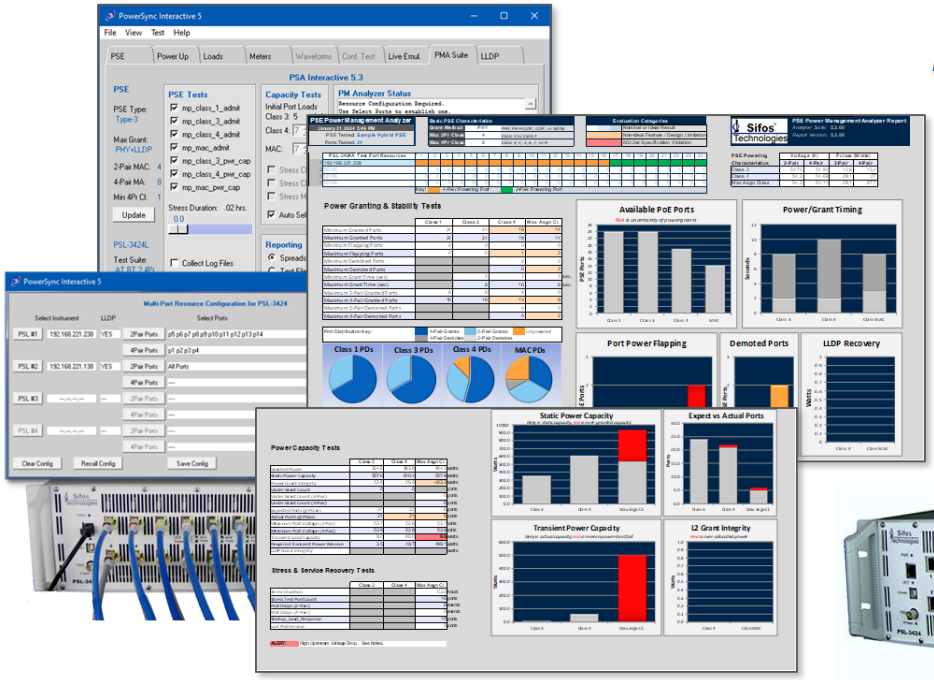
PSE Power Management Analyzer Suite

*for **2-Pair, 4-Pair, Hybrid Pair PSE's***

IEEE 802.3 Power over Ethernet

Product Overview



PSL-3424A, PSL3424L

Key Features

- ❑ **One-of-a-kind System for PSE Power Management (PM) Behavioral Analysis**
- ❑ **Automatically assess PSE PM Stability and Capacity Management**
- ❑ **Tests 802.3 at/bt PSE's with Any Combination of 2-Pair and 4-Pair PSE ports**
- ❑ **Tests PSE's that grant power with Multi-Event, LLDP*, or Both Multi-Event and LLDP**
- ❑ **Automatically Adapts to PSE maximum assigned class (MAC) and power demotions on 2-Pair and 4-Pair ports**
- ❑ **Highly Informative Reports cover dozens of parameters using Colorful Graphics**
- ❑ **Tests PSE's with up to 96 PoE Ports**
- ❑ **Emulated PD's are 802.3 specification compliant including built-in support for multi-event classification, power demotion, and 802.3at/802.3bt LLDP**
- ❑ **Available License Option to PSL-3424A / PSL-3424L Instruments**

Verification, *Simplified.*

IEEE 802.3 PSE's

802.3at 2-Pair PSE's

802.3bt 2-Pair and 4-Pair PSE's

Combination 2-Pair/4-Pair PSE's

Automatically Evaluate PoE Admin Behaviors

Power/Grant Responses to Banks of Class 1, Class 3, Class 4, and Maximum Assigned Class (MAC) PD's

Assess Granted, Demoted, Unpowered, and Flapping Ports

Assess Repeatability

Automatically Evaluate PoE Power Capacity Behaviors

Static Power Capacity with Banks of Class 3, Class 4, and Maximum Assigned Class (MAC) PD's

Power Granting Integrity including Under-Grants, Over-Grants, Static Utilization, and LLDP* Grant Integrity

Transient Power Capacity vs Transient Requirements

Long Term Power Stressing

PoE Service Integrity

* LLDP PD emulation and test parameters require PSL-3424L instrument(s)

Overview

The **Power Management Analyzer Suite** for the **PSL-3424** is a one-of-a-kind solution that provides deep insights into the power administration and management functions of a multi-port PSE. With full automation, the suite supports 2-Pair, 4-Pair, and hybrid-pair PSE's conforming to 802.3af, 802.3at, and 802.3bt specifications. The analysis can be performed on PSE's with up to 96 total ports.

Whereas PSE Conformance Testing assesses compliance of each stand-alone PSE port to 802.3at or 802.3bt specifications, the Power Management Analyzer provides deep insights into the collective behavior of many or all PSE ports while connected to banks of PD's.

PSE Power Administration

The Power Management Analyzer Suite includes four tests assessing PSE power administration decisions and associated stability and predictability of those behaviors. Each test involves emulation of different PD types that include exclusive **Class 1**, **Class 3**, **Class 4**, and Maximum Assigned Class (**MAC**) devices. Testing seamlessly adapts to PSE's that grant power at power-up using multi-event classification, PSE's that grant power only with PoE LLDP, and PSE's that grant full class power at power-up and then use LLDP to trim back power demand. Testing produces parameters such as granted port counts, demoted port counts, flapping port counts, and the repeatability of these across multiple powering cycles. Also analyzed is the range of power/grant times required to achieve stable powering configurations. Further analysis with LLDP granting PSE's assesses PSE behaviors in response to reduced LLDP grant requests.

PSE Power Capacity Analysis

The suite includes three tests assessing PSE power capacity management and associated system behaviors. Each test involves emulation of different PD types that include exclusive **Class 3**, **Class 4**, and Maximum Assigned Class (**MAC**) devices. Testing utilizes sophisticated multi-port loading algorithms to produce **Static Power Capacity** from which key policies such as power **Grant Integrity** and associated consequences including **Under-Granting** and **Over-Granting** parameters are discerned. As with Power Administration tests, there is seamless adaptation to PSE's that use multi-event, LLDP, and combination multi-event+LLDP to allocate PSE power.

Power Capacity Analysis also includes a detailed assessment of PSE **Transient Load Capacity** where ports operating a full static load capacity are exposed to valid, short duration PD load transients. This is compared to a calculated **Transient Reserve** derived from the granted ports and the static capacity.

Additional testing includes user-defined **Stress Testing** of PSE's at full static capacity, LLDP power granting integrity, and PoE stability in response to simultaneous full assigned class loading on all ports as they power (**PoE Service Recovery**).

Easy Setup, One-Click Automated Test Sequencing

Like other automated test suites from Sifos, the Power Management Analyzer Suite is fully automated, configured in just a few mouse clicks with PSA Interactive or a few commands in PowerShell PSA, and automatically presents colorful spreadsheet reports with intuitive graphics, limit analysis, and detail information for each parameter.

Verification, Simplified.

Power Management (PM) Analyzer Tests and Parameters

The following tables introduce each test in the Power Management Analyzer Suite, describing the basic purpose and design of each test along with the parameters that are produced by each test. Parameters are organized into Standard Parameters that are always produced and Conditional Parameters that are conditionally produced. Any limitations to testing with the PSL-3424A versus the PSL-3424L are described at the bottom of each table.

Standard Configuration Requirements to All Tests

Each test in the PM Analyzer requires the following two inputs:

Maximum Power Grant Method	This is a fundamental **PSE attribute** that can be declared in a PSE Attribute file, on the PSA Interactive **PSE** tab menu, or using the **psa_pse** command in PowerShell PSA. *It must be properly specified before running any PM Analyzer Suite tests*. It is specified as one of: **NONE**: A (Type-1 or Type-3) PSE that is restricted to 15W maximum power. **PHY**: A (Type-2, Type-3, or Type-4) PSE that grants a maximum available power that is higher than 15W using exclusively multi-event classification prior to powering PDs. **LLDP**: A (Type-2, Type-3, or Type-4) PSE that requires the PD to negotiate for power above 15W using PoE LLDP protocol. **PHY+LLDP**: A (Type-2, Type-3, or Type-4) PSE that grants maximum available power using multi-event classification prior to powering and then uses LLDP to refine the PD power demand after granting maximum available power.
Multi-Port Resource Configuration	The multi-port resource configuration describes the test instruments (addresses) and test ports that are connected to 2-Pair powering PSE ports and separately that are connected 4-Pair powering PSE ports. The Resource Configuration is established using either the PSA Interactive Multi-Port Resource Configuration menus or the **st_config** command in PowerShell PSA. *This must be specified before running any tests*.

