

# Spirent TestCenter™ Virtual

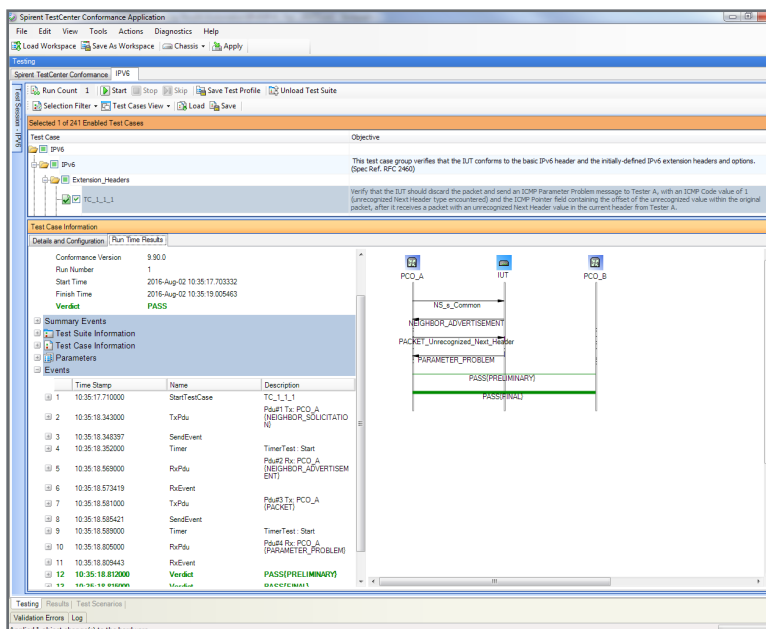
## Conformance Test Solution

The standard for testing tomorrow's networks

Convergence is creating a new generation of integrated network devices and services that are much more complex than ever before. The resulting increased complexity, scarcity of testing skills and architectural shortcomings in current test systems are hurting the ability of manufacturers to ship products on time at escalating quality levels and slowing service providers' ability to deploy networks that get Quality of Experience (QoE) right the first time.

## Increase Productivity: Get there faster with Spirent Conformance Test Solution

- Multiple test suites can be run sequentially without user intervention. This key capability saves time by allowing the user to configure and then execute multiple test suites without any further interaction. The user can then move on to other tasks and analyze the data later in the day once all tests are completed.
- The user can automate all interaction with the device under test, eliminating the need for a user to actively monitor the test
- A hierarchical view of pass, fail, or inconclusive results enables users to quickly find any issues when looking through hundreds or thousands of results
- Multiple results views including pass/fail, packet decodes, ladder diagrams and raw hex views facilitate rapid identification and analysis of failure or inconclusive conditions
- Easily compare the results from multiple test runs to facilitate bug-tracking metrics through regression cycles
- User can rerun tests based on their conclusion in a previous test (e.g. pass, fail, or inconclusive). This unique ability allows users to quickly focus on problem areas during troubleshooting phases of the test cycle.



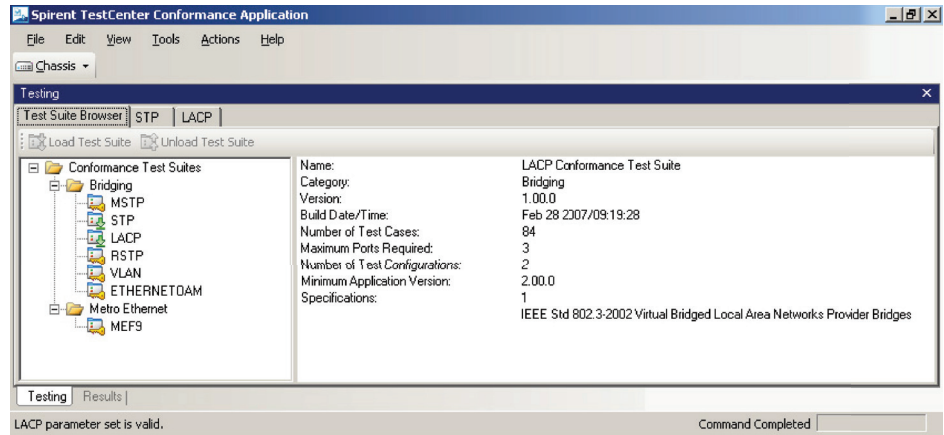
Spirent can help you address this challenge with Spirent TestCenter™ and its innovative Inspire Architecture™. Now you can create and execute more complex test cases in less time with the same resources – and scale tests higher while debugging problems faster. The results: lower CAPEX and OPEX, faster time to market, greater market share and higher profitability. The Conformance Test Solution enables customers to lower development costs and improve product interoperability by identifying correct protocol operation earlier in the development cycle. Best effort is not enough. Ten years ago, enterprises approached data communications as an interesting opportunity to evolve portions of their business. These new capabilities unlocked new sales channels, improved enterprise management and business-to-business transactions on a wide scale. As these facilities migrated from niche deployments to become primary business activities, the underlying network became mission critical.

The data communications industry is evolving to meet the divergent needs of increasing functionality, lowering communications cost and addressing a very large deployment for an ever-increasing customer base. To add to the challenges, new products must work in the same network with existing products from the previous decade of growth.

Interoperability, time-to-market and reliability are critical to the success of any new product or service. Spirent Conformance Test Solution is uniquely suited to help customers improve their testing process and ensure their success in each of the above areas.

Spirent Conformance Test Solution on Spirent TestCenter Virtual enables users to perform conformance testing without the need for Spirent hardware and in turn lowers the total cost of ownership. It can be used by groups beyond Quality Assurance and Product Verification.

The availability of virtual DUT and Conformance Test Solution on Spirent TestCenter Virtual enables users to establish a true virtual test bed for conformance which can be setup and modified quickly and easily.



## Applications

- Determine the level of compliance with the standards and specifications relating to a protocol or application
- Identify protocol failures earlier in the development and integration cycles to reduce project costs
- Isolate which non-interoperable products not behaving

## Benefits

- **Reduce time to test:** By using BPK-1024A, testers can dramatically decrease the time required to test their network devices and qualify their new network services.
  - User interaction with the test execution is completely eliminated. There is no need for the user to actively monitor the system to reconfigure the device under test or to manually start new tests.
  - Multiple test suites can be run simultaneously from a single Conformance Application instance. This change enables chaining multiple test suites together for sequential execution or to run multiple test suites in parallel to reduce test execution time.
  - Each test case is fully documented in the application. The documentation includes the specification section reference, the actual text from the section if the specification is in the public domain, an indication of the number of ports required for the test case, and a graphical depiction of the configuration being tested.
  - Multiple results views and execution options facilitate the rapid identification, comparison, troubleshooting and retesting of test cases.
- **Industry-leading experience:** BPK-1024A represents the next generation of conformance testing from the established leader in test and measurement.
  - Spirent Conformance Test Solution is developed by Spirent and is not a third party product. The primary benefit to the user is seamless and rapid execution of the conformance tests on Spirent TestCenter Virtual and industry-leading technical support.
  - Established expertise in numerous technologies including Ethernet, IPv6, routing, broadband access and multicast technologies.
- **Leverages the investment of a single platform to serve multiple needs.** Spirent TestCenter has been designed from the ground up to serve the needs of the telecommunications industry for the next decade.
  - Spirent Conformance Test Solution works with Spirent TestCenter Virtual, eliminating the need for hardware test modules
  - Once conformance testing is complete, the system can be reused for functional and performance testing.
  - An investment in Spirent TestCenter is protected by the long technological life of this product. Spirent will continue to develop and integrate more solutions into Spirent TestCenter to deliver both a broadened technology footprint and dramatically improved productivity.

