.1Qav Forwarding and Queuing for Time-Sensitive Streams (FQTSS)-Credit Based Shaping
- Supported

IEEE 802.1Qb
- IEEE 802.1Qb Enhancements for Scheduled Traffic-Time Aware Shaping
- Supported

IEEE 802.1Qc
- IEEE 802.1Qc Asynchronous Traffic Shaping
- Supported

IEEE 802.1Qc
- IEEE 802.1Qc Cyclic Queuing and Forwarding
- Supported

IEEE 1722
- IEEE 1722 Layer 2 AVB Transport
- Supported

IEEE 1733
- IEEE 1733 Layer 3 AVB Transport
- Supported

IEEE 802.1Qc
- IEEE 802.1Qc Per-Stream Filtering and Policing
- Supported

IEEE 802.3br
- IEEE 802.3br Interspersing Express Traffic
- Supported

IEEE 802.1Qbu
- IEEE 802.1Qbu Frame preemption
- Supported

IEEE 802.1CB
- IEEE 802.1CB Seamless Redundancy
- Supported

IEEE 802.1AS-Rev
- IEEE 802.1AS-Rev Timing and Synchronization for Time-Sensitive Applications
- Supported

IEEE 802.1Qat
- IEEE 802.1Qat Stream Reservation Protocol (SRP)
- Supported

IEEE 802.1Qav
- IEEE 802.1Qav Forwarding and Queuing for Time-Sensitive Streams (FQTSS)-Credit Based Shaping
- Supported

IEEE 802.1Qb
- IEEE 802.1Qb Enhancements for Scheduled Traffic-Time Aware Shaping
- Supported

IEEE 802.1Qc
- IEEE 802.1Qc Asynchronous Traffic Shaping
- Supported

IEEE 802.1Qc
- IEEE 802.1Qc Cyclic Queuing and Forwarding
- Supported

IEEE 1722
- IEEE 1722 Layer 2 AVB Transport
- Supported

IEEE 1733
- IEEE 1733 Layer 3 AVB Transport
- Supported

IEEE 802.1Qc
- IEEE 802.1Qc Per-Stream Filtering and Policing
- Supported

IEEE 802.3br
- IEEE 802.3br Interspersing Express Traffic
- Supported

IEEE 802.1Qbu
- IEEE 802.1Qbu Frame preemption
- Supported

IEEE 802.1CB
- IEEE 802.1CB Seamless Redundancy
- Supported

IEEE 802.1AS-Rev
- IEEE 802.1AS-Rev Timing and Synchronization for Time-Sensitive Applications
- Supported

IEEE 802.1Qat
- IEEE 802.1Qat Stream Reservation Protocol (SRP)
- Supported

IEEE 802.1Qav
- IEEE 802.1Qav Forwarding and Queuing for Time-Sensitive Streams (FQTSS)-Credit Based Shaping
- Supported

IEEE 802.1Qb
- IEEE 802.1Qb Enhancements for Scheduled Traffic-Time Aware Shaping
- Supported

IEEE 802.1Qc
- IEEE 802.1Qc Asynchronous Traffic Shaping
- Supported

IEEE 802.1Qc
- IEEE 802.1Qc Cyclic Queuing and Forwarding
- Supported

IEEE 1722
- IEEE 1722 Layer 2 AVB Transport
- Supported

IEEE 1733
- IEEE 1733 Layer 3 AVB Transport
- Supported

IEEE 802.1Qc
- IEEE 802.1Qc Per-Stream Filtering and Policing
- Supported

IEEE 802.3br
- IEEE 802.3br Interspersing Express Traffic
- Supported

IEEE 802.1Qbu
- IEEE 802.1Qbu Frame preemption
- Supported

IEEE 802.1CB
- IEEE 802.1CB Seamless Redundancy
- Supported
The Spirent Advantage