Optional Configuration Settings to All Tests

Each test accepts an optional input to generate detailed logs (text files) produced by the test. These can be extremely useful in understanding and diagnosing details of PSE behavior. The class 4 and MAC power capacity tests accept an optional per port starting power used during the static power capacity scan. All three power capacity tests accept an optional parameter to execute Stress Testing.

Power Administrative Decisions and Decision Stability Tests

mp_class_1_admit — **Power Administrative Decisions with Class 1 PD's**

Test Objective	Analyze PSE responses to a full bank of Class 1 PD's including port powering (granting) and the stability / repeatability of those processes.	
Description	The test cycles 3 rounds of power-ups involving emulated class 1 PD's drawing very low power (~1W each) on all PSE ports. Tallies are collected of the number of ports that power (i.e. grant Class 1 PD power) along with any ports that cycle power more than once (i.e. flapping) until a stable powering situation is established. The test retains lists of PSE ports that consistently power across all 3 cycles ("trusted ports"). The test can optionally create log files that carry all of the detail results and calculations that occur throughout the test.	
PSE Qualification	This test can and should be run on all PSE's.	
Standard Parameters	**Class_1_Power_Count(Min)**	The minimum number of Class 1 PD's that get powered when all PD's are simultaneously connected to PSE ports and draw ~1 watt each.
	Class_1_Power_Count(Max)	The maximum number of Class 1 PD's that get powered when all PD's are simultaneously connected to PSE ports and draw ~1 watt each.
	Class_1_Max_Count(2Pr)	The number of 2-Pair powering PSE ports that power Class 1 PD's on a test cycle that captures **Class_1_Power_Count(Max).**
	Class_1_Max_Count(4Pr)	The number of 4-Pair powering PSE ports that power Class 1 PD's on a test cycle that captures **Class_1_Power_Count(Max).**
	Class_1_Flap_Count(Min)	The minimum number of flapping, that is ports that power more than once per cycle, over the 3 cycles of Class 1 PD power-ups.
	Class_1_Flap_Count(Max)	The maximum number of flapping, that is ports that power more than once per cycle, over the 3 cycles of Class 1 PD power-ups.
	Trusted_Class_1_Ports(2Pr)	List of 2-pair powering PSE ports, presented in format of {instrument ID,test port} that consistently power Class 1 PD's across all 3 cycles of power-ups.
	Trusted_Class_1_Ports(4Pr)	List of 4-pair powering PSE ports, presented in format of {instrument ID,test port} that consistently power Class 1 PD's across all 3 cycles of power-ups.
PSL-3424A Limitations	None. This test does not use LLDP in any measurements.	

mp_class_3_admit — Power Administrative Decisions with Class 3 PD's

Test Objective

Analyze PSE responses to a full bank of Class 3 PD's including port powering (granting) and the stability / repeatability of those processes.

Description

The test cycles 3 rounds of power-ups involving emulated class 3 PD's drawing very low power (~1W each) on all PSE ports. Tallies are collected of the number of ports that power (i.e. grant Class 3 PD power) along with any ports that cycle power more than once (i.e. flapping) until a stable powering situation is established. The test retains lists of PSE ports that consistently power across all 3 cycles ("trusted ports"). The test can optionally create log files that carry all of the detail results and calculations that occur throughout the test.

PSE Qualification

This test can and should be run on all PSE's.

Standard Parameters

Class_3_Power_Count(Min)	The minimum number of Class 3 PD's that get powered when all PD's are simultaneously connected to PSE ports and draw ~1 watt each.
Class_3_Power_Count(Max)	The maximum number of Class 3 PD's that get powered when all PD's are simultaneously connected to PSE ports and draw ~1 watt each.
Class_3_Max_Count(2Pr)	The number of 2-Pair powering PSE ports that power Class 3 PD's on a test cycle that captures **Class_3_Power_Count(Max).**
Class_3_Max_Count(4Pr)	The number of 4-Pair powering PSE ports that power Class 3 PD's on a test cycle that captures **Class_3_Power_Count(Max).**
Class_3_Flap_Count(Min)	The minimum number of flapping, that is ports that power more than once per cycle, over the 3 cycles of Class 3 PD power-ups.
Class_3_Flap_Count(Max)	The maximum number of flapping, that is ports that power more than once per cycle, over the 3 cycles of Class 3 PD power-ups.
Powerup_Time_3(Min)	The time to get a first port powered (granted) given connection of a bank of Class 3 PD's
Powerup_Time_3(Max)	The time to get a final port powered (granted) given connection of a bank of Class 3 PD's
Trusted_Class_3_Ports(2Pr)	List of 2-pair powering PSE ports, presented in format of {instrument ID,test port} that consistently power Class 3 PD's across all 3 cycles of power-ups.
Trusted_Class_3_Ports(4Pr)	List of 4-pair powering PSE ports, presented in format of {instrument ID,test port} that consistently power Class 3 PD's across all 3 cycles of power-ups.

PSL-3424A Limitations

None. This test does not use LLDP in any measurements.

mp_class_4_admit — Power Administrative Decisions with Class 4 PD's

Test Objective

Analyze PSE responses to a full bank of Class 4 PD's including port powering (granting) and the stability / repeatabilty of those processes.

Description

The test cycles 3 rounds of power-ups involving emulated class 4 PD's drawing very low power (~1W each) on all PSE ports. Tallies are collected of the number of ports that power and grant Class 4 PD power along with any ports that cycle power more than once (i.e. flapping) until a stable powering situation is established. The test retains lists of PSE ports that consistently power across all 3 cycles ("trusted ports"). The test can optionally create log files that carry all of the detail results and calculations that occur throughout the test.

PSE Qualification

This test can and should be run on all Type-2 (30W), Type-3 (30W or higher) and Type-4 (90W) PSE's.

Standard Parameters

Class_4_Grant_Count(Min)	The minimum number of Class 4 PD's that get powered and granted (25.5W) when all PD's are simultaneously connected to PSE ports and draw ~1 watt each.
Class_4_Grant_Count(Max)	The maximum number of Class 4 PD's that get powered and granted (25.5W) when all PD's are simultaneously connected to PSE ports and draw ~1 watt each.
Class_4_Flap_Count(Min)	The minimum number of flapping, that is ports that power more than once per cycle, over the 3 cycles of Class 4 PD power-ups.
Class_4_Flap_Count(Max)	The maximum number of flapping, that is ports that power more than once per cycle, over the 3 cycles of Class 4 PD power-ups.
Grant_Time_4(Min)	The time to get a first port powered and granted given connection of a bank of Class 4 PD's
Grant_Time_4(Max)	The time to get a final port powered and granted given connection of a bank of Class 4 PD's
Class_4_Max_Count(2Pr)	The number of 2-Pair powering PSE ports that power and grant Class 4 (25.5W) PD's on a test cycle that captures **Class_4_Grant_Count(Max)**.
Class_4_Max_Count(4Pr)	The number of 4-Pair powering PSE ports that power and grant Class 4 (25.5W) PD's on a test cycle that captures **Class_4_Grant_Count(Max).**
Class_4_Max_Demote_ Count(2Pr)	The number of 2-Pair powering PSE ports that power but do not grant more than 13W to Class 4 PD's on a test cycle that captures **Class_4_Grant_Count(Max).**
Class_4_Max_Demote_ Count(4Pr)	The number of 4-Pair powering PSE ports that power but do not grant more than 13W to Class 4 PD's on a test cycle that captures **Class_4_Grant_Count(Max).**

mp_class_4_admit

Power Administrative Decisions with Class 4 PD's

Class_4_Demote_ Count(Min)	The minimum number of PSE ports that demote Class 4 PD's across the 3 powering cycles.
Class_4_Demote_ Count(Max)	The maximum number of PSE ports that demote Class 4 PD's across the 3 powering cycles.
Trusted_Class_4_Ports(2Pr)	List of 2-pair powering PSE ports, presented in format of {instrument ID,test port} that consistently power and grant Class 4 PD's (25.5W) across all 3 cycles of power-ups.
Trusted_Class_4_Ports(4Pr)	List of 4-pair powering PSE ports, presented in format of {instrument ID,test port} that consistently power and grant Class 4 PD's (25.5W) across all 3 cycles of power-ups.