## Supported Applications

- Spirent TestCenter Virtual
- Spirent TestCenter Anywhere

## Requirements

- Pentium or greater PC running Windows® with mouse/color monitor required for GUI operation. (See BPK-1001A data sheet for supported operating systems and Minimum PC Requirements)
- One Ethernet cable and one 10/100/1000 Mbps Ethernet card installed in the PC
- Windows or a Unix based server that supports a hypervisor for hosting Spirent TestCenter VM

Ordering Information			
Part No.	Test Package Name	Supported Test Features	Relevant Specifications
IP Routing			
V-TPK-0017	Virtual CTS BGP-4 IPv6 Test Package	<b>BGP-4 for IPv6</b> <ul style="list-style-type: none"> <li>• BGP/OSPF Interaction</li> <li>• BGP Communities Attribute</li> <li>• BGP Route Flap Damping</li> <li>• Route Refresh for BGP-4</li> <li>• AS Confederations</li> <li>• Multiprotocol Extensions for BGP-4</li> <li>• Use of Multiprotocol Extensions</li> <li>• BGP Support for Four-octet AS Number Space</li> <li>• Graceful Restart Mechanism for BGP</li> <li>• Cooperative Route Filtering Capability for BGP-4</li> <li>• BGP Extended Communities Attribute</li> <li>• Capabilities Advertisement with BGP-4</li> <li>• Address Prefix Based Outbound Route Filter for BGP-4</li> </ul>	<ul style="list-style-type: none"> <li>• RFC 4271</li> <li>• RFC 1403</li> <li>• RFC 2439</li> <li>• RFC 2918</li> <li>• RFC 4360</li> <li>• RFC 3392</li> <li>• RFC 2545</li> <li>• Draft-ietf-idr-rfc3065bis-05</li> <li>• draft-ietf-idr-rfc2796bis-02 (obsolete RFC 2796)</li> <li>• draft-ietf-idr-rfc2858bis-08</li> <li>• draft-ietf-idr-as4bytes-12</li> <li>• draft-ietf-idr-restart-10</li> <li>• draft-ietf-idr-route-filter-11</li> <li>• draft-ietf-idr-bgp-prefix-orf-02</li> </ul>
V-TPK-0018	Virtual CTS BGP-4 IPv4 Test Package	<b>BGP-4 for IPv4</b> <ul style="list-style-type: none"> <li>• BGP/OSPF Interaction</li> <li>• BGP Communities Attribute</li> <li>• BGP Route Flap Damping</li> <li>• Route Refresh for BGP-4</li> <li>• AS Confederations</li> <li>• Multiprotocol Extensions for BGP-4</li> <li>• BGP Support for Four-octet AS Number Space</li> <li>• Graceful Restart Mechanism for BGP</li> <li>• Cooperative Route Filtering Capability for BGP-4</li> <li>• BGP Extended Communities Attribute</li> <li>• Capabilities Advertisement with BGP-4</li> <li>• Address Prefix Based Outbound Route Filter for BGP-4</li> </ul>	<ul style="list-style-type: none"> <li>• RFC 4271</li> <li>• RFC 1403</li> <li>• RFC 2439</li> <li>• RFC 2918</li> <li>• RFC 4360</li> <li>• RFC 3392</li> <li>• RFC 2545</li> <li>• Draft-ietf-idr-rfc3065bis-05</li> <li>• draft-ietf-idr-rfc2796bis-02 (obsolete RFC 2796)</li> <li>• draft-ietf-idr-rfc2858bis-08</li> <li>• draft-ietf-idr-as4bytes-12</li> <li>• draft-ietf-idr-restart-10</li> <li>• draft-ietf-idr-route-filter-11</li> <li>• draft-ietf-idr-bgp-prefix-orf-02</li> </ul>

IP Routing			
V-TPK-0019	Virtual CTS IPv4/V6 Interworking Test Package	<ul style="list-style-type: none"> <li>• Common tunneling transition mechanisms, including configured tunneling and automatic tunneling</li> <li>• NAT-PT TCP, UDP and ICMP checksum calculation and checking</li> <li>• NAT-PT FTP Application Level Gateway (ALG) functionality check</li> <li>• Intra-Site Automatic Tunnel Addressing Protocol (ISATAP) verification</li> <li>• Stateless IP/ICMP protocol translation algorithm verification for both IPv4 to v6 and IPv6 to v4 protocol translation</li> <li>• Exercise IPv4 over an IPv6 tunnel in the dual stack transition mechanism</li> <li>• Verify generic packet tunneling including nested encapsulation, tunnel packet size and tunnel error process validation</li> <li>• Functionality verification of the connection of IPv4-IPv6 domains via IPv4 clouds</li> </ul>	<ul style="list-style-type: none"> <li>• Draft-ietf-ngtrans-dstm-07</li> <li>• RFC 2473</li> <li>• RFC 2893</li> <li>• RFC 3056</li> </ul>
V-TPK-0020	Virtual CTS IPv4v6 Interworking Extension Test Package	<ul style="list-style-type: none"> <li>• NAT-PT TCP, UDP and ICMP checksum calculation and checking</li> <li>• NAT-PT FTP Application Level Gateway (ALG) functionality check</li> <li>• Intra-Site Automatic Tunnel Addressing Protocol (ISATAP) verification</li> <li>• Stateless IP/ICMP protocol translation algorithm verification for both IPv4 to v6 and IPv6 to v4 protocol translation</li> </ul>	<ul style="list-style-type: none"> <li>• RFC 2766</li> <li>• RFC 2765</li> <li>• RFC 4214</li> </ul>
V-TPK-1013	Virtual CTS IPv6 Test Package	<ul style="list-style-type: none"> <li>• NDP</li> <li>• Stateless Autoconfiguration</li> <li>• Path MTU Discovery</li> <li>• IPv6 Jumbograms</li> <li>• ICMP</li> <li>• Connecting IPv6 Domains via IPv4 Clouds</li> <li>• Inverse Discovery for NDP</li> </ul>	<ul style="list-style-type: none"> <li>• draft-ietf-ipngwg-icmp-v3-02</li> <li>• RFC 1981</li> <li>• RFC 2374</li> <li>• RFC 2460</li> <li>• RFC 2461</li> <li>• RFC 2675</li> <li>• RFC 3056</li> <li>• RFC 3122</li> <li>• RFC 4443</li> <li>• RFC 2462</li> </ul>
V-TPK-1015	Virtual CTS OSPFv3 Test Package	<ul style="list-style-type: none"> <li>• Adjacency establishment, maintenance, and deletion</li> <li>• Designated router election</li> <li>• Error handling</li> <li>• Preferred path hierarchical routing</li> <li>• Database exchange</li> <li>• Neighbor state verification</li> <li>• Support for virtual link</li> <li>• LSA operation and support for the various LSA fields</li> <li>• Support for different types of routers—such as internal routers, area border routers, backbone routers, and AS boundary routers</li> <li>• OSPFv3 header and IPv6 header format checking for OSPFv3 protocol packets</li> <li>• OSPFv3 packet format checking</li> <li>• Verification of OSPFv3 operation per-link basis</li> <li>• Verification of OSPFv3 multiple protocol instance operation over a single link</li> <li>• Support of multiple prefixes on a single interface</li> <li>• Point-to-point, NBMA (non-broadcast multi-access) and Ethernet network operation</li> </ul>	<ul style="list-style-type: none"> <li>• RFC 2328</li> <li>• RFC 2740</li> </ul>