- Easy to use TSN wizards and result views
- The only True Preemption support available allowing creation and scheduling of real preempted segments along with Express traffic at line rate
- Highly capable and accurate traffic generation and analysis
- Highly accurate timing and synchronization measurement (best in class)
- Multi-faceted solution for L2-3 conformance/performance, L4-7 and vulnerability testing in one platform
- Conformance, performance and functional testing in one platform
- Support on all types of interfaces including 100BASE-T1 & 1000BASE-T1
- Support across all speeds from 10M to 400GbE
- Solutions in portable, desktop and rack-mount form factor
- Expandable and scalable test setup

<table>
<thead>
<tr>
<th>APPLICATION LAYER</th>
<th>TCP/IP Protocol Stack</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry 4.0 (e.g. OPC UA over TSN)</td>
<td>AVB</td>
</tr>
<tr>
<td>Automotive (e.g. Infotainment, ADAS, DoIP)</td>
<td>Security</td>
</tr>
<tr>
<td>Telecom (e.g. Fronthaul Traffic)</td>
<td>Redundancy</td>
</tr>
<tr>
<td>Transport (L2)</td>
<td>Quality of Service</td>
</tr>
<tr>
<td>1722-2011 (AVTP)</td>
<td>802.1Qav-2009 (FQTSS/Credit Based Shaper)</td>
</tr>
<tr>
<td>Security</td>
<td>Stream Reservation</td>
</tr>
<tr>
<td>802.1Qbv-2015 (Time Aware Shaper)</td>
<td>802.1Qat-2010 (SRP)</td>
</tr>
<tr>
<td>Redundancy</td>
<td>Time Synchronization</td>
</tr>
<tr>
<td>802.1Qbu-2016 &amp; 802.3br-2016 (Frame Preemption)</td>
<td>802.1AS-2011 (gPTP)</td>
</tr>
<tr>
<td>Quality of Service</td>
<td>TSN</td>
</tr>
<tr>
<td>802.1Qch-2017 (Cyclic Queuing &amp; Forwarding)</td>
<td>1722-2016 (Enhanced AVTP)</td>
</tr>
<tr>
<td>Stream Reservation</td>
<td>802.1Qcr-2017 (Filtering &amp; Policing)</td>
</tr>
<tr>
<td>802.1Qcc-2018 (Enhanced SRP)</td>
<td>802.1CB-2017 (Frame Replication &amp; Elimination)</td>
</tr>
<tr>
<td>Time Synchronization</td>
<td>802.1Qbr-2016 (Frame Preemption)</td>
</tr>
<tr>
<td>802.1CS (LLRP)</td>
<td>802.1Qca-2015 (Path Control &amp; Reservation)</td>
</tr>
<tr>
<td>Quality of Service</td>
<td>802.1Qcc-2018 (Enhanced SRP)</td>
</tr>
<tr>
<td>802.1AS-2011 (gPTP)</td>
<td>802.1CS (LLRP)</td>
</tr>
<tr>
<td>TSN</td>
<td>Device Under Test – DUT</td>
</tr>
<tr>
<td>802.1AS-Rev (Enhanced gPTP)</td>
<td>(e.g. TSN network device, ECU, Gateway)</td>
</tr>
<tr>
<td>PHY (e.g. 100M/1G BASE-T or BASE-T1, 2.5/5/10G)</td>
<td>Conformance, Performance &amp; Functional Testing</td>
</tr>
</tbody>
</table>
### Ordering Information