Conditional Parameters (*L2 Power Recovery*)

Produced only if PSE is **LLDP** or **PHY+LLDP** granting AND PSE is (Type-2/3) limited to 30W powering AND PSE fails to grant all ports (Class_4_Grant_Count(Min) < total ports)

L2_Grant_Count_4(2Pr)	The count of 2-pair ports that power and grant the requested **Pclass_15pt5(2Pr)** power level using LLDP. **Pclass_15pt5(2Pr)** is 15.5W escalated for cable loss.
L2_Grant_Count_4(4Pr)	The count of 4-pair ports that power and grant the requested **Pclass_15pt5(4Pr)** power level using LLDP. **Pclass_15pt5(2Pr)** is 15.5W escalated for cable loss.
Pclass_15pt5(2Pr)	Minimum 2-pair PSE port power capacity required after allocating (via LLDP) 15.5W to a Class 4 PD.
Pclass_15pt5(4Pr)	Minimum 4-pair PSE port power capacity required after allocating (via LLDP) 15.5W to a Class 4 PD.
Released_Power_4	The total watts, at the PSE interface, that are theoretically made available when Class 4 PD's will only demand 15.5W rather than 25.5W.
Utilized_Power_4	Based on any additional port grants, the additional power made available to PD's on ports that were otherwise unpowered and/or ungranted.
Power_Recovery_4	The ratio (in %) of **Utilized_Power_4** to **Released_Power_4**.

PSL-3424A Limitations

A PSL-3424A cannot test an LLDP granting PSE and will not be able to produce the L2 (LLDP) Power Recovery parameters.

mp_mac_admit

Power Administrative Decisions with MAC PD's

Test Objective

Analyze PSE responses to a full bank of PD's that emulate the maximum PD Class supported respectively by 4-pair and 2-pair powering PSE ports. Evaluate port powering (granting) and the stability / repeatability of those grants. ("MAC" refers to **Maximum Assigned Class**.) As an example, a PSE with a mix of 4-pair and 2-pair powering ports might support Class 8 (90W) power on the 4-pair ports and Class 4 (30W) power on the 2-pair ports. MAC would then be Class 8 on the 4-pair ports and Class 4 on the 2-pair ports.

Description

The test cycles 3 rounds of power-ups involving emulated MAC PD's drawing very low power (~1W each) on all PSE ports. Tallies are collected of the number of ports that power and grant MAC PD power along with any ports that cycle power more than once (i.e. flapping) until a stable powering situation is established. The test retains lists of PSE ports that consistently power across all 3 cycles ("trusted ports"). The test can optionally create log files that carry all of the detail results and calculations that occur throughout the test.

PSE Qualification

This test should be run on all PSE's that include one or more 4-pair ports capable 45W (Class 5) or higher

Standard Parameters

MAC_Grant_Count(Min)	The minimum number of MAC (maximum assigned class) PD's that get powered and granted when all PD's are simultaneously connected to PSE ports and draw ~1 watt each.
MAC_Grant_Count(Max)	The maximum number of MAC (maximum assigned class) PD's that get powered and granted when all PD's are simultaneously connected to PSE ports and draw ~1 watt each.
MAC_Flap_Count(Min)	The minimum number of flapping, that is ports that power more than once per cycle, over the 3 cycles of MAC PD power-ups.
MAC_Flap_Count(Max)	The maximum number of flapping, that is ports that power more than once per cycle, over the 3 cycles of MAC PD power-ups.
Grant_Time_MAC(Min)	The time to get a first port powered and granted given connection of a bank of MAC PD's
Grant_Time_MAC(Max)	The time to get a final port powered and granted given connection of a bank of MAC PD's
MAC_Max_Count(2Pr)	The number of 2-Pair powering PSE ports that power and grant MAC (maximum assigned class) PD's on a test cycle that captures **MAC_Grant_Count(Max).**
MAC_Max_Count(4Pr)	The number of 4-Pair powering PSE ports that power and grant MAC (maximum assigned class) PD's on a test cycle that captures **MAC_Grant_Count(Max).**
MAC_Max_Demote_ Count(2Pr)	The number of 2-Pair powering PSE ports that power but do not grant Class 4 power level to Class 4 PD's on a test cycle that captures **MAC_Grant_Count(Max).**
MAC_Max_Demote_ Count(4Pr)	The number of 4-Pair powering PSE ports that power but do not grant MAC power level to MAC PD's on a test cycle that captures **MAC_Grant_Count(Max)**.
MAC_Demote_Count(Min)	The minimum number of PSE ports that demote MAC PD's across the 3 powering cycles.
MAC_Demote_Count(Max)	The maximum number of PSE ports that demote MAC PD's across the 3 powering cycles.

mp_mac_admit

Power Administrative Decisions with MAC PD's

	Trusted_MAC_ Ports(2Pr)	List of 2-pair powering PSE ports, presented in format of {instrument ID,test port} that consistently power and grant MAC PD's across all 3 cycles of power-ups.
	Trusted_MAC_ Ports(4Pr)	List of 4-pair powering PSE ports, presented in format of {instrument ID,test port} that consistently power and grant MAC PD's across all 3 cycles of power-ups.
Conditional Parameters (*L2 Power Recovery*)	Produced only if PSE is LLDP or PHY+LLDP granting AND PSE fails to grant all ports (MAC_Grant_Count(Min) < total ports)	
	L2_Grant_Count_ MAC(2Pr)	The count of 2-pair ports that power and grant the requested **Pclass_MACminus10(2Pr)** power level using LLDP. **Pclass_MACminus10(2Pr)** is described below.
	L2_Grant_Count_ MAC(4Pr)	The count of 4-pair ports that power and grant the requested **Pclass_MACminus10(4Pr)** power level using LLDP. **Pclass_MACminus10(4Pr)** is described below.
	Pclass_ MACminus10(2Pr)	Minimum 2-pair PSE port power capacity required after allocating (via LLDP): 2-Pair Port MAC is Class 4: 15.5W escalated for maximum cable loss 2-Pair Port MAC is Class 3: 3W escalated for maximum cable loss
	Pclass_ MACminus10(4Pr)	Minimum 2-pair PSE port power capacity required after allocating (via LLDP): 4-Pair Port MAC is Class 5: 40.0W escalated for maximum cable loss 4-Pair Port MAC is Class 6: 51.0W escalated for maximum cable loss 4-Pair Port MAC is Class 7: 62.0W escalated for maximum cable loss 4-Pair Port MAC is Class 8: 71.3W escalated for maximum cable loss
	Released_Power_MAC	The total watts, at the PSE interface, that are theoretically made available when 2-pair and 4-pair MAC PD's will demand 10W less, via LLDP, than their respective PD classes are entitled to. Example: Emulated class 4 PD's on 2-pair ports request 15.5W and emulated 4-pair class 8 PD's on 4-pair ports request 61.3W.
	Utilized_Power_MAC	Based on any additional port grants, the additional power made available to PD's on ports that were otherwise unpowered and/or ungranted.
	Power_Recovery_MAC	The ratio (in %) of **Utilized_Power_4** to **Released_Power_4**.
PSL-3424A Limitations	A PSL-3424A cannot test an LLDP granting PSE and will not be able to produce the L2 (LLDP) Port Recovery parameters.	

Power Capacity and Integrity Tests

mp_class_3_pwr_cap

Power Management and Integrity with Class 3 PD's

Test Objective	Assess the management of PSE shared power source while powering a bank of Class 3 PD's. Determine Static Power Capacity, Transient Load Capacity, and Power Utilization. Conditionally assess full capacity stability over a long time duration. Conditionally assess response to a bank of PD's connected simultaneously that draw full load (13W) immediately when powered.
Description	The test initially measures **Static Power Capacity**. This is done by connecting all ports to Class 3 PD's that draw initially 1 watt, then step up to 5 watt loading. From that point, total load power is incremented in steps of 24 watts, 18 watts, or 12 watts depending on proximity to **Pclass** (Class 3) per port. The test scans to find the maximum power allowed before port drops start reducing the total power output. Static Capacity is compared to initial power grants in order to determine the integrity of those power grants. The test then determines the **Static Power Utilization** by calculating the number of **Pclass** (Class 3) port loads the PSE should support and then verifying that it will support that loading scenario. Next the test assesses **Transient Load Capacity**, that is PSE support of **Ppeak** load transients from all the Class 3 PD's. The PSE is brought to 99% of the earlier determined Static Power Capacity, and then a succession of 45msec load transients are applied to all powered ports simultaneously, starting with 5% of Ppeak, then 15%, then 30%, 50%, 75%, 100%, and 115%. If the PSE drops one more ports during any of those load transients, then the transient load capacity is reported as the total power above the Static Power Capacity that was tolerated by the prior transient level where power was maintained on all powered ports. The test also computes what the **Required Power Reserve** above the Static Power Capacity would be in order for the PSE to properly tolerate **Ppeak** loading from the bank of Class 3 PD's. If the PSE tested is restricted to 15 watt power on all ports, two optional sub-tests can run: The optional **Stress Test**, like the Transient Load Capacity test, brings the PSE to 99% of Static Power Capacity, then monitors for power cycling on any PSE ports over a user-specified duration that could be many hours in length. The **PoE Service Restoration Test** analyzes PSE response following simultaneous connection of a bank of Class 3 PD's that immediately draw **Pclass_pd** (13W) when powered rather than the lower ~1W loads used at initial power-ups in prior tests. The test looks for any PSE ports that have PoE service either temporarily or permanently inhibited in response to the initial load "shock".
PSE Qualification	This test can and should be run on all PSE's.