## IP Routing

V-TPK-1016	Virtual CTS IPv6 Host Testing Test Package	<ul style="list-style-type: none"> <li>• IPv6 tests               <ul style="list-style-type: none"> <li>– Extension headers</li> </ul> </li> <li>• Neighbor Discovery tests               <ul style="list-style-type: none"> <li>– Router Prefix Discovery</li> <li>– Address Resolution &amp; Neighbor Unreachability Detection</li> </ul> </li> <li>• ICMPv6 tests               <ul style="list-style-type: none"> <li>– Processing rules</li> <li>– Error messages</li> <li>– Informational messages</li> </ul> </li> <li>• IPv6 stateless address autoconfiguration</li> </ul>	<ul style="list-style-type: none"> <li>• RFC 2460</li> <li>• RFC 2461</li> <li>• RFC 4443</li> <li>• RFC 2462</li> </ul>
V-TPK-1017	Virtual CTS OSPFV2 Test Package	<ul style="list-style-type: none"> <li>• Adjacency establishment, maintenance, and deletion</li> <li>• Designated router election</li> <li>• Error Handling</li> <li>• Preferred path hierarchical routing</li> <li>• Database exchange</li> <li>• Neighbor state verification</li> <li>• Support for virtual link</li> <li>• LSA operation and support for the various LSA fields</li> <li>• Support for different types of routers, including internal routers, area border routers, backbone routers, and AS boundary routers</li> <li>• Point-to-point, non-broadcast Multi Access (NBMA) and broadcast operation</li> </ul>	<ul style="list-style-type: none"> <li>• RFC 1587</li> <li>• RFC 1765</li> <li>• RFC 1793</li> <li>• RFC 2328</li> <li>• RFC 2370</li> </ul>
V-TPK-1018	Virtual CTS RIPv1V2 Test Package	<ul style="list-style-type: none"> <li>• RIPv1 and RIPv2 interoperability</li> <li>• Request message processing</li> <li>• Response message processing</li> <li>• Packet forwarding via RIP learned routes</li> <li>• Split horizon</li> <li>• Timers</li> <li>• Text authentication</li> </ul>	<ul style="list-style-type: none"> <li>• RFC 2082</li> <li>• RFC 2453</li> </ul>
V-TPK-1028	Virtual CTS VRRP Test Package	<ul style="list-style-type: none"> <li>• VRRP protocol requirements and overview</li> <li>• VRRP packet format</li> <li>• Protocol state machines</li> <li>• Sending and receiving validation</li> <li>• Response to host ARP requests</li> <li>• Multiple Virtual Routers scenario</li> </ul>	<ul style="list-style-type: none"> <li>• RFC 3768</li> </ul>

IP Routing

V-TPK-1029	Virtual CTS IS-ISv4 Test Package	<ul style="list-style-type: none"> <li>• Can be concurrently or separately run in IPv4, and OSI environments</li> <li>• Level 1 and Level 2 adjacency operations, including establishment, maintenance, and deletion for point-to-point and broadcast operations</li> <li>• IPv4 extensions for adjacency establishment</li> <li>• Level 1 and Level 2 adjacency independence for point-to-point and broadcast operations</li> <li>• Designated IS election and resignation</li> <li>• IS-IS Update process integrity for point-to-point and broadcast operations</li> <li>• IS-IS Decision process operation</li> <li>• IPv4 extension summary address operation</li> <li>• Manual routing information propagation</li> <li>• Attach flag management</li> <li>• Address summarization</li> <li>• External link operation</li> <li>• Adjacency state table operation, including maintenance, establishment, and deletion</li> <li>• OSI and IP authentication for link, area, and domain authentication</li> <li>• Level 1 and Level 2 routing</li> <li>• ESH PDU handling/soliciting ES configuration</li> <li>• Protocol error scenarios</li> <li>• PDU encoding errors</li> <li>• Timer jitter measurement</li> </ul>	<ul style="list-style-type: none"> <li>• ISO/IEC 10589:1992</li> <li>• ISO/IEC 10589:1992/Cor.1: 1993</li> <li>• ISO/IEC 10589:1992/Cor.2: 1996</li> <li>• ISO/IEC 10589:1992/Cor.3: 1996</li> <li>• IETF RFC 1195</li> </ul>
V-TPK-1030	Virtual CTS IS-ISv6 Test Package	<ul style="list-style-type: none"> <li>• Can be concurrently or separately run in IPv6, and OSI environments</li> <li>• Level 1 and Level 2 adjacency operations, including establishment, maintenance, and deletion for point-to-point and broadcast operations</li> <li>• IPv6 extensions for adjacency establishment</li> <li>• Level 1 and Level 2 adjacency independence for point-to-point and broadcast operations</li> <li>• Designated IS election and resignation</li> <li>• IS-IS Update process integrity for point-to-point and broadcast operations</li> <li>• IS-IS Decision process operation</li> <li>• IPv6 extension summary address operation</li> <li>• Manual routing information propagation</li> <li>• Attach flag management</li> <li>• Address summarization</li> <li>• External link operation</li> <li>• Adjacency state table operation, including maintenance, establishment, and deletion</li> <li>• OSI and IP authentication for link, area, and domain authentication</li> <li>• Level 1 and Level 2 routing</li> <li>• ESH PDU handling/soliciting ES configuration</li> <li>• Protocol error scenarios</li> <li>• PDU encoding errors</li> <li>• Timer jitter measurement</li> </ul>	<ul style="list-style-type: none"> <li>• Draft-ietf-isis-ipv6-05</li> <li>• ISO/IEC 10589:1992</li> <li>• ISO/IEC 10589:1992/Cor.1: 1993</li> <li>• ISO/IEC 10589:1992/Cor.2: 1996</li> <li>• ISO/IEC 10589:1992/Cor.3: 1996</li> <li>• RFC 1195</li> </ul>

