

Spirent® A/X 4000 Certification

ServPoET BMS 200/500/800/1000



Making Broadband Manageable: Be Empowered.

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PREFACE

The Fine Point Networks PPPoE Certification Lab (FPCL) simulates large-scale broadband networks to fully stress test Access Concentrators, Servers, DSLAMs, and BRAS solutions implemented in PPPoE networks. This certification procedure gives Internet service providers complete confidence when implementing new devices in their access networks.



Spirent AX/4000 Certified

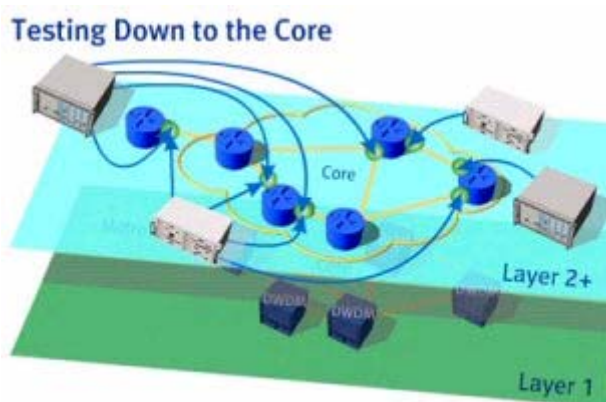
The ServPoET BMS Network Operating System (NOS) is tested and certified with the Spirent AX/4000 Broadband Test System. The Spirent AX/4000 Broadband Test System is simply the most powerful system ever developed for testing the performance and Quality of Service of broadband networks. AX/4000 certification leverages multi-port architecture that verifies multiple transmission technologies such as ATM, IP, Frame Relay and Ethernet simultaneously at speeds up to 10 Gbps. Before purchasing any broadband network solution, make sure it is Spirent AX/4000 certified.



Spirent AX/4000

The Spirent AX/4000 certification process:

- Simulates large scale DSL deployment to fully stress ServPoET BMS
- Validates and demonstrates the true performance of ServPoET BMS accommodating ATM and Ethernet networks
- Verifies the abilities of the ServPoET control and data plane by testing capacity, setup rate, throughput, latency and loss
- Verifies capacity through a comprehensive range of Protocol Support that includes: DHCP, OSPF, IGMP, PPP over L2TP, IGMP over PPP, PPPoEoA, PPPoA, PPPoE



METHODOLOGY

Each unit of the ServPoET BMS Family that ships is quality assurance tested a final time to ensure the performance and reliability of the hardware. The Spirent AX/4000 Broadband Test System emulates 32,768 (32K) PPPoX subscribers per port and passes broadband traffic through each session simultaneously. Besides verifying capacity, the ServPoET BMS Family is certified against a comprehensive list of access protocols including: PPPoE, PPPoEoA, and PPP over L2TP.

Fine Point Networks Certification Labs offers control-plane and data-plane testing, at capacity with real traffic and keep-alives. During the certification process, FPCL creates data-plane traffic as if it were coming from subscribers (PPP sessions) and LAC or LNS (PPP over L2TP). Data-plane generation allows us to certify data integrity and performance, exposing packet loss, throughput, and latency in each PPP session or L2TP tunnel. For complex network topologies, FPCL supports the full range of IEEE 802.1Q Ethernet VLANs and ATM VCCs.

Below you will see the process that Fine Point takes before releasing a ServPoET unit to its customers, based on the Fine Point PPPoE certification lab.

In the standard round of PPPoE certification testing we run the following tests:

- PPPoE Session Load Capacity
- PPPoE Stability Test
- PPPoE stability test with traffic from subscribers to host
- PPPoE stability test with bi-directional traffic
- Stress test via PPPoE stability test with bi-directional traffic
- RFC 2544 Throughput with traffic from subscribers to host
- RFC 2544 Throughput with bi-directional traffic
- L2TP Stability Test
- L2TP Stability Test with PPPoE sessions
- L2TP Stability Test with PPPoE sessions and traffic from subscriber to host
- L2TP Stability Test with PPPoE sessions and bi-directional traffic
- Stress test via L2TP Stability test with bi-directional traffic
- Optional tests are PPPoEoA stability tests

PPPoE SESSION LOAD CAPACITY

The PPPoE Session Load Capacity test attempts to add a specified number of PPPoE sessions to the ServPoET BMS and reports how many were successful. The sessions are added in groups called “trials”. Each trial adds an additional 1,000 PPPoE sessions to the unit. Results shown in the trial are cumulative for each trial that preceded the current trial.