mp_class_3_pwr_cap

Power Management and Integrity with Class 3 PD's

Standard Parameters

Granted_Class_3_Power	This is the total power that the PSE offers to provide to a bank of Class 3 PD's. Because these are Class 3 (13W) PD's, any port that powers is effectively granting full Class 3 power, **Pclass** (class 3) to the connected PD. **Pclass** includes worst case cable loss added to the 13W PD demand.
Static_Capacity_3	The measured static (or continuous) power capacity of the PSE. The test uses a an intricate scheme to search for this total power output level with granularity generally of 12W, 18W, or 24W depending on how near **Pclass** (class 3) per port that the peak capacity is discovered. The logic adapts to any combination of 4-Pair granted ports and 2-Pair granted ports. The measurement allows at least 5 seconds for PSE's to make decisions about removing power from one or more ports when static loads are adjusted.
Grant_Integrity_3	This indicates if the power offered to all PD's is "genuine" up to the maximum (13W) power the Class 3 PD's are allowed to draw. It is simply the **Static_Capacity_3** less the **Granted_Class_3_Power**. A negative value means the PSE is over-granting the PD's by that amount of watts.
Under_Grant_Count_3	Given the measured **Static_Capacity_3**, this is the number of additional ports that could be powered in cases where the PSE does not power all ports initially. It will be larger than zero if **Grant_Integrity_3** is greater than **Pclass_3**() and the count of ports powering for the **Static_Capacity_3** measurement is smaller than the total port count.
Expect_Pclass_3_Count	Given the measured **Static_Capacity_3**, this is the number of Class 3 PD's drawing 13W each over maximum allowable (100M) cable lengths that the PSE can reliably support.
Actual_Pclass_3_Count	This parameter determines if the PSE will actually power and support the **Expect_Pclass_3_Count** of PD's, each drawing **Pclass**, that is, the power required when powering 13W PD's over maximum allowable (100M) cable lengths.
Min_Vport_3(2Pr)	The minimum port voltage measured during the **Static_Capacity_3** measurement across all 2-Pair ports. This will typically occur at the maximum static capacity level.
Min_Vport_3(4Pr)	The minimum port voltage measured during the **Static_Capacity_3** measurement across all 4-Pair ports. This will typically occur at the maximum static capacity level.
Transient_Capacity_3	PSE ports are required to support **Ppeak** transient power loads while powering PD's. On the PD side, Class 3 PD's are allowed to draw up to 14.4W for up to 50 msec with ~5% duty cycle. **Ppeak** then escalates that load to account for cable loss. **Transient_Capacity_3** is measured by applying a static power load that is 99% of the measured **Static_Capacity_3** power, then on top of that, applying transient loads lasting 45msec across all powered ports. The transient loads start at 5% of **Ppeak**, then increment to 15%, 30%, 50%, 75%, 100%, and 115% of **Ppeak**. When an applied transient causes one or more PSE ports to remove power, the **Transient_Capacity_3** is the incremental power above **Static_Capacity_3** that is tolerated before any ports shut down.
Required_Reserve_3	This is the total transient power above **Static_Capacity_3** that is required to support class 3 **Ppeak** loads on all powered PSE ports. In most cases, it is calculated as Count of Powered Ports * **Ppeak** - **Static_Capacity_3** where **Ppeak** is the respective 2-Pair and 4-Pair transient requirement of each PSE port.

Conditional Parameters (*Stress Test*)

Produced only if user or the test sequencer specifies to run stress test with Class 3 loading. Sequencer will specify the stress test if the PSE is a Type-1 (15W) capable PSE

Stress_Test_Duration	This is the user-specified stress test duration in units of hours ranging from .02 hours to 24 hours. During the Stress Test, just like the **Transient_Capacity_3** measurement, static power load is brought to exactly 99% of **Static_Capacity_3**.
Stress_Test_Ports_3	This is a count of the ports that are powered for the Stress Test. It will match the number ports powered for the **Transient Load Capacity** measurement.
Port_Drops_3(2Pr)	This is a count of the number of times one or more 2-Pair ports spontaneously killed power, then re-powered the emulated PD over the duration of the stress test.
Port_Drops_3(4Pr)	This is a count of the number of times one or more 4-Pair ports spontaneously killed power, then re-powered the emulated PD over the duration of the stress test.
Dropped_Ports_3(2Pr)	A list of each 2-Pair port, presented as {Chassis ID,test port}, that removed, then restored power over the duration of the stress test.
Dropped_Ports_3(4Pr)	A list of each 4-Pair port, presented as {Chassis ID,test port}, that removed, then restored power over the duration of the stress test.

Conditional Parameters (*PoE Service Integrity*)

Produced only if the PSE is limited to Type-1 (15W) power AND if **Grant_Integrity_3** < -15W OR **Actual_Pclass_3_Count** < **Expect_Pclass_3_Count**

Startup_Load_ Response_3	This is a count of ports that will power and support continous **Pclass_pd** (13W) loading that is applied immediately at power-up on each PSE port.
Lost_PoE_Service_3	This is a count of ports that fail to power class 3 PD's with 1W loading AFTER the **Startup_Load_Response_3** measurement is completed and emulated PD's are all disconnected.

mp_class_3_pwr_cap

Power Management and Integrity with Class 3 PD's

Disabled_Ports_3	A list of the test ports in {chassis ID,test port} format, that did not restore PoE service when the low power (1W) power-ups were subsequently attempted.

PSL-3424A Limitations

None. This test does not use LLDP in any measurements.

mp_class_4_pwr_cap

Power Management and Integrity with Class 4 PD's

Test Objective

Assess the management of PSE shared power source while powering a bank of Class 4 PD's. Determine Static Power Capacity, Transient Load Capacity, and Power Utilization.

Conditionally assess full capacity stability over a long time duration. Conditionally assess response to a bank of PD's connected simultaneously that draw full load (25.5W) immediately when powered (or granted via LLDP).

Description

The test initially measures **Static Power Capacity**. This is done by connecting all ports to Class 4 PD's that draw initially 1 watt, then step up to 7 watt loading. From that point, total load power is incremented in steps of 24 watts, 18 watts, or 12 watts depending on proximity to **Pclass** (Class 4) per port. The test scans to find the maximum power allowed before port drops start reducing the total power output. Static Capacity is compared to initial power grants in order to determine the integrity of those power grants.

The test then determines the **Static Power Utilization** by calculating the number of **Pclass** (Class 4) port loads the PSE should support and then verifying that it will support that loading scenario.

Next the test assesses **Transient Load Capacity**, that is PSE support of **Ppeak** load transients from all the Class 4 PD's. The PSE is brought to 99% of the earlier determined Static Power Capacity, and then a succession of 45msec load transients are applied to all powered ports simultaneously, starting with 5% of Ppeak, then 15%, then 30%, 50%, 75%, 100%, and 115%. If the PSE drops one more ports during any of those load transients, then the transient load capacity is reported as the total power above the Static Power Capacity that was tolerated by the prior transient level where power was maintained on all powered ports. The test also computes what the **Required Power Reserve** above the Static Power Capacity would be in order for the PSE to properly tolerate Ppeak loading from the granted Class 4 PD's.

If the PSE tested is restricted to 30 watt power on all ports, two optional sub-tests can run:

The optional **Stress Test**, like the Transient Load Capacity test, brings the PSE to 99% of Static Power Capacity, then monitors for power cycling on any PSE ports over a user-specified duration that could be many hours in length.

The **PoE Service Restoration Test** analyzes PSE response following simultaneous connection of a bank of Class 4 PD's that immediately draw **Pclass_pd** (25.5W) when powered rather than the lower ~1W loads used at initial power-ups in prior tests. The test looks for any PSE ports that have PoE service either temporarily or permanently shut down in response to the initial load "shock".

PSE Qualification

This test can and should be run on all Type-2 (30W), Type-3 (30W or higher) and Type-4 (90W) PSE's.