## IP Routing

V-TPK-1041	Virtual CTS RIPNG Test Package	<ul style="list-style-type: none"> <li>• Request Message Processing</li> <li>• Response Message Processing</li> <li>• Split Horizon</li> <li>• Timers</li> <li>• Forwarding</li> </ul>	<ul style="list-style-type: none"> <li>• RFC 3623</li> <li>• RFC 2328</li> </ul>
V-TPK-1034	Virtual CTS OSPFV2 Graceful Restart Test Package	<ul style="list-style-type: none"> <li>• Message Format</li> <li>• Restarting Router</li> <li>• Helper Mode</li> </ul>	<ul style="list-style-type: none"> <li>• RFC 3623</li> <li>• RFC 2328</li> </ul>
V-TPK-1035	Virtual CTS OSPFV3 Graceful Restart Test Package	<ul style="list-style-type: none"> <li>• Message Format</li> <li>• Restarting Router</li> <li>• Helper Mode</li> </ul>	<ul style="list-style-type: none"> <li>• draft-ietf-ospf-ospfv3-graceful-restart-07.txt</li> <li>• RFC 3623</li> <li>• RFC 2328</li> </ul>
V-TPK-1009	Virtual CTS BFD Test Package	<ul style="list-style-type: none"> <li>• BFD Message format verification               <ul style="list-style-type: none"> <li>– State Machine transitions</li> <li>– Sending and receiving of BFD Echo messages</li> <li>– IUT operation in BFD asynchronous and demand mode</li> <li>– Implementation of SHA1, MD5 and Simple Password authentication</li> <li>– Sending and receiving of BFD control packets</li> <li>– Functional testing for BFD Multihop operation</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• draft-ietf-bfd-base-08.txt: Bidirectional Forwarding Detection</li> <li>• draft-ietf-bfd-multihop-06.txt: BFD for Multihop Paths</li> <li>• draft-ietf-bfd-v4v6-1hop-08.txt: BFD for IPv4 and IPv6 (Single Hop)</li> </ul>

## IP Multicast

V-TPK-0021	Virtual CTS PIM-SM IPV6 Test Package	<b>PIM-SM operation over IPV6</b> <ul style="list-style-type: none"> <li>• PIM-SM Finite state machines</li> <li>• Hello message processing and Designated Router Election</li> <li>• Register message processing</li> <li>• Join/Prune message processing</li> <li>• Assert message processing</li> <li>• PIM-SM Timers</li> <li>• PIM-SM packet format</li> <li>• Optional Informational (these test cases verify optional requirements and provide helpful information regarding the support of such requirements on the IUT)</li> <li>• SSM - Source Specific Multicast</li> <li>• Interoperability of PIM-SM with the following host routing protocols: MLDv1 and MLDv2</li> <li>• Support of RIP and BGP unicast routing protocol for creating the PIM-SM multicast routing table</li> <li>• Support for the following Layer 2 types: Broadcast, NBMA and PPP</li> </ul>	<ul style="list-style-type: none"> <li>• Draft-ietf-pim-sm-v2-new-07</li> </ul> <b>Supplementary:</b> <ul style="list-style-type: none"> <li>• Draft-vida-ml-d-v2-07</li> <li>• RFC 2710</li> <li>• RFC 2715</li> </ul>
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IP Multicast			
V-TPK-0022	Virtual CTS PIM-SM IPv4 Test Package	<b>PIM-SM operation over IPv6</b> <ul style="list-style-type: none"> <li>• PIM-SM Finite state machines</li> <li>• Hello message processing and Designated Router Election</li> <li>• Register message processing</li> <li>• Join/Prune message processing</li> <li>• Assert message processing</li> <li>• PIM-SM Timers</li> <li>• PIM-SM packet format</li> <li>• Optional Informational (these test cases verify optional requirements and provide helpful information regarding the support of such requirements on the IUT)</li> <li>• SSM - Source Specific Multicast</li> <li>• Interoperability of PIM-SM with the following host routing protocols: MLDv1 and MLDv2</li> <li>• Support of RIP and BGP unicast routing protocol for creating the PIM-SM multicast routing table</li> <li>• Support for the following Layer 2 types: Broadcast, NBMA and PPP</li> </ul>	<ul style="list-style-type: none"> <li>• Draft-ietf-pim-sm-v2-new-07</li> </ul> <b>Supplementary:</b> <ul style="list-style-type: none"> <li>• Draft-vida-mld-v2-07</li> <li>• RFC 2710</li> <li>• RFC 2715</li> </ul>
V-TPK-0023	Virtual CTS PIM-BSR IPv4 Test Package	<b>PIM-BSR IPv4</b> <ul style="list-style-type: none"> <li>• State transitions for Candidate BSR</li> <li>• State transitions for Non-Candidate BSR</li> <li>• Admin-Scope and Non-Admin scope operation</li> <li>• Periodic Transmission</li> <li>• Updating the RP to group mapping</li> <li>• BSM validation</li> <li>• Bootstrap Message format</li> <li>• C-RP Adv message format</li> </ul>	<ul style="list-style-type: none"> <li>• Draft-ietf-pim-sm-bsr-06</li> </ul>
V-TPK-0024	Virtual CTS PIM- BSR IPv6 Test Package	<b>PIM-BSR IPv6</b> <ul style="list-style-type: none"> <li>• State transitions for Candidate BSR</li> <li>• State transitions for Non-Candidate BSR</li> <li>• Admin-Scope and Non-Admin scope operation</li> <li>• Periodic Transmission</li> <li>• Updating the RP to group mapping</li> <li>• BSM validation</li> <li>• Bootstrap Message format</li> <li>• C-RP Adv message format</li> </ul>	<ul style="list-style-type: none"> <li>• Draft-ietf-pim-sm-bsr-06</li> </ul>
V-TPK-0026	Virtual CTS IGMPv3 Test Package	<ul style="list-style-type: none"> <li>• Format verification for IGMPv3 Query and IGMPv3 Report messages</li> <li>• Operation as an IGMPv3 Group Member</li> <li>• Operation as an IGMPv3-capable Multicast Router</li> <li>• Multicast data forwarding</li> <li>• Interoperability with IGMPv2</li> </ul>	<ul style="list-style-type: none"> <li>• RFC 2236</li> <li>• RFC 3376</li> </ul>
V-TPK-0030	Virtual CTS IGMPv2 Test Package	<ul style="list-style-type: none"> <li>• Format verification for IGMPv2 Query and IGMPv2 Report message</li> <li>• Operation as IGMPv2 Group Member</li> <li>• Operation as IGMPv2 capable Multicast Router.</li> <li>• Interoperability with IGMPv1</li> </ul>	<ul style="list-style-type: none"> <li>• RFC 2236</li> </ul>