The Results

Each model of the BMS is tested as follows and the results are depicted below.

- BMS 200 = 1,000 simultaneous sessions
- BMS 500 = 3,000 simultaneous sessions
- BMS 800 = 6,000 simultaneous sessions
- BMS 1000 = 6,000 simultaneous sessions per blade

ServPoET BMS 200

For the ServPoET BMS 200, the PPPoE Session Load Capacity test attempted to connect 2,000 sessions. As shown in the results of the test, only 1,000 of the sessions successfully connected.

PPPoE Load Capacity Test – BMS 200				
Trial	Attempted (Sessions)	Successful (Sessions)	Failed (Sessions)	Rate (per Second)
1	1,000	1,000	0	17
2	2,000	1,000	1,000	0

ServPoET BMS 500

For the ServPoET BMS 500, the PPPoE Session Load Capacity test attempted to connect 4,000 sessions. As shown in the results of the test, only 3,000 of the sessions successfully connected.

PPPoE Load Capacity Test – BMS 500				
Trial	Attempted (Sessions)	Successful (Sessions)	Failed (Sessions)	Rate (per Second)
1	1,000	1,000	0	17
2	2,000	2,000	0	17
3	3,000	3,000	0	19
4	4,000	3,000	1,000	0

ServPoET BMS 800

For the ServPoET BMS 800, the PPPoE Session Load Capacity test attempted to connect 7,000 sessions. As shown in the results of the test, only 6,000 of the sessions successfully connected.

PPPoE Load Capacity Test – BMS 800				
Trial	Attempted (Sessions)	Successful (Sessions)	Failed (Sessions)	Rate (per Second)
1	1,000	1,000	0	17
2	2,000	2,000	0	17
3	3,000	3,000	0	19
4	4,000	4,000	0	19
5	5,000	5,000	0	19
6	6,000	6,000	0	19
7	7,000	6,000	1,000	0

ServPoET BMS 1000

For the ServPoET BMS 1000, the PPPoE Session Load Capacity test attempted to connect 7,000 sessions on one (1) blade. As shown in the results of the test, only 6,000 of the sessions successfully connected.

PPPoE Load Capacity Test – BMS 1000				
Trial	Attempted (Sessions)	Successful (Sessions)	Failed (Sessions)	Rate (per Second)
1	1,000	1,000	0	17
2	2,000	2,000	0	17
3	3,000	3,000	0	19
4	4,000	4,000	0	19
5	5,000	5,000	0	19
6	6,000	6,000	0	19
7	7,000	6,000	1,000	0

PPPoE STABILITY TEST

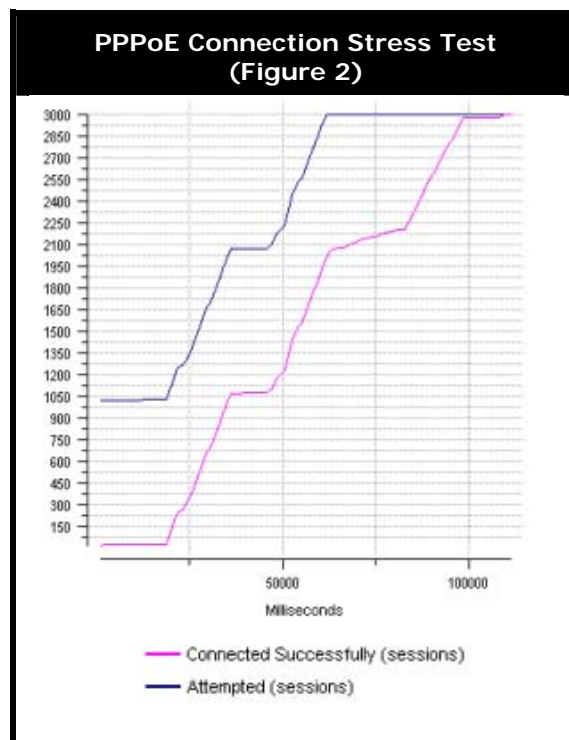
The PPPoE Stability Test creates real-world PPPoE sessions on the ServPoET BMS and then verifies the traffic across those sessions. This test verifies the elapsed time to establish a specified amount of PPPoE subscriber sessions and the elapsed time to disconnect those subscriber sessions.