Standard Parameters

Granted_Class_4_Power	This is the total power that the PSE offers to provide to a bank of Class 4 PD's. The Maximum Power Grant Method (see above) defines how the test will pursue a Class 4 power grant. With **PHY** or **PHY+LLDP** method, the grant is provided right at power-up where as with **LLDP** method, the test will use PoE LLDP to obtain an allocation for 25.5W. **Pclass** includes worst case cable loss added to the 25.5W PD demand.
Static_Capacity_4	The measured static (or continuous) power capacity of the PSE. The test uses a an intricate scheme to search for this total power output level with granularity generally of 12W, 18W, or 24W depending on how near **Pclass** (class 4) *per port* that the peak capacity is discovered. The logic adapts to any combination of 4-Pair granted ports, 2-Pair granted ports, and demoted ports. The measurement allows at least 5 seconds for PSE's to make decisions about removing power from one or more ports when static loads are adjusted.
Grant_Integrity_4	This indicates if the power offered to all PD's is "genuine" up to the maximum (25.5W) power the Class 4 PD's are allowed to draw. It is simply the **Static_Capacity_4** less the **Granted_Class_4_Power**. A negative value means the PSE is over-granting the PD's by that amount of watts.
Under_Grant_Count_4	Given the measured **Static_Capacity_4**, this is the number of additional ports that could be powered in cases where the PSE does not power all ports initially. It will be larger than zero if **Grant_Integrity_4** is greater than **Pclass_4()** and the count of ports powering for the **Static_Capacity_4** measurement is smaller than the total port count.
Expect_Pclass_4_Count	Given the measured **Static_Capacity_4**, this is the number of Class 4 PD's drawing 25.5W each over maximum allowable (100M) cable lengths that the PSE can reliably support.
Actual_Pclass_4_Count	This parameter determines if the PSE will actually power and support the **Expect_Pclass_4_Count** of PD's, each drawing **Pclass**, that is, the power required when powering 25.5W PD's over maximum allowable (100M) cable lengths.
Min_Vport_4(2Pr)	The minimum port voltage measured during the **Static_Capacity_4** measurement across all 2-Pair ports. This will typically occur at the maximum static capacity level.

mp_class_4_pwr_cap

Power Management and Integrity with Class 4 PD's

Min_Vport_4(4Pr)	The minimum port voltage measured during the **Static_Capacity_4** measurement across all 4-Pair ports. This will typically occur at the maximum static capacity level.
Transient_Capacity_4	PSE ports are required to support **Ppeak** transient power loads while powering PD's. On the PD side, Class 4 PD's are allowed to draw up to 28.3W for up to 50 msec with ~5% duty cycle. **Ppeak** then escalates that load to account for cable loss. **Transient_Capacity_4** is measured by applying a static power load that is 99% of the measured **Static_Capacity_4** power, then on top of that, applying transient loads lasting 45msec across all powered ports. The transient loads start at 5% of **Ppeak**, then increment to 15%, 30%, 50%, 75%, 100%, and 115% of **Ppeak**. When an applied transient causes one or more PSE ports to remove power, the **Transient_Capacity_4** is the incremental power above **Static_Capacity_4** that is tolerated before any ports shut down.
Required_Reserve_4	This is the total transient power above Static_Capacity_4 that is required to support class 4 **Ppeak** loads on all powered PSE ports. In most cases, it is calculated as Count of Powered Ports * **Ppeak** - **Static_Capacity_4** where **Ppeak** is the respective 2-Pair and 4-Pair transient requirement of each PSE port.

Conditional Parameters (*L2 Grant Integrity*)

Produced only on PHY+LLDP granting PSE's where **Grant_Integrity_4** < MIN(-**Pclass_4(2Pr)**, -**Pclass_4(4Pr)**)

L2_Grant_Integrity_4	This parameter determines if a PSE that over-grants power with multi-event power-ups (**Grant_Integrity_4** < -**Pclass_4()**) also over-grants power following LLDP power negotiations.

Conditional Parameters (*Stress Test*)

Produced only if user or the test sequencer specifies to run stress test with Class 4 loading. Sequencer will specify the stress test if the PSE is a 30W capable PSE.

Stress_Test_Duration	This is the user-specified stress test duration in units of hours ranging from .02 hours to 24 hours. During the Stress Test, just like the **Transient_Capacity_4** measurement, static power load is brought to exactly 99% of **Static_Capacity_4**.
Stress_Test_Ports_4	This is a count of the ports that are powered for the Stress Test. It will match the number ports powered for the **Transient Load Capacity** measurement.
Port_Drops_4(2Pr)	This is a count of the number of times one or more 2-Pair ports spontaneously killed power, then re-powered the emulated PD over the duration of the stress test.
Port_Drops_4(4Pr)	This is a count of the number of times one or more 4-Pair ports spontaneously killed power, then re-powered the emulated PD over the duration of the stress test.
Dropped_Ports_43(2Pr)	A list of each 2-Pair port, presented as {Chassis ID,test port}, that removed, then restored power over the duration of the stress test.
Dropped_Ports_4(4Pr)	A list of each 4-Pair port, presented as {Chassis ID,test port}, that removed, then restored power over the duration of the stress test.

Conditional Parameters (*PoE Service Integrity*)

Produced only if the PSE is limited to maximum 30W (Type-2 or Type-3) power AND if **Grant_Integrity_4** < -30W OR **Actual_Pclass_4_Count** < **Expect_Pclass_4_Count**

Startup_Load_ Response_4	This is a count of ports that will power and support continuous **Pclass_pd** (25.5W) loading that is applied immediately at power-up on each PSE port.
Lost_PoE_Service_4	This is a count of ports that fail to power and grant class 4 PD's with 1W loading AFTER the **Startup_Load_Response_4** measurement is completed and emulated PD's are all disconnected.
Disabled_Ports_4	A list of the test ports in {chassis ID,test port} format, that did not restore PoE service when the low power (1W) power-ups were subsequently attempted.

PSL-3424A Limitations

A PSL-3424A cannot test an **LLDP** granting PSE and will not be able to produce **the L2 Grant Integrity** parameter if testing PSE's that are **LLDP** or **PHY+LLDP** granting.

mp_mac_pwr_cap

Power Management and Integrity with MAC (max assigned class) PD's

Test Objective

Assess the management of PSE shared power source while powering a bank of MAC (Maximum Assigned Class) PD's. Determine Static Power Capacity, Transient Load Capacity, and Power Utilization. Conditionally assess full capacity stability over a long time duration. Assess response to a bank of PD's connected simultaneously that draw full **Pclass_pd**(MAC) load (e.g. 25.5W on 30W ports and 71.3W on 90W capable ports) immediately when powered (or granted via LLDP).

Description

The test initially measures **Static Power Capacity**. This is done by connecting all ports to PD's that will operate at the maximum assigned class (MAC) and draw initially 1 watt, then step up to 7 watt loading. From that point, total load power is incremented in steps of 24 watts, 18 watts, or 12 watts depending on proximity to **Pclass** (MAC) per port. The test scans to find the maximum power allowed before port drops start reducing the total power output. Static Capacity is compared to initial power grants in order to determine the integrity of those power grants.

The test then determines the **Static Power Utilization** by calculating the number of **Pclass** (MAC) port loads the PSE should support and then verifying that it will in fact support that loading scenario.

Next the test assesses **Transient Load Capacity**, that is PSE support of **Ppeak** load transients from all

mp_mac_pwr_cap

Power Management and Integrity with MAC (max assigned class) PD's

the MAC PD's. The PSE is brought to 99% of the earlier determined Static Power Capacity, and then a succession of 45msec load transients are applied to all powered ports simultaneously, starting with 5% of Ppeak, then 15%, then 30%, 50%, 75%, 100%, and 115%. If the PSE drops one more ports during any of those load transients, then the transient load capacity is reported as the total power above the Static Power Capacity that was tolerated by the prior transient level where power was maintained on all powered ports. The test also computes what the **Required Power Reserve** above the Static Power Capacity would be in order for the PSE to properly tolerate **Ppeak** loading from the granted MAC PD's.

The **Stress Test**, like the Transient Load Capacity test, brings the PSE to 99% of Static Power Capacity, then monitors for power cycling on any PSE ports over a user-specified duration that could be many hours in length.

The **PoE Service Restoration Test** analyzes PSE response following simultaneous connection of a bank of MAC PD's that immediately draw **Pclass_pd** (e.g. 25.5W for class 4, 51W for class 6) when powered rather than the lower ~1W loads used at initial power-ups in prior tests. The test looks for any PSE ports that have PoE service either temporarily or permanently shut down in response to the initial load "shock".