## IP Multicast

V-TPK-0031	Virtual CTS IGMP Snooping Test Package	<ul style="list-style-type: none"> <li>• IGMPv2 and IGMPv3 message forwarding</li> <li>• Multicast data forwarding</li> <li>• IGMP v2/v3 interoperability</li> <li>• IGMPv2 and IGMPv3 Snooping Querier</li> </ul>	<ul style="list-style-type: none"> <li>• RFC 4541</li> </ul>
V-TPK-1014	Virtual CTS MLDV2 Test Package	<ul style="list-style-type: none"> <li>• IFormat verification for MLDv2 Query and MLDv2 Report message</li> <li>• Operation as MLDv2 Listener</li> <li>• Operation as MLDv2 capable multicast router</li> <li>• Multicast data forwarding</li> <li>• Informational (these test cases are for optional specifications and provide information regarding the protocol implementation under test)</li> <li>• Interoperability with MLDv1</li> </ul>	<ul style="list-style-type: none"> <li>• RFC 3810</li> </ul>
V-TPK-1019	Virtual CTS MLD Snooping Test Package	<ul style="list-style-type: none"> <li>• MLDv1 and MLDv2 message forwarding</li> <li>• Multicast data forwarding.</li> <li>• MLDv1/v2 Interoperability</li> <li>• MLDv1 and MLDv2 Snooping Querier</li> </ul>	<ul style="list-style-type: none"> <li>• RFC 4541</li> </ul>
V-TPK-1040	Virtual CTS MLDV1 Test Package	<ul style="list-style-type: none"> <li>• IPv6 header options, source and destination addresses formatting</li> <li>• MLD messages formatting and contents validation</li> <li>• Reserved fields handling</li> <li>• Multicast group joining/leaving procedures</li> <li>• Startup procedures</li> <li>• Multicast group solicitation procedures</li> <li>• Querier and Non-Querier operations and transition procedures</li> </ul>	<ul style="list-style-type: none"> <li>• RFC 2464</li> <li>• RFC 2710</li> <li>• RFC 2711</li> </ul>
V-TPK-1039	Virtual CTS MSDP Test Package	<ul style="list-style-type: none"> <li>• MSDP Protocol Operation <ul style="list-style-type: none"> <li>– Caching SA- messages.</li> <li>– MSDP Peer-RPF forwarding.</li> <li>– MSDP mesh group operation.</li> <li>– Source-Active Filtering</li> </ul> </li> <li>• MSDP Packet Format Verification <ul style="list-style-type: none"> <li>– Source-Active Message processing</li> <li>– Source-Active TLV format verification</li> <li>– Packet Format Error processing</li> </ul> </li> <li>• MSDP Timers</li> </ul>	<ul style="list-style-type: none"> <li>• RFC 3618</li> </ul>

VPN & MPLS

V-TPK-0025	Virtual CTS PWE3 Ethernet Encap Test Package	<b>Ethernet, Ethernet VLAN</b> <ul style="list-style-type: none"> <li>• Pseudowire signaling (using LDP) including tunnel establishment, tunnel deletion and tunnel error handling</li> <li>• Pseudowire signaling support for capability exchange for control word usage, FCS retention, Fragmentation, VCCV</li> <li>• Pseudowire status notification using either label withdraw, PW Status TLV or wildcard withdraw</li> <li>• Pseudowire signaling support for Generalized PWID FEC (129), including support for related TLVs (Group ID TLV and PW Interface Parameters TLV)</li> <li>• Layer 2 error handling</li> <li>• Sequence number processing</li> <li>• Virtual Circuit Connectivity Verification (VCCV) with LSP-Ping Encapsulation</li> <li>• Ethernet encapsulation FCS retention</li> <li>• Ethernet encapsulation fragmentation</li> <li>• RSVP-TE or LDP as core tunneling protocol</li> </ul>	<ul style="list-style-type: none"> <li>• draft-ietf-pwe3-control-protocol-17</li> <li>• draft-ietf-pwe3-ethernet-encap-11</li> <li>• RFC 4385</li> <li>• draft-ietf-pwe3-fcs-retention-04</li> <li>• draft-ietf-pwe3-fragmentation-10</li> <li>• draft-ietf-pwe3-vccv-07</li> </ul>
V-TPK-0028	Virtual CTS VPLS Test Package	<ul style="list-style-type: none"> <li>• Supports different MPLS label distribution mechanisms (RSVP-TE, LDP) for tunnel label distribution within the MPLS core network</li> <li>• Supports the following layer 2 encapsulations <ul style="list-style-type: none"> <li>– Ethernet</li> <li>– Ethernet VLAN</li> <li>– Control Word usage</li> </ul> </li> <li>• Verifies VC Tunnel Set Up <ul style="list-style-type: none"> <li>– VC tunnel establishment</li> <li>– Control Word negotiation</li> <li>– VC tunnel deletion</li> </ul> </li> <li>• Verifies VPLS topological model <ul style="list-style-type: none"> <li>– Data flooding (proper operation w/ various multicast, broadcast and unknown addresses)</li> <li>– Spanning tree protocol PDU handling</li> </ul> </li> <li>• Verifies Control Plane functionality - MAC TLV handling in Address Withdraw message</li> <li>• Verifies data forwarding functionality - Support of qualified and unqualified learning for overlapping and unique customer MAC address space</li> <li>• Verifies Hierarchical Model support <ul style="list-style-type: none"> <li>– Interworking of the IUT with MTUs or PEr</li> <li>– Exercises the redundant spoke connections</li> </ul> </li> <li>• Functional Tests <ul style="list-style-type: none"> <li>– Checks for proper MAC address learning across user-specified range of MAC addresses and/or VLAN IDs from directly connected customer interfaces and from pseudo-wire connected interfaces.</li> <li>– Checks for proper packet forwarding across user-specified range of MAC addresses and/or VLAN IDs from core to edge and from edge to core.</li> <li>– Checks for proper packet forwarding w/ different ether type fields</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• RFC 4762</li> <li>• RFC 4447</li> <li>• RFC 4448</li> <li>• RFC 4665</li> <li>• RFC 4385</li> </ul>

## VPN & MPLS

V-TPK-1048	Virtual CTS Point-To-Multipoint RSVP-TE Test Package	<b>This test suite includes coverage for the following areas:</b> <ul style="list-style-type: none"> <li>• P2MP Mechanism</li> <li>• P2MP Path Message</li> <li>• Multiple sub LSPs in single Path</li> <li>• Multiple Path messages</li> <li>• P2MP Resv Message</li> <li>• Resv Message Throttling</li> <li>• ERO/SERO Processing</li> <li>• RRO/SRRO Processing</li> <li>• Path Tear Message</li> <li>• Notify Messages</li> <li>• ResvConf Messages</li> <li>• P2MP State Management</li> <li>• Error Processing : PathErr/ResvErr and Branch Failure Handling</li> <li>• Compatibility with P2P</li> <li>• LSP Remerge</li> <li>• P2Mp Message Object encodings</li> <li>• Invalid Packet handling</li> </ul>	<ul style="list-style-type: none"> <li>• RFC 4875 Extensions to Resource Reservation Protocol - Traffic Engineering (RSVP-TE) for Point-to-Multipoint TE Label Switched Paths (LSPs)</li> </ul>
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## Security