When you add traffic to the PPPoE Stability Test, the Spirent AX/4000 then passes (in base cases) 10% (100 Mbps) of the maximum line capacity (1 Gbps) from subscriber to host through the ServPoET BMS for a specified duration. The test then demonstrates whether or not all the packets were received from the host at that specific packet per second rate. With bi-directional traffic the test is the same, however traffic is sent both ways from subscriber to host and host to subscriber for the same duration. The PPPoE Stability Test then shows whether or not all the packets were received from the host at that specific packet per second rate. The PPPoE Stability Test is then performed a final time with the traffic set to 80% of maximum load for time period of 72 hours. This confirms that no PPPoE sessions are dropped and that all traffic is properly passed through the ServPoET BMS.

The Results

The following table (Figure 1) details the results for the basic PPPoE Stability Test for the ServPoET BMS Network Operating System with bi-directional traffic and 3,000 subscriber sessions generated (at a rate of 1000 sessions per second) for test duration. The Spirent AX/4000 Certification verifies that each event in the test or event completed successfully. The following chart (Figure 2) demonstrates the connection time for initiating 3,000 sessions with the ServPoET BMS Network Operating System. In these results the Spirent AX/4000 Certification verified that it took 1 minute and 53 seconds to establish 3,000 subscriber sessions with the ServPoET BMS Network Operating System, or on average 26.5 subscribers per second. This connection time included RADIUS authentication for each session.

Index	Event	Result	Elapsed Time
1	Validate System	Completed	00:00:00
2	Layer2_Check	Completed	00:00:10
3	Commit Emulation	Completed	00:00:03
4	PPPoX Connect	Completed	00:01:53
5	Program Traffic	Completed	00:00:18
6	Receive Start	Completed	00:00:05
7	Traffic Start	Completed	00:00:03
8	SW Timer	Completed	00:00:16
9	Traffic Stop	Completed	00:00:01
10	SW Timer	Completed	00:00:16
11	Receive Stop	Completed	00:00:01
12	PPPoX Disconnect	Completed	00:00:21
13	Access Results	Completed	00:00:05
14	End Test	Completed	00:00:12



TX & RX Dataplane Port Summary

The following table (Figure 3) displays the Transmit (TX) and Receive (RX) Dataplane results for the PPPoE Stability Test. Here the Spirent AX/4000 Certification confirms that the number of total packets transmitted from the AX/4000 test head match the number received by the AX/4000 test head. The results in this figure demonstrate that the ServPoET Network Operating System did not lose any of the traffic sent through it and successfully stripped the PPP header from the incoming Ethernet packets, and sent out the IP packets to the RX port of the AX/4000.

PPPoE Stability Test – Data Transmit/Receive Summary (Figure 3)						
Port	Total Packets (TX)	Total Packets (RX)	Packet Rate (pkts/sec)	TX Total Packet Bit Rate (Mbits/sec)	Good Packets (RX)	% Max Bandwidth Bytes
1	187,356	179,687	10,196	95.36	179,687	5.23
2	179,687	187,356	10,263	95.36	187,356	5.15

RX Dataplane Stream Summary Checksum

The Spirent AX/4000 Confirmed that all streams on the ports tested returned:

- All Streams marked as “Good”
- Zero (0) Errors
- Zero (0) Missing Streams.