PSE Qualification Standard Parameters

This test should be run on all PSE's that include one or more 4-pair ports capable 45W (Class 5) or higher

Granted_MAC_Power	This is the total power that the PSE offers to provide at the PSE output to a bank of MAC (maximum assigned class) PD's. The Maximum Power Grant Method (see above) defines how the test will pursue a MAC power grant. With **PHY** or **PHY+LLDP** method, the grant is provided right at power-up where as with **LLDP** method, the test will use PoE LLDP to obtain an allocation for **Pclass_PD** associated with PSE port MAC. **Pclass_PD** is 13W for class 3, 25.5W for class 4, 40W for class 5, 51W for class 6, 62W for class 7, and 71.3W for class 8. **Pclass** includes worst case cable loss added to the **Pclass_PD** demand.
Static_Capacity_MAC	The measured static (or continuous) power capacity of the PSE. The test uses a an intricate scheme to search for this total power output level with granularity generally of 12W, 18W, or 24W depending on how near **Pclass** (MAC) *per port* that the peak capacity is discovered. The logic adapts to any combination of 4-Pair granted ports, 2-Pair granted ports, and demoted ports. The measurement allows at least 5 seconds for PSE's to make decisions about removing power from one or more ports when static loads are adjusted.
Grant_Integrity_MAC	This indicates if the power offered to all PD's is "genuine" up to the maximum power the MAC PD's are allowed to draw. It is simply the **Static_Capacity_MAC** less the **Granted_Class_MAC_Power**. A negative value means the PSE is over-granting the PD's by that amount of watts.
Under_Grant_Count_ MAC_2	Given the measured **Static_Capacity_MAC**, this is the number of additional 2-pair ports that could be powered in cases where the PSE does not power all 2-pair ports initially. It will be larger than zero if **Grant_Integrity_MAC** is greater than **Pclass_MAC(2Pr)** and the count of 2-pair ports powering for the **Static_Capacity_MAC** measurement is smaller than the total number of 2-pair ports.
Under_Grant_Count _MAC_4	Given the measured **Static_Capacity_MAC**, this is the number of additional 4-pair ports that could be powered in cases where the PSE does not power all 4-pair ports initially. It will be larger than zero if **Grant_Integrity_MAC** is greater than **Pclass_MAC(4Pr)** and the count of 4-pair ports powering for the **Static_Capacity_MAC** measurement is smaller than the total number of 4-pair ports.
Expect_Pclass_MAC_ Count	Given the measured **Static_Capacity_MAC**, this is the number of MAC PD's drawing MAC power levels each over maximum allowable (100M) cable lengths that the PSE can reliably support. Total power is first split among any 4-pair PSE ports, and then excess beyond that is split among 2-pair PSE ports.
Actual_Pclass_MAC_ Count	This parameter determines if the PSE will actually power and support the **Expect_Pclass_MAC_Count o**f PD's, each drawing **Pclass (MAC)**, that is, the power at the PSE interface required when powering MAC PD's drawing full load. 4-pair PSE ports are prioritized first, then 2-pair PSE ports as required to achieve **Expect_Pclass_MAC_Count** granted with Pclass loads.
Min_Vport_MAC(2Pr)	The minimum port voltage measured during the **Static_Capacity_MAC** measurement across all 2-Pair ports. This will typically occur at the maximum static capacity level.
Min_Vport_MAC(4Pr)	The minimum port voltage measured during the **Static_Capacity_MAC** measurement across all 4-Pair ports. This will typically occur at the maximum static capacity level.
Transient_Capacity_MAC	PSE ports are required to support **Ppeak** transient power loads while powering PD's. On the PD side, PD's are allowed to draw up to **Ppeak_pd** (class dependent) for up to 50 msec with ~5% duty cycle. **Ppeak** then escalates that load to account for cable loss. **Transient_Capacity_MAC** is measured by applying a static power load that is 99% of the measured **Static_Capacity_MAC** power, then on top of that, applying transient loads lasting 45msec across all powered ports. The transient loads start at 5% of **Ppeak**, then increment to 15%, 30%, 50%, 75%, 100%, and 115% of **Ppeak**. 4-pair granted ports and 2-pair granted ports each experience **Ppeak** loads consistent with assigned class. When an applied transient causes one or more PSE ports to shut down, the **Transient_Capacity_MAC** is the incremental power above **Static_Capacity_MAC** that is tolerated before any ports shut down.

mp_mac_pwr_cap

Power Management and Integrity with MAC (max assigned class) PD's

Conditional Parameters (*L2 Grant Integrity*)	Produced only on PHY+LLDP granting PSE's where **Grant_Integrity_MAC** < MIN(-**Pclass_MAC(2Pr)**, - **Pclass_MAC(4Pr)**)	
	L2_Grant_Integrity_MAC	This parameter determines if a PSE that over-grants power with multi-event power-ups (**Grant_Integrity_MAC** < -**Pclass_MAC()**) also over-grants power following LLDP power negotiations.
Conditional Parameters (*Stress Test*)	Produced only if user specifies to run stress test with MAC loading. By default, the sequencer will require this of any PSE that supports class 5 to class 8 on one or more ports.	
	Stress_Test_Duration	This is the user-specified stress test duration in units of hours ranging from .02 hours to 24 hours. During the Stress Test, just like the **Transient_Capacity_MAC** measurement, static power load is brought to exactly 99% of **Static_Capacity_MAC**.
	Stress_Test_Ports_MAC	This is a count of the ports that are powered for the Stress Test. It will match the number ports powered for the **Transient Load Capacity** measurement.
	Port_Drops_MAC(2Pr)	This is a count of the number of times one or more 2-Pair ports spontaneously killed power, then re-powered the emulated PD over the duration of the stress test.
	Port_Drops_MAC(4Pr)	This is a count of the number of times one or more 4-Pair ports spontaneously killed power, then re-powered the emulated PD over the duration of the stress test.
	Dropped_Ports_MAC(2Pr)	A list of each 2-Pair port, presented as {Chassis ID,test port}, that removed, then restored power over the duration of the stress test.
	Dropped_Ports_MAC(4Pr)	A list of each 4-Pair port, presented as {Chassis ID,test port}, that removed, then restored power over the duration of the stress test.
Conditional Parameters (*PoE Service Integrity*)	Produced only if **Grant_Integrity_MAC** < -30W OR **Actual Pclass_MAC_Count** < **Expect_Pclass_MAC_Count**	
	Startup_Load_Response_ MAC	This parameter is a count of ports that will power and support continuous **Pclass_pd** (MAC) loading that is applied immediately at power-up (or upon LLDP grant for **LLDP** granting PSE's) on each PSE port.
	Lost_PoE_Service_MAC	This is a count of ports that fail to power MAC PD's with 1W loading AFTER the **Startup_Load_Response_MAC** measurement is completed and emulated PD's are all disconnected.
	Disabled_Ports_MAC	A list of the test ports in {chassis ID,test port} format, that did not restore PoE service when the low power (1W) power-ups were subsequently attempted.
PSL-3424A Limitations	A PSL-3424A cannot test an **LLDP** granting PSE and will not be able to produce **the L2 Grant Integrity** parameter if testing PSE's that are **LLDP** or **PHY+LLDP** granting.	

Power Management (PM) Analyzer Reporting

The Power Management Analyzer Suite automatically generates Microsoft Excel* spreadsheet reports with an extensive set of features. These reports will pop up when the test sequencer is completed with the selected group of tests. Features include:

- Header description of PSE and critical PSE attributes including **MAC** (maximum assigned class for 2-pair and 4-pair ports), **Pclass** values for Class 3, Class 4, and MAC PD powering, and single port PSE **Output Voltages** at Pclass loading for Class 3, Class 4, and MAC PD's on both 2-pair and 4-pair powering ports.
- Multi-Port Resource Chart indicating test instruments and test ports utilized including connections to 2-pair versus 4-pair PSE ports.
- Tabular tables of data from the four **mp_class_*_admit** tests with limit logic utilized to annunciate non-ideal PSE limitations and trade-offs.
- Pie graphs presenting allocation, by PD class, of 2-pair and 4-pair powered/granted ports, unpowered ports, and 2-pair / 4-pair demoted (un-granted) ports.
- Bar graphs depicting counts and any uncertainty in the number of powered and granted ports.
- Bar graphs describing the time range from first port grant to final port grant over the course of several multi-port power-ups.
- Bar graphs depicting Class 4 and MAC demoted ports and any flapping (power cycling) ports observed over the course of several multi-port power-ups.
- Tabular table (conditional) and bar graph describing Class 4 and MAC LLDP power grant recovery measurements involving 10 watt reduced PD power demands.
- Tabular tables of data from the three **mp_* *_pwr_cap** tests with limit logic utilized to annunciate non-ideal PSE limitations and trade-offs as well as 802.3 specification conformance violations.
- Bar graphs comparing granted static power capacity to actual static power capacity available to Class 3, Class 4, and MAC PD's.