V-TPK-0027	Virtual CTS 802.1X Test Package	<ul style="list-style-type: none"> <li>• Verifies both the Authenticator and the Supplicant functionalities</li> <li>• Authenticator verification supports the use of a third-party Authentication Server (for example FreeRadius) or Spirent's own emulated RADIUS server</li> <li>• Exercises the test scenarios between the Backend Authentication state machine and the RADIUS server</li> <li>• Supports the use of either IPv4 or IPv6 for the RADIUS session</li> <li>• Supports the use of either IPv4 data packets or IPv6 data packets for verifying data path connectivity</li> </ul>	<ul style="list-style-type: none"> <li>• IEEE 802.1X-2004</li> </ul> <b>Supplementary standards from the IETF:</b> <ul style="list-style-type: none"> <li>• RFC 3748</li> <li>• RFC 2865</li> <li>• RFC 3579</li> <li>• RFC 3850</li> <li>• RFC 1994</li> <li>• RFC 2246</li> <li>• RFC 2716</li> <li>• draft-josefsson-pppext-eap-tls-eap-06.txt</li> </ul>
V-TPK-1026	Virtual CTS IEEE 802.1X Advanced With PEAP And TLS Test Package	<ul style="list-style-type: none"> <li>• Verifies both the Authenticator and the Supplicant functionalities</li> <li>• Uses Spirent's own emulated RADIUS server - the RADIUS server is emulated within the test suite itself and exercises the test scenarios between the Backend Authentication state machine and the RADIUS server</li> <li>• Supports MD5, EAP-TLS and PEAP based authentication type PDUs</li> <li>• Supports the use of IPv4 for the RADIUS session</li> <li>• Supports the use of either IPv4 data packets or IPv6 data packets for verifying data path connectivity</li> </ul>	<ul style="list-style-type: none"> <li>• IEEE 802.1X-2004</li> </ul> <b>Supplementary standards from the IETF:</b> <ul style="list-style-type: none"> <li>• RFC 3748</li> <li>• RFC 2865</li> <li>• RFC 3579</li> <li>• RFC 3850</li> <li>• RFC 1994</li> <li>• RFC 2246</li> <li>• RFC 2716</li> <li>• draft-josefsson-pppext-eap-tls-eap-06.txt</li> </ul>

Carrier Ethernet			
V-TPK-0029	Virtual CTS Ethernet CFM (802.1ag) Test Package	<b>Verifies:</b> <ul style="list-style-type: none"> <li>• Connectivity Check Protocol</li> <li>• Linktrace Protocol</li> <li>• Loopback Protocol</li> <li>• MEP and MHF functions</li> <li>• Validation tests of CFM PDUs and TLVs</li> </ul>	<ul style="list-style-type: none"> <li>• IEEE 802.1ag-D8</li> </ul>
V-TPK-0034	Virtual CTS Ethernet Link OAM (802.3ah) Test Package	<b>Verifies:</b> <ul style="list-style-type: none"> <li>• OAM sublayer for Active and Passive mode functionalities</li> <li>• OAMPDU Reception</li> <li>• OAMPDU Transmission</li> <li>• Verify the OAM discovery mechanism</li> <li>• Verify the OAM transmit state diagram</li> <li>• Verify the OAM sublayer multiplexer state diagram</li> <li>• Verify the OAM Parse state diagram</li> <li>• Verify the OAM functions for monitoring link operation such as remote loopback control.</li> <li>• Initiating OAM Remote Loopback</li> <li>• During OAM Remote Loopback</li> <li>• Exiting OAM Remote Loopback</li> <li>• Verify the OAM Event Notification for link operation</li> </ul>	<ul style="list-style-type: none"> <li>• IEEE 802.3ah</li> </ul>
V-TPK-1006	Virtual CTS MEF9 Test Package	<ul style="list-style-type: none"> <li>• MEF 6 – Ethernet Services Definition – Phase I</li> <li>• MEF 9 - Abstract Test Suite For Ethernet</li> <li>• Services at the UNI</li> <li>• MEF 10 (obsoletes MEF 1 and MEF 5) –</li> <li>• Ethernet Services Model, Phase 1</li> <li>• MEF 11 – User Network Interface (UNI) Requirements and Framework</li> </ul>	<ul style="list-style-type: none"> <li>• MEF 1</li> <li>• MEF 14</li> </ul>

## Carrier Ethernet

V-TPK-1007	Virtual CTS MSTP Test Package	<ul style="list-style-type: none"> <li>• Verify BPDU handling and bridge operation</li> <li>• Verify that the bridge correctly updates the learned station location information</li> <li>• Verify the configuration of active topology into a single spanning tree for any given VLAN</li> <li>• Verify that an implementation is compatible with previous standard, and can co-exist with RSTP and legacy bridges</li> <li>• Verify the operation of each bridge port that is represented by a set of state machines: <ul style="list-style-type: none"> <li>– Port timers state machine</li> <li>– Port information state machine</li> <li>– Port role selection state machine</li> <li>– Port role transitions state machine</li> <li>– Port state transition state machine</li> <li>– Topology change state machine</li> <li>– Port protocol migration state machine</li> <li>– Port receive state machine</li> <li>– Port transmit state machine</li> </ul> </li> <li>• Verify general procedures such as: <ul style="list-style-type: none"> <li>– Packet format</li> <li>– BPDUs validation</li> <li>– Functional procedures</li> <li>– Port variables</li> <li>– Priority vector calculations</li> <li>– Verify the setting of the MSTP parameters</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• IEEE 802.1Q-2003</li> <li>• IEEE 802.1s</li> <li>• IEEE 802.1w-2001</li> </ul>
V-TPK-1012	Virtual CTS MEF 14 Test Package	<ul style="list-style-type: none"> <li>• Allows user to use different EVC type (EPL, EVPL, and ELAN)</li> <li>• Performance Service Attributes <ul style="list-style-type: none"> <li>– Frame Delay Performance</li> <li>– Frame Delay Variation Performance</li> <li>– Frame Loss Ratio Performance</li> </ul> </li> <li>• Bandwidth Profile Service Attributes <ul style="list-style-type: none"> <li>– Per Ingress UNI</li> <li>– Per EVC</li> <li>– Per Class of Service</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• MEF 10</li> <li>• MEF 14</li> </ul>
V-TPK-1038	Virtual CTS Provider Bridges (802.1AD) Test Package	<ul style="list-style-type: none"> <li>• Customer VLAN aware component conformance</li> <li>• Service VLAN aware component conformance</li> <li>• Layer 2 Protocol message processing</li> <li>• Provider Bridge Network Operation</li> </ul>	<ul style="list-style-type: none"> <li>• IEEE P802.1ad/D6.0</li> <li>• IEEE P802.1ad/D2.0</li> </ul>