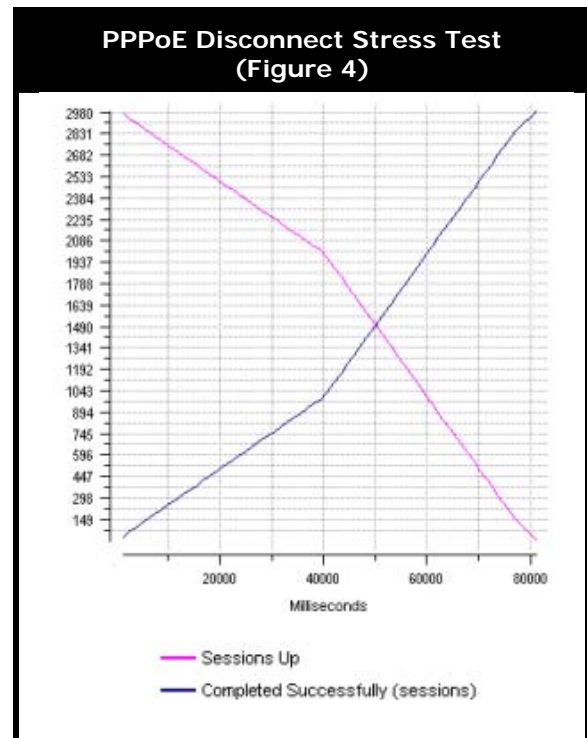
This checksum results indicated that the test data streams expected by the AX/4000 where received with no errors and all tests passed.

Session Disconnect Stress Test

The follow graph (Figure 4) depicts the elapsed time to disconnect 3,000 subscriber sessions from the ServPoET BMS. 3,000 sessions were disconnected in just over 80 seconds which translates to 37.5 sessions per second.

Platform Specific Results

Since this test is specific to the ServPoET BMS Network Operating System and hardware independent, the test is applicable to all ServPoET BMS family systems (200/500/800/1000).



PPPoE OVER ATM (PPPoEoA) STABILITY TEST

PPPoEoA stability tests are the same as the PPPoE Stability Test described above, however it is conducted over an OC-3 or OC-12 interface instead of the default dual gigabit Ethernet interfaces.

The Results

The following table (Figure 5) details the results for the basic PPPoE over ATM Stability Test for the ServPoET BMS Network Operating System with bi-directional traffic and 6,000 subscriber sessions generated for test duration. The Spirent AX/4000 Certification verifies that each event in the test or event completed successfully. The following chart (Figure 2) demonstrates the connection time for initiating 6,000 sessions with the ServPoET BMS Network Operating System. In these results the Spirent AX/4000 Certification verified that it took 3 minutes and 46 seconds to establish 6,000 subscriber sessions with the ServPoET BMS Network Operating System, or on average 26.5 subscribers per second. This connection time included the time necessary to perform RADIUS authentication for each session. In these results Fine Point looks to make sure each event, more specifically the up time and downtime for the established PPPoE sessions created (6,000).

Index	Event	Result	Elapsed Time
1	Validate System	Completed	00:00:00
2	Layer2_Check	Completed	00:00:10
3	Commit Emulation	Completed	00:00:03
4	PPPoX Connect	Completed	00:03:46
5	Program Traffic	Completed	00:00:18
6	Receive Start	Completed	00:00:05
7	Traffic Start	Completed	00:00:03
8	SW Timer	Completed	00:00:16
9	Traffic Stop	Completed	00:00:01
10	SW Timer	Completed	00:00:16
11	Receive Stop	Completed	00:00:01
12	PPPoX Disconnect	Completed	00:00:21
13	Access Results	Completed	00:00:05
14	End Test	Completed	00:00:12

TX & RX Dataplane Port Summary

The following table (Figure 6) displays the Transmit (TX) and Receive (RX) Dataplane results for the PPPoEoA Stability Test. Here the Spirent AX/4000 Certification confirms that the number of total packets transmitted from the AX/4000 test head match the number received by the AX/4000 test head. The results in this figure demonstrate that the ServPoET Network Operating System did not lose any of the traffic sent through it and successfully stripped the PPP header from the incoming Ethernet packets, and sent out the IP packets to the RX port of the AX/4000.