* Separately requires Microsoft Excel version 2007 or newer on the host PC

- Bar graphs depicting, given the measured static power capacity, the expected PSE ports that will support **Pclass** loads and the actual ports that supported those loads, again for Class 3, Class 4, and MAC PD's.
- Bar graphs that present the transient power capacity as compared to the required transient reserve power available to powered (granted) Class 3, Class 4, and MAC PD's.
- Bar graphs indicating the LLDP* power grant integrity to Class 4 and MAC PD's.
- Tabular data with limit checking for conditional test parameters from the long duration stress test and the PoE Service Integrity test.
- **ALERT** notifications for:
  - PSE's demonstrating large voltage drops between the shared DC power supply and each PSE controller.
  - PSE's that appear to remove PoE service or re-boot after or during the static power capacity scan.
  - PSE's that appear to remove PoE service or re-boot during the transient load capacity scan.
  - PSE's that appear to remove PoE service or re-boot during the PoE Service Integrity test.

In the figure 1, a hybrid 4-pair 802.3bt / 2-pair 802.3at PSE is tested. The PSE is **PHY** granting and over-allocates power when connected to a bank of MAC PD's.

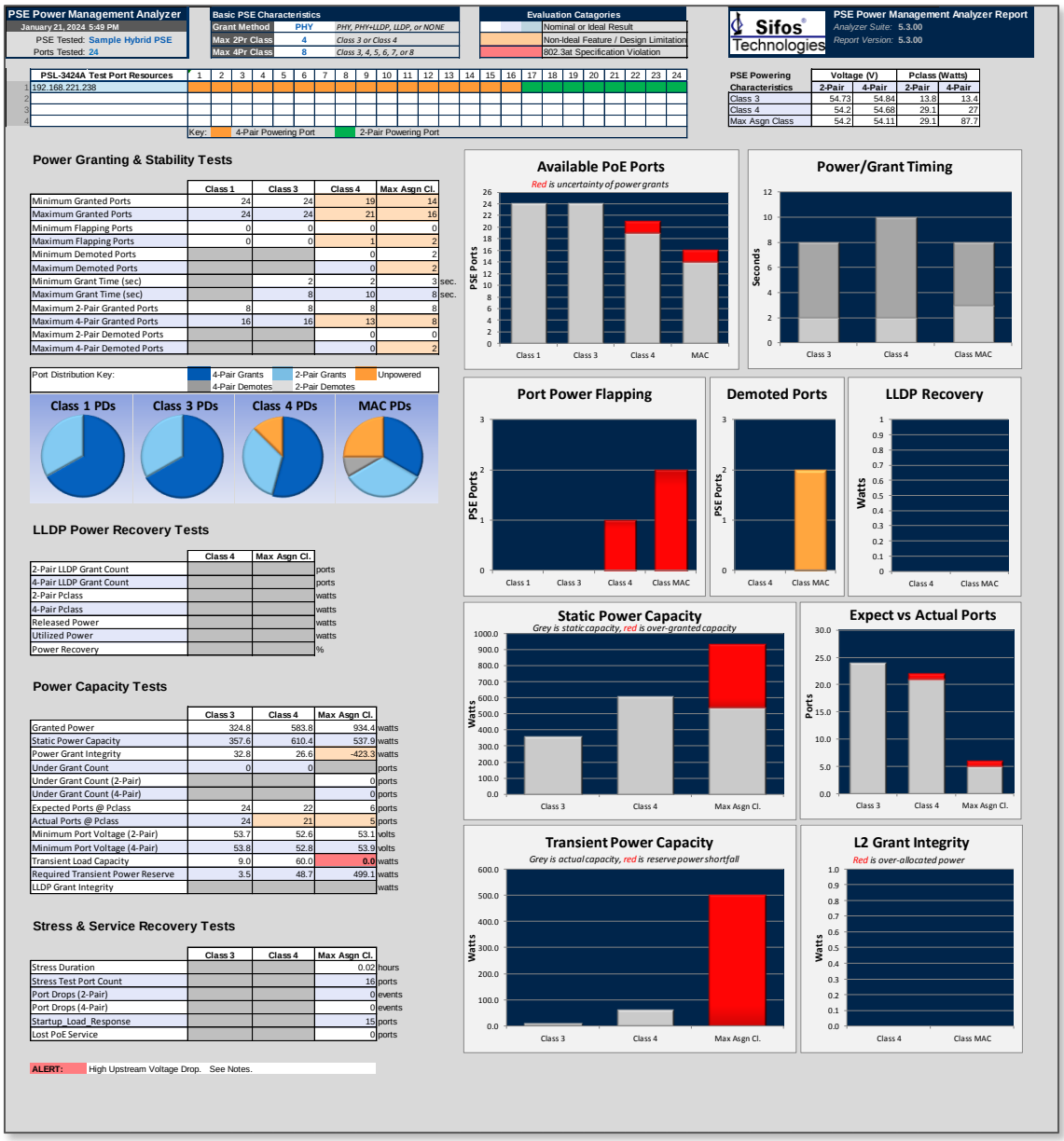


Figure 1: Hybrid 4-pair / 2-pair PSE Power Management Report

* LLDP parameters require the PSL-3424L instrument(s)

Each report includes a **Port Stats** page that charts the test ports that were consistently powered / granted during the **mp_class_*_admit** tests and also ports that indicate power re-cycling and/or loss of service during the **mp_**_pwr_cap** tests. This is shown in figure 2.

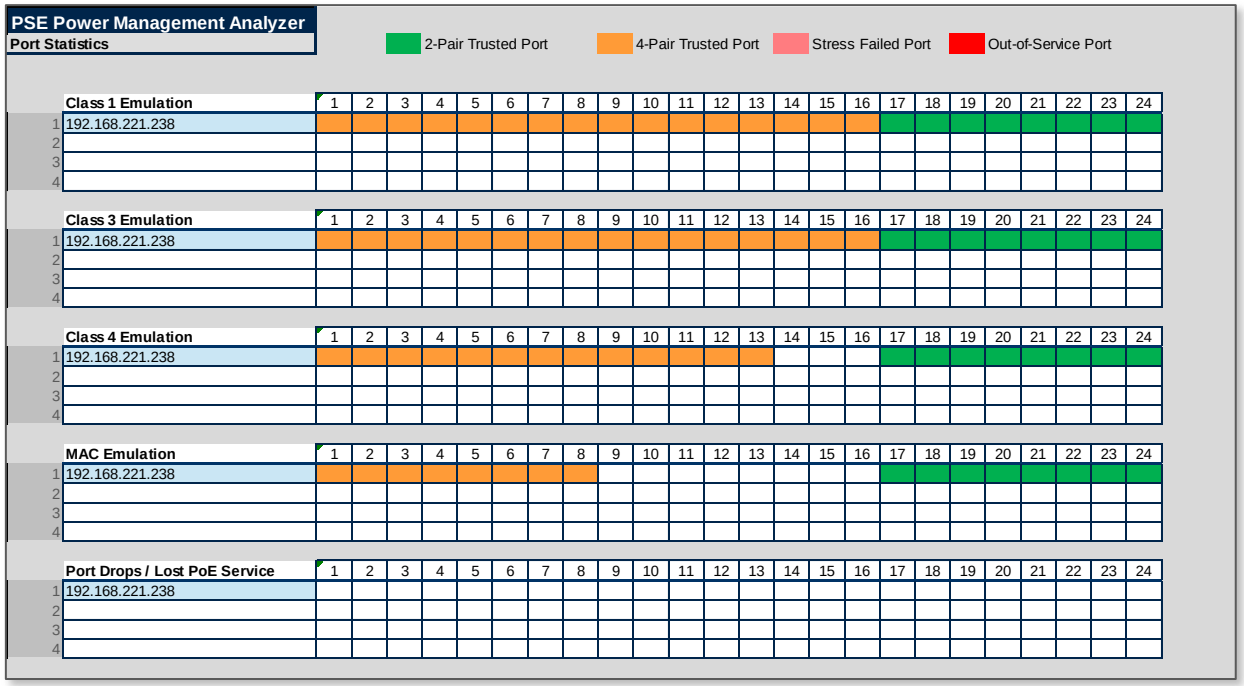


Figure 2: Port Stats page of standard test report

In figure 3, a 24 port PSE that is **PHY+LLDP** granting is presented. This PSE demonstrates good power management practice in not over-granting PD's and in utilizing PoE LLDP to recover power after PD power demands are conveyed using LLDP.