## Carrier Ethernet

V-TPK-1047 Virtual CTS  
802.1ah (PBB)  
Test Package

- **Customer Service Interfaces**—Three types of service interface defined for a Provider Backbone Bridge are tested for conformance: Port-based, S-tagged based and I-tagged based service interfaces. Also, the S-tagged service interface can be one of two types: one to one or bundled
- **Provider Instance Ports**—A Provider Backbone Bridge is made up of I-components and a B-component. The I-component is the customer facing service interface. It comprises an S-VLAN component with the EISS on each Customer Network Port supported by the use of a Service VLAN tag, and the EISS for each Virtual Instance Port configured on a Provider Instance Port supported by the use of both a Service VLAN tag and a Backbone Service Instance tag. This test group tests the EISS for each Virtual Instance Port configured on a Provider Instance Port
- **Customer Backbone Ports**—A Provider Backbone Bridge is made up of I-components and a B-component. A B-component comprises an S-VLAN component with the EISS on each Provider Network Port supported by the use of a Service VLAN tag, and the EISS on each Customer Backbone Port supported by the use of both a Service VLAN tag and a Backbone Service Instance tag. This test group tests the EISS on a Customer Backbone Port
- **Functional Tests**—A set of test cases which provide the functional testing for the three types of service interface: Port-based service interface, S-tag based service interface and I-tag based service interface
- IEEE Std 802.1ah-2008: Virtual Bridged Local Area Networks - Amendment 7: Provider Backbone Bridges
- IEEE Std 802.1Q-2005: Virtual Bridged Local Area Networks
- IEEE Std 802.1ad-2005: Virtual Bridged Local Area Networks - Amendment 4: Provider Bridges

V-TPK-1049 Virtual CTS MEF 21  
Test Package

- Abstract Test Cases for UNI-C Type 2 Link OAM
  - OAM Functional Specifications
  - OAM Event Notification Generation and Reception
  - OAM PDUs
  - OAM Local Information TLVs
  - OAM Remote Information TLVs
  - OAM Organization Specific Information TLVs
  - Link Events TLVs
  - Variable Descriptor & Containers
  - OAM Additional Conformance Tests
- Abstract Test Cases for UNI-N Type 2 Link OAM
  - OAM Functional Specifications
  - OAM Event Notification Generation and Reception
  - OAM PDUs
  - OAM Local Information TLVs
  - OAM Remote Information TLVs
  - OAM Organization Specific Information TLVs
  - Link Events TLVs
  - Variable Descriptor & Containers
  - OAM Additional Conformance Tests
- MEF 21 Abstract Test Suite for UNI Type 2 Part 1: Link OAM
- MEF 20 UNI Type 2 Implementation Agreement
- IEEE 802.3-2005 Clause 57 Operations, Administration, and Maintenance

Access			
V-TPK-0032	Virtual CTS DHCPV6 Host Test Package	<ul style="list-style-type: none"> <li>• Message Validation</li> <li>• DHCP Server Solicitation</li> <li>• Client Initiated ConfigExchange</li> <li>• Server Initiated ConfigExchange</li> <li>• DHCP Options</li> </ul>	<ul style="list-style-type: none"> <li>• RFC 3315</li> <li>• RFC 3633</li> <li>• RFC 3646</li> <li>• RFC 3736</li> </ul>
V-TPK-0033	Virtual CTS DHCPV6 Server Test Package	<ul style="list-style-type: none"> <li>• Message Validation</li> <li>• DHCP Server Solicitation</li> <li>• Client Initiated ConfigExchange</li> <li>• Server Initiated ConfigExchange</li> <li>• DHCP Options</li> </ul>	<ul style="list-style-type: none"> <li>• RFC 3315</li> <li>• RFC 3633</li> <li>• RFC 3646</li> <li>• RFC 3736</li> </ul>
V-TPK-1033	Virtual CTS ANCP Test Package	<ul style="list-style-type: none"> <li>• ANCP Connection</li> <li>• TCP Connection</li> <li>• Adjacency Format</li> <li>• Adjacency State</li> <li>• Capability Negotiation</li> <li>• GSMP Extensions</li> </ul>	<ul style="list-style-type: none"> <li>• draft-ietf-ancp-protocol-02</li> <li>• RFC 3292</li> <li>• RFC 3293</li> </ul>
Bridging			
V-TPK-1008	Virtual CTS VLAN Test Package	<ul style="list-style-type: none"> <li>• Ingress, Forwarding and Egress Rules</li> <li>• Frame Reception and Transmission</li> <li>• Learning Process</li> <li>• VLAN Classification</li> <li>• Filtering Database</li> <li>• Tagged Frame Format</li> <li>• Tagging/Untagging of layer2 data</li> <li>• GVRP (GARP VLAN Registration Protocol) <ul style="list-style-type: none"> <li>– Static VLAN Registration</li> <li>– VLAN message propagation</li> <li>– GARP state transitions for Applicant and Registrar state machines</li> <li>– GARP Timers</li> </ul> </li> <li>• GMRP (GARP Multicast Registration Protocol) <ul style="list-style-type: none"> <li>– Static MAC Multicast address registration</li> <li>– Forwarding/Filtering of multicast traffic</li> <li>– GARP state transitions for Applicant and Registrar state machines</li> <li>– GARP Timers</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• IEEE 802.1Q-2005</li> <li>• IEEE 802.1D-2004</li> </ul>
V-TPK-1009	Virtual CTS LACP/802.3AD Test Package	<p><b>LACP</b></p> <ul style="list-style-type: none"> <li>• LACPDU Format Verification</li> <li>• Receive State Machine</li> <li>• Periodic Transmission State Machine</li> <li>• Mux State Machine.</li> </ul> <p><b>Marker Protocol</b></p> <ul style="list-style-type: none"> <li>• PDU structure verification</li> <li>• Marker protocol operation.</li> </ul> <p><b>Functional</b></p> <ul style="list-style-type: none"> <li>• Capability to perform Link Aggregation</li> <li>• Dynamic reallocation of conversation to different ports</li> </ul>	<ul style="list-style-type: none"> <li>• IEEE 802.3-2005</li> </ul>

## Bridging

V-TPK-1010	Virtual CTS STP Test Package	<ul style="list-style-type: none"> <li>• Communication of the bridge protocol entity with its peer entities</li> <li>• Update of stored protocol variables and timers</li> <li>• State change of the Bridge ports</li> <li>• Verifies all the procedures associated with the Bridge Protocol entity such as: <ul style="list-style-type: none"> <li>– Validation of Transmit Configuration Bridge Protocol Data Units (BPDUs)</li> <li>– Recording of configuration information and configuration timeout value</li> <li>– Reply to Configuration BPDUs</li> <li>– Response to Transmit Topology Change Notification BPDUs</li> <li>– Configuration updates</li> <li>– Root selection process</li> <li>– Designated port selection</li> </ul> </li> <li>• Topology change detection and acknowledgement</li> <li>• Verifies Processing of frames received from individual MAC entities associated with the port, the submission of frames to the MAC entity for transmission, and the possible inclusion of the port in the active topology of the bridged LAN.</li> <li>• Verifies the basic functions of a bridge when it is selected to play roles such as a Root, Designated Bridge, or an Alternate Bridge.</li> <li>• Verifies the structures and encoding of the BPDUs that are exchanged between the Bridge Protocol Entities</li> </ul>	• IEEE 802.1D-1998
V-TPK-1011	Virtual CTS RSTP Test Package	<ul style="list-style-type: none"> <li>• Verifies proper Bridge Port behavior</li> <li>• Verifies the information contained in the BPDU may be used by a Bridge in calculating its own BPDU to transmit, and may stimulate that transmission.</li> <li>• Verifies the bridge updating the learned station location information correctly.</li> <li>• Verifies the operation of each Bridge Port that is represented by a set of state machines: <ul style="list-style-type: none"> <li>– Port Timers state machine</li> <li>– Port Information state machine</li> <li>– Port Role Selection state machine</li> <li>– Port Role Transitions state machine</li> <li>– Port State Transition state machine</li> <li>– Topology Change state machine</li> <li>– Port Protocol Migration state machine</li> <li>– Port Transmit state machine</li> </ul> </li> <li>• Verifies the general procedures such as: <ul style="list-style-type: none"> <li>– Packet format</li> <li>– BPDUs Validation</li> <li>– Functional procedures</li> </ul> </li> <li>• Verifies the setting of the RSTP parameters</li> </ul>	• IEEE 802.1D-2004