Port	Total Packets (TX)	Total Packets (RX)	Packet Rate (pkts/sec)	TX Total Packet Bit Rate (Mbits/sec)	Good Packets (RX)	% Max Bandwidth Bytes
1	187,356	179,687	10,196	95.36	179,687	5.23
2	179,687	187,356	10,263	95.36	187,356	5.15

RX Dataplane Stream Summary Checksum

The Spirent AX/4000 Confirmed that all streams on the ports tested returned:

- All Streams marked as “Good”
- Zero (0) Errors
- Zero (0) Missing Streams.

This checksum results indicated that the test data streams expected by the AX/4000 where received with no errors and all tests passed. Above summaries that the test data streams expected by the AX/4000 where received with no errors.

RFC 2544 THROUGHPUT TEST

The RFC 2544 Benchmarking Methodology for Network Interconnect Devices test sends a specific number of frames at a specific rate through the ServPoET BMS. If the count of offered frames is greater than the count of received frames, the rate of the offered stream is reduced and the test is rerun. The throughput is the fastest rate at which the count of test frames transmitted by the ServPoET BMS is equal to the number of test frames sent to it by the test equipment.

In laymen's terms, The RFC 2544 Throughput Test, creates a specified number of subscriber PPPoE sessions then begins to place a traffic load evenly distributed by the number of subscriber sessions, starting at 100% load, which would be 1 gigabit per second (Gbps) and then scales back the load to a 1% difference between packets being dropped and no packets being dropped by the ServPoET BMS, in this case for 120 seconds. When the number of packets transmitted and received by the Spirent AX/4000 is equal that is the maximum throughput able to be handled by the ServPoET BMS.

For more information on the RFC 2544 Benchmarking Methodology for Network Interconnect Devices see <http://www.faqs.org/rfcs/rfc2544.html>.

The Results

RFC 2544 Throughput Test shows each event, more specifically the up time and downtime for the established PPPoE sessions created (1,000). You will see that in this test it took 32 seconds to establish 1,000 subscriber PPPoE sessions, or on average 31.25 subscribers per second, this includes RADIUS authentication for each subscriber.

The test shows that it then took 6 minutes and 6 seconds to complete the RFC 2544

Throughput Test. As mentioned above this test begins at 100% of the determined load for the ServPoET BMS interfaces and then sends traffic for a duration of 120 seconds at this load, if it finds frame loss it scales down in 1% increments until no frame loss occurs.

Index	Event	Result	Elapsed Time
1	Validate System	Completed	00:00:00
2	Layer2_Check	Completed	00:00:04
3	Commit Emulation	Completed	00:00:04
4	PPPoX Connect	Completed	00:00:32
5	RFC2544 Throughput	Completed	00:06:06
6	PPPoX Disconnect	Completed	00:00:58
7	End Test	Completed	00:00:10

ServPoET BMS 1000

The table shown to the right (Figure 8) depicts the total combined throughput for the ServPoET BMS 1000 is 931.025 Mbps (with dual gigabit Ethernet interfaces) as determined by the RFC 2544 Throughput Test.

Bit Rate (Mbps)	Frame Rate (fps)	Frames (TX)	Frames Lost
931.025	99,536	11,955,383	0

BMS 200/500/800

The table shown to the right (Figure 9) depicts total combined throughput for the ServPoET BMS 200/500/800 is 887.04 Mbps (with dual gigabit Ethernet interfaces) as determined by the RFC 2544 Throughput Test.