Though all PSE ports here are 4-pair powering, the Class 1 – Class 4 pie charts indicate that the PSE uses just 2-pair powering with Class 1-Class 4 PD's. In the MAC tests, this PSE utilizes 4-pair powering when connected to MAC (class 6) PD's.

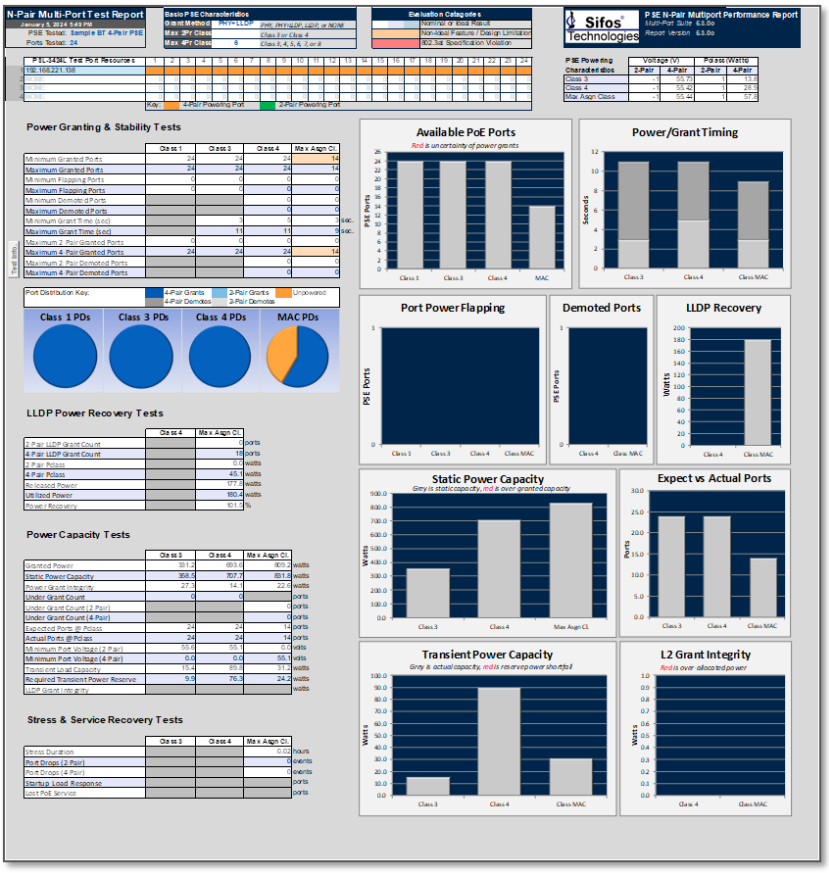


Figure 3: PHY+LLDP granting PSE with high integrity

Configuring and Running the Power Management Analyzer Suite

The PSE Power Management Analyzer Suite can be accessed from either PSA Interactive Software (GUI) or PowerShell PSA, an extended Tcl/Tk command line shell.

PSA Interactive contains a **PMA Suite** tab menu that allows access to the test suite menu. This menu is context sensitive. When PSA Interactive is connected to a PSL-3424 instrument licensed for the PMA Suite, the PMA Suite tab menu in figure 5 will appear. If PSA Interactive were connected to a PSA/PSL-3000 instrument, the menu would change to support the (2-Pair) PM Analyzer Suite for 802.3at PSE's.

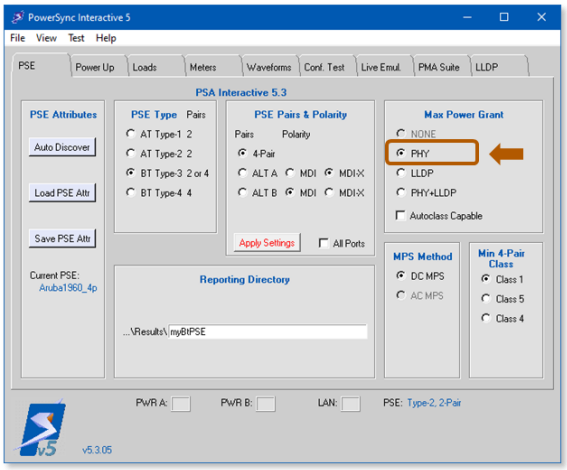


Figure 4: PSE Attributes Tab Menu

Before running the tests in the PM Analyzer Suite, one PSE attribute must be properly declared using the **PSE** tab menu. The **Max Power Grant** setting must properly describe how the PSE grants power levels beyond 15 watts (*see figure 4*). The **Standard Configuration Requirements to All Tests** on Page 3 provides a description of this PSE attribute. All other PSE attributes described in this menu are not required because the PM Analyzer Suite will automatically determine everything else it needs to know about the PSE.

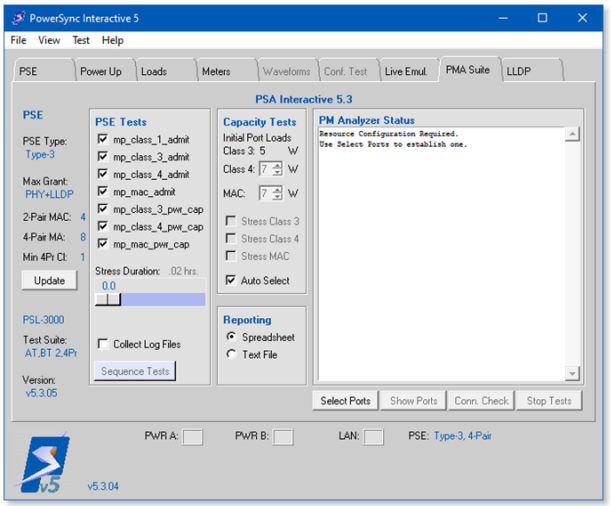


Figure 5: Power Management Analyzer Menu

Before PM Analyzer testing can commence, the PSE test port connections must be described. This is done using the Multi-Port Resource Configuration menus accessed from the **Select Ports** button in the **PMA Suite** tab menu (*figure 5*). A description of that process is provided below.

The PM Analyzer Suite menu allows selection of tests, test configurations, PSE connection verification, and direct access to the PSE characterization module that automatically discovers all relevant PSE attributes given that Max Power Grant is properly described (see above). When PSE characterization is completed, the menu will update the 2-Pair MAC, 4-Pair MAC, and Minimum 4-Pair Class PSE attributes. This happens using the **Update** button or automatically when a test sequence is initiated using the **Sequence Tests** button.

Resource Configuration (*see figure 6*) is used to define the field of up to four instruments and their associated test ports to be used in PM Analyzer Testing. Test ports are grouped according to connected PSE port powering capability, 2-Pair or 4-Pair.

Resource Configuration automatically determines if the instrument type is a **PSL-3424A** or **PSL-3424L**. Both instrument types can be combined in which case all will be treated as PSL-3424A's in the resource configuration.

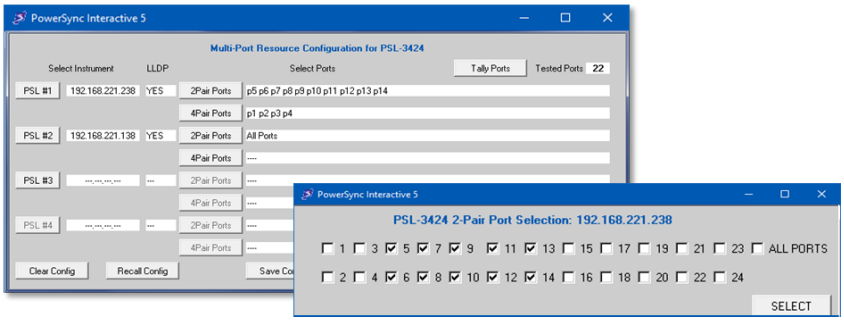


Figure 6: Multi-Port Resource Configuration Menus

Once a Resource Configuration is validated, the Multi-Port Resource Configuration menus close and the newly described resource configuration is displayed in the PM Analyzer Suite menu.

Ordering Information

PSL-3424-PMA	PSE Power Management Analyzer Suite for 2-pair, 4-pair, and hybrid-pair powering PSE's for one **PSL-3424** Address (24 ports). Requires **Live PD Emulation** license, PSL-3424_EMUL.
PSL-3424-EMUL	Single Instrument Feature License for Multi-Port Live PD Emulation

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