**Spirent TestCenter Application - Bundled Packages**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUTO-SWA-001</td>
<td>TSN- IEEE 802.1AS &amp; AS-Rev: Enhanced Timing and Synchronization</td>
</tr>
<tr>
<td>AUTO-SWB-201</td>
<td>AVB IEEE 802.1BA STC Pack for Functional and Performance Testing Includes: IEEE 802.1 (AS (-Rev), Qat, Qav), IEEE 1722 &amp; IEEE 1733</td>
</tr>
<tr>
<td>AUTO-SWB-203</td>
<td>TSN PACK 1 - ALL TSN STANDARDS EXCEPT FOR IEEE 802.1QBU (Pre-emption) Includes: IEEE 802.1 (AS (-Rev), Qat, Qav, Qbv, Qci), IEEE 1722, IEEE 1733 &amp; IEEE 802.3br</td>
</tr>
<tr>
<td>AUTO-SWB-204-C1</td>
<td>TSN PACK 2 - PRE-EMPTION BUNDLE FOR C1/C50 Includes: IEEE 802.1Qbu &amp; IEEE 802.3br</td>
</tr>
<tr>
<td>AUTO-SWB-205-C1</td>
<td>TSN SUPER PACK (INCLUDES PACK 1 AND PACK 2) FOR C1/C50 Includes: IEEE 802.1 (AS (-Rev), Qat, Qav, Qbu, Qbv, Qci), IEEE 1722, IEEE 1733 &amp; IEEE 802.3br</td>
</tr>
<tr>
<td>AUTO-SWB-206</td>
<td>TSN TIMING &amp; SYNCHRONIZATION SOLUTION PACK. IEEE 1588 &amp; IEEE 802.1AS</td>
</tr>
<tr>
<td>AUTO-SWB-207</td>
<td>TSN- IEEE 802.1Qci (Per Stream Filtering &amp; Policing) &amp; IEEE802.1AS (gPTP) Pack</td>
</tr>
<tr>
<td>AUTO-SWB-208</td>
<td>TSN- IEEE 802.1Qbv (Time Aware Shaper) &amp; IEEE802.1AS (gPTP) Pack</td>
</tr>
<tr>
<td>AUTO-SWA-010</td>
<td>TSN- IEEE 802.1CB: Frame Replication and Elimination for Reliability</td>
</tr>
</tbody>
</table>

**Individual Packages and License References**

- **A** AUTO-SW-A001 IEEE 802.1AS-Rev: Timing and Synchronization for Time-Sensitive Applications (gPTP)
- **B** AUTO-SW-A002 IEEE 802.1Qat: Stream Reservation Protocol (SRP)
- **C** AUTO-SW-A003 IEEE 802.1Qav: Forwarding and Queuing for Time-Sensitive Streams (FQTSS)
- **D** AUTO-SW-A004 IEEE 1722: Layer 2 AVB Transport
- **E** AUTO-SW-A005 IEEE 1733: Layer 3 AVB Transport
- **F** AUTO-SW-A006 IEEE 802.1Qci - Per Stream Filtering & Policing
- **G** AUTO-SW-A007 IEEE 802.1Qbv: Time Aware Shaper
- **H** AUTO-SW-A008 IEEE 802.3br: Interspersing Express Traffic
- **I** AUTO-SW-A009 IEEE 802.1Qbu: Preemption (per chassis license-all capable port in the chassis are enabled)

**Spirent TTworkbench Application (Conformance)**

- **TEC-SUITE-AVBA** Avnu Automotive AVB Test Suite Pack (for Bridges and End Stations)
- **TEC-SUITE-AVBA-BRIDGE** Avnu Automotive AVB Test Suite Pack (for Bridges)
- **TEC-SUITE-AVBA-ENDSTATION** Avnu Automotive AVB Test Suite Pack (for End Stations)
- **TEC-SUITE-TSN-PRE** TTsuite-TSN-Preemption: Conformance test package for TSN Pre-emption (IEEE802.1Qbu & 802.3br)
- **TEC-SUITE-TSN-TAS** TTsuite-TSN-Time Aware Shaper: Conformance test package for TSN Time Aware Shaper
- **TEC-SUITE-TSN-FP** TTsuite-TSN-Filtering & Policing: Conformance test package for TSN Filtering & Policing
- **TEC-SUITE-TSN-RED** TTsuite-TSN-Redundancy: Conformance test package for TSN Redundancy (IEEE802.1CB)
- **TEC-SUITE-TSN-TSP** TSN Conformance Test Suite Pack: TSN conformance test suite pack includes Pre-emption (PRE), Time Aware Shaper (TAS), Filtering & Policing (FP) and Redundancy (Red) test packs