Bit Rate (Mbps)	Frame Rate (fps)	Frames (TX)	Frames Lost
887.04	94,834	11,386,381	0

L2TP TUNNEL STABILITY TEST

The L2TP Tunnel Stability Test creates L2TP tunnels with PPPoE subscribers for the ServPoET BMS and then verifies traffic across those subscribers. Here the Spirent AX/4000 Certification can either simulate acting as a L2TP Access Concentrator (LAC) connecting to the ServPoET BMS, which is then a L2TP Network Server (LNS), or the LNS with the ServPoET BMS acting as the LAC. The L2TP Tunnel Stability Test tests the ability for the ServPoET BMS to establish a specified number of L2TP tunnels as well as the elapsed time to connect and disconnect each L2TP tunnel.

The next step in the test is to add PPPoE session to the L2TP tunnel. This is accomplished by establishing a specified amount of PPPoE sessions through the L2TP tunnel (to the LNS) and measuring the elapsed time it takes to connect and disconnect those subscriber PPPoE sessions.

As real-world simulated traffic is added to the L2TP Tunnel Stability Test, the Spirent AX/4000 then transmits 10% (approximately 100 Mbps) of the maximum line capacity (1 Gbps) from subscriber to host through the L2TP tunnel for a specified amount of time. The L2TP Tunnel Stability Test then shows whether or not all the packets were received from the host at that specific packet per second rate.

With bi-directional traffic the L2TP Tunnel Stability Test is the same as described above, however traffic is being sent both ways from subscriber to host and host to subscriber through the L2TP tunnel for a specified period of time. In this case, the L2TP Tunnel Stability Test then shows whether or not all the packets were received from the host at that specific packet per second rate. The bi-directional traffic L2TP Tunnel Stability Test utilizes traffic set to 70% of the maximum for a period of 72 hours, to confirm that no PPPoE sessions are dropped and that all traffic is passed through the ServPoET BMS.

The chart to the right (Figure 10) displays the results of the L2TP Tunnel Stability Test with bi-directional traffic.

In these results Fine Point looks to make sure each event, more specifically the up time and downtime for the established PPPoE sessions created. We also look to see how long it took to establish the L2TP tunnel, and then to also disconnect that tunnel. You will see that all events completed successfully.

TX & RX Dataplane Port Summary

The following table (Figure 11) displays the Transmit (TX) and Receive (RX) Dataplane results for the L2TP Stability Test. Here the Spirent AX/4000 Certification confirms that the number of total packets transmitted from the AX/4000 test head match the number received by the AX/4000 test head. The results in this figure demonstrate that the ServPoET Network Operating System did not lose any of the traffic sent through it and successfully stripped the PPP header from the incoming Ethernet packets, and sent out the IP packets to the RX port of the AX/4000.

Index	Event	Result	Elapsed Time
1	Validate System	Completed	00:00:01
2	Layer2_Check	Completed	00:00:10
3	Commit Emulation	Completed	00:00:10
4	LAC Connect	Completed	00:00:16
5	PPPoX Connect	Completed	00:00:20
6	Program Traffic	Completed	00:00:28
7	Receive Start	Completed	00:00:05
8	Traffic Start	Completed	00:00:03
9	SW Timer	Completed	00:00:15
10	Traffic Stop	Completed	00:00:01
11	SW Timer	Completed	00:00:15
12	Receive Stop	Completed	00:00:01
13	PPPoX Disconnect	Completed	00:00:19
14	LAC Disconnect	Completed	00:00:04
	Access Results	Completed	00:00:05
	End Test	Completed	00:00:15

**L2TP Stability Test – Data Transmit/Receive Summary
(Figure 11)**

Port	Total Packets (TX)	Total Packets (RX)	Packet Rate (pkts/sec)	TX Total Packet Bit Rate (Mbits/sec)	Good Packets (RX)	% Max Bandwidth Bytes
1	187,356	179,687	10,196	95.36	179,687	5.23
2	179,687	187,356	10,263	95.36	187,356	5.15

RX Dataplane Stream Summary Checksum

The Spirent AX/4000 Confirmed that all streams on the ports tested returned:

- All Streams marked as “Good”
- Zero (0) Errors
- Zero (0) Missing Streams.

This checksum results indicated that the test data streams expected by the AX/4000 where received with no errors and all tests passed. Above summaries that the test data streams expected by the AX/4000 where received with no errors.

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