

# **Power over Ethernet**

**Clause 33 PD  
Parametric Test Suite  
Version 1.8**

*Technical Document*



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## **MODIFICATION RECORD**

- September 22, 2008 – Version 1.8  
Zachary Clifton: Further updates for IEEE802.3at/D3.1
- July 2, 2008 – Version 1.7  
Zachary Clifton: Initial test suite update for IEEE 802.3at D3.0
- June 1, 2006 – Version 1.6  
David Schwarzenberg: Added tests 33.1.10 *PD Maintain Power Signature* and 33.1.11 *Classification Stability Time*
- October 8, 2004 – Version 1.5  
Sean LaPierre: Added test 33.1.9 *Ripple and Noise Operation*
- July 19, 2004 – Version 1.4  
Jeremy Kent: Extracted part b from test 33.1.5 *Classification Signature Characteristics* and created tests 33.1.6 *Input Average Power*, and test 33.1.7 *Backfeed Voltage*; subsequent tests were renumbered appropriately.
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- April 16, 2003 – Version 1.2  
Veena Venugopal
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Veena Venugopal
- January 10, 2003 - Version 1.0 Released  
Initial Release

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|                     |                             |
|---------------------|-----------------------------|
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## **INTRODUCTION**

### **Overview**

The University of New Hampshire's InterOperability Laboratory (IOL) is an institution designed to improve the interoperability of standards based products by providing an environment where a product can be tested against other implementations of a standard. This suite of tests has been developed to help implementers evaluate the functionality of their IEEE *DraftP802.3at*<sup>TM</sup>/D3.1 based products. The tests do not determine if a product conforms to the IEEE *DraftP802.3at*<sup>TM</sup>/D3.1 standard, not definitively. Successful completion of all tests contained in this suite does not guarantee that the tested device will operate with other Power over Ethernet capable devices. However, combined with satisfactory operation in the IOL's interoperability test bed, these tests provide a reasonable level of confidence that the Device Under Test (DUT) will function well in many Power over Ethernet environments.

### **Organization of Tests**

The tests contained in this document are organized to simplify the identification of information related to a test and to facilitate in the actual testing process. Each test contains an identification section that describes the test and provides cross-reference information. The discussion section covers background information and specifies why the test is to be performed. Tests are grouped in order to reduce setup time in the lab environment. Each test contains the following information:

### **Test Number**

The Test Number associated with each test follows a simple grouping structure. Listed first is the Test Group Number followed by the test's number within the group. This allows for the addition of future tests to the appropriate groups of the test suite without requiring the renumbering of the subsequent tests.

### **Purpose**

The purpose is a brief statement outlining what the test attempts to achieve. The test is written at the functional level.

### **References**

The references section lists cross-references to the IEEE *DraftP802.3at*<sup>TM</sup>/D3.1 standard and other documentation that might be helpful in understanding and evaluating the test and results.

### **Resource Requirements**

The requirements section specifies the hardware, and test equipment that will be needed to perform the test. The items contained in this section are special test devices or other facilities, which may not be available on all devices.

### **Last Modification**

This specifies the date of the last modification to this test.

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**Discussion**

The discussion covers the assumptions made in the design or implementation of the test as well as known limitations. Other items specific to the test are covered here.

**Test Setup**

The setup section describes the configuration of the test environment. Small changes in the configuration should be included in the test procedure.

**Procedure**

The procedure section of the test description contains the step-by-step instructions for carrying out the test. It provides a cookbook approach to testing, and may be interspersed with observable results.

**Observable Results**

The observable results section lists specific items that can be examined by the tester to verify that the DUT is operating properly. When multiple values are possible for an observable result, this section provides a short discussion on how to interpret them. The determination of a pass or fail for a certain test is often based on the successful (or unsuccessful) detection of a certain observable result.

**Possible Problems**

This section contains a description of known issues with the test procedure, which may affect test results in certain situations.

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## **GROUP 1: PD ELECTRICAL CHARACTERISTICS**

**Scope:** The following tests cover parametric tests specific to Type 1 and Type 2 Powered Devices (PDs) that support 10BASE-T, 100BASE-TX, and 1000BASE-T devices.

**Overview:** The following group of tests pertains to the determination of various parametric values as defined in IEEE DraftP802.3at™/D3.1. Note, successfully passing these tests, or failing these tests does not necessarily indicate that the DUT will, or will not, be interoperable. Devices that pass these tests are more inclined to be interoperable with, not only existing products, but also all future standard compliant devices.

### **33.1.1: Source Power**

**Purpose:** To verify that DUT does not source power on its power interface (PI).

**Reference:**

[1] IEEE *Draft*P802.3at™/D3.1: Subclause 33.3.1, Table 33-13

**Resource Requirements:**

- Voltmeter
- Ammeter
- Power Supply

**Last Modification:** June 12, 2008

**Discussion:** A device that is either drawing power or requesting power from PSE should not be capable of sourcing power on either of the two sets of PI conductors at any time.

**Test Setup:** Connect the Mode A positive  $V_{port}$  pins of the DUT to the positive terminal of the voltmeter, and the negative  $V_{port}$  pins to the negative terminal of the voltmeter.

**Procedure:**

1. Measure  $V_{port}$  at the PI of the DUT using a voltmeter.
2. Verify that there is no power present at the PI.

**Observable Results:**

- a. The DUT should not source power onto the PI at any time.

**Possible Problem:** None



### **33.1.2: Valid PD Pinout**

**Purpose:** To verify that the DUT is insensitive to the polarity of the power supply and is able to operate in either Mode A or Mode B, but not both at the same time.