## Bridging

V-TPK-1027	Virtual CTS LLDP (802.1AB) Test Package	<b>LLDP Transmit</b> <ul style="list-style-type: none"> <li>• Protocol initialization</li> <li>• Frame transmission</li> <li>• Transmission</li> <li>• LLDPDU construction</li> <li>• LLDP frame formatting transmission</li> </ul> <b>LLDP Receive</b> <ul style="list-style-type: none"> <li>• Protocol initialization</li> <li>• Frame reception</li> <li>• Frame recognition</li> <li>• LLDPDU Validation</li> <li>• LLDP remote MIB update</li> <li>• Statistical counter</li> </ul>	<ul style="list-style-type: none"> <li>• IEEE Std. 802.1AB-2005</li> </ul>
V-TPK-1031	Virtual CTS LLDP-MED (ANSI/TIA-1057) Test Package	<ul style="list-style-type: none"> <li>• LLDP-MED initialization</li> <li>• LLDP-MED Capabilities TLV</li> <li>• Network Policy TLV</li> <li>• Location Identification TLV</li> <li>• Extended Power Via MDI TLV</li> <li>• Inventory Management TLV Set</li> <li>• LLDP TLV update</li> <li>• LLDP-MED transmission</li> <li>• LLDP-MED reception</li> <li>• Remote MIB TTL expiration</li> <li>• Frame Validation</li> </ul>	<ul style="list-style-type: none"> <li>• ANSI/TIA-1057-2006</li> </ul>
V-TPK-1036	Virtual CTS MMRP (802.1AK) Test Package	<ul style="list-style-type: none"> <li>• Multiple MAC Registration Protocol</li> <li>• MRP State Transitions</li> <li>• MRP Timers</li> <li>• Forwarding and Filtering Rules for Data traffic</li> <li>• Validation of PDUs</li> </ul>	<ul style="list-style-type: none"> <li>• IEEE P802.1ak/D8</li> <li>• IEEE P802.1ak/D8 Corrigendum 1</li> </ul>

## Switching

V-TPK-1052	Virtual CTS DCBX Test Package	<ul style="list-style-type: none"> <li>• DCBX</li> <li>• Test the DCBX specific requirements beyond LLDP</li> <li>• DCBX_Control_State_Machine</li> <li>• DCBX_Feature_State_Machine                             <ul style="list-style-type: none"> <li>– Priority_Group_Feature</li> <li>– Priority_Based_Flow_Control_Feature</li> <li>– FCoE_Application_Feature</li> </ul> </li> <li>• Other_Feature_TLVs (BCN TLV and Logical Link Status TLV)</li> </ul>	<ul style="list-style-type: none"> <li>• DCB Capability Exchange Protocol Base Specification Rev 1.03</li> <li>• DCB Capability Exchange Protocol Base Specification Rev 1.0</li> </ul>
V-TPK-1053	Virtual CTS FIP Test Package	<ul style="list-style-type: none"> <li>• Discovery Protocol: This test group verifies the FIP FCF Discovery between E-Node and FCF, and FCF-FCF.</li> <li>• Virtual Link Instantiation: This test group verifies the FLOGI procedure used by E-Nodes to login/logout into the fabric and the creation of VN ports and creation of VE ports for FCF.</li> <li>• Virtual Link Maintenance: Verifies the IUT's implementation of virtual link maintenance using FIP Keep Alive and periodic Discovery Advertisement messages.</li> <li>• VLAN Discovery: Verifies the procedure used by E-Node or FCF to get the VLANs supported by other FCFs for FIP operation.</li> <li>• FIP Frame Format: Verifies the format of the various FIP messages and descriptor formats used in FIP.</li> </ul>	<ul style="list-style-type: none"> <li>• INCITS xxx-200x Fibre Channel Backbone - 5 Rev 1.05 March 30, 2009: Fibre Channel – Fibre Channel Backbone - 5</li> </ul>

## Security

	Virtual CTS IPSEC Test Package	<ul style="list-style-type: none"> <li>• IPv4 and IPv6 data protection</li> <li>• ESP; AH; and ESP and AH protection:</li> <li>• ESP Supports the following encryption/decryption algorithms: data encryption</li> </ul>	<ul style="list-style-type: none"> <li>• RFC 4301</li> <li>• RFC 4302</li> <li>• RFC 4303</li> <li>• RFC 2409</li> </ul>
V-TPK- 1043	IPSEC-IKE	<ul style="list-style-type: none"> <li>• standard (DES), 3DES, advanced encryption standard (AES), NULL</li> </ul>	<ul style="list-style-type: none"> <li>• RFC 2408</li> <li>• RFC 2403</li> <li>• RFC 2404</li> </ul>
V-TPK- 1044	IPSEC-ESP	<ul style="list-style-type: none"> <li>• (uses ESP without encryption/decryption)</li> </ul>	<ul style="list-style-type: none"> <li>• RFC 2405</li> <li>• RFC 2407</li> <li>• RFC 2410</li> <li>• RFC 2451</li> </ul>
V-TPK- 1045	IPSEC-AH	<ul style="list-style-type: none"> <li>• Supports the following authentication algorithms: hash-function message</li> <li>• authentication codes (HMAC)-Message Digest version 5 (MD5), HMACsecure</li> <li>• hash algorithm (SHA), NULL (uses ESP without authentication)</li> <li>• AH Supports the following authentication algorithms: HMAC-MD5, HMAC-SHA</li> <li>• Five (5) different Phase 1 authentication modes:                             <ul style="list-style-type: none"> <li>– Supports the use or non-use of Perfect Forward Secrecy (PFS)</li> <li>– Tunnel Mode and Transport Mode</li> <li>– Main Mode and Aggressive Mode for Phase 1 negotiations</li> <li>– Quick Mode for Phase 2 negotiations</li> <li>– New Group Mode</li> </ul> </li> <li>• Supports Extended Sequence Number</li> </ul>	<ul style="list-style-type: none"> <li>• RFC 3602</li> </ul>

## About Spirent Communications

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.

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