**Reference:**

[1] IEEE *DraftP802.3at*<sup>TM</sup>/D3.1: Subclause 33.3.1, Table 33-13

**Resource Requirements**

- Power Supply

**Last Modification:** June 12, 2008

**Discussion:** After detection and optional classification, a PSE may supply power on either set of the four wire pairs, hence the PD must support drawing its power from both Mode A and Mode B regardless of the polarity of the power supply.

**Test Setup:** Connect the Mode A positive  $V_{\text{port}}$  pins of the DUT to the positive terminal of the power supply, and the negative  $V_{\text{port}}$  pins to the negative terminal of the power supply.

**Procedure:**

1. Apply power to the PI using Alternative A MDI.
2. Observe the operational status of the DUT.
3. Repeat steps 1 and 2, however, applying power on Mode A MDI-X, Mode B MDI, and Mode B MDI-X.

**Observable Results:**

- a. In all cases the DUT should accept the applied power and become operational once the requested power has been supplied.
- b. The DUT should not accept power on both pairs simultaneously.

**Possible Problem:** None

### 33.1.3: Valid Detection Signature Characteristics

**Purpose:** To verify that the DUT presents a valid detection signature while it is requesting power on the power interface (PI).

**References:**

[1] IEEE DraftP802.3at™/D3.1: Section 33.3.4, Annex 33C.4, Figure 33C.20, Table 33-14

**Resource Requirements:**

- Power Supply
- Voltage meter
- Ammeter

**Last Modification:** June 12, 2008

**Discussion:** If a PD will accept power, but is not powered, via the PI then it should present a valid detection signature at the PI between the positive and negative  $V_{\text{port}}$  pins for both pinout Modes such that the attached PSE will properly detect the PD's request for power. The standard defines the signature to be comprised of five characteristics: a valid resistance, capacitance, and inductance; and either a voltage offset or a current offset. The voltage offset limit was specified to allow for the inherent voltage offset for two series diode drops. Similarly, the current limit allows for internal FET leakage. Given the minimum and maximum limits on the defined resistive slope, there are no minimum bounds for the offset components as a maximum current implies a minimum voltage, and vice versa. Figure 33C.20 of Annex C in Clause 33, reproduced below, illustrate the signature resistance and voltage offsets.

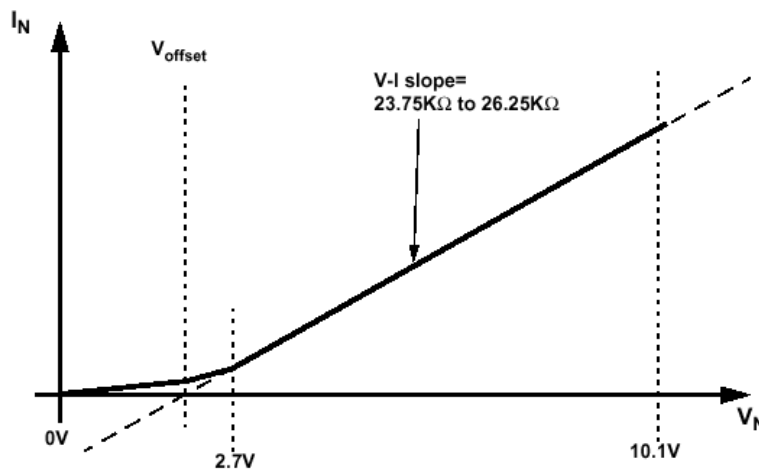


Figure 33C.20—Signature voltage offset

**Test Setup:** Connect the Mode A positive  $V_{\text{port}}$  pins of the DUT to the positive terminal of the power supply, and the negative  $V_{\text{port}}$  pins to the negative terminal of the power supply.

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**Procedure:**

1. Limit the power supply current between 4 to 5 mA.
2. Applying voltage using Alternative A, vary the power supply voltage,  $V_N$ , from 0.0 V to 3.0 V in steps of 50 mV and measure the corresponding current,  $I_N$ , drawn by the DUT.
3. Vary the power supply voltage,  $V_N$ , from 3.2 V to 10.2 V in steps of 200 mV and measure the corresponding current,  $I_N$ , drawn by the DUT.
4. Calculate  $R_{\text{sigN}}$  using a 1 V chord between measurement points.
5. Determine either the voltage offset or the current offset by calculating the intersection of the line between the  $(V_N, I_N)$  and  $(V_{N+1}, I_{N+1})$  data points and V/I axis.
6. Repeat steps 1-5, however, connect the DUT to accept power on Mode B.

**Observable Results:**

- a. In step 4 the observed signature resistance should be between 23.75 K $\Omega$  and 26.25K $\Omega$  (inclusive).
- b. In step 5 the DUT should have either a voltage offset less than or equal to 1.9 V, or a current offset less than 10  $\mu$ A.

**Possible Problems:** None

### **33.1.4: Non-Valid Detection Signature Characteristics**

**Purpose:** To verify that the DUT presents a non-valid detection signature while it is not requesting power, or once powered, at the power interface (PI) of the non-powered pairs.

**Reference:**

[1]IEEE *DraftP802.3at*<sup>TM</sup>/D3.1: Subclause 33.3.4, Annex 33C.4, Figure 33C.19, Table 33-15

**Resource Requirements:**

- Power Supply
- Voltage meter
- Ammeter

**Last Modification:** June 12, 2008

**Discussion:** There are two cases when a PD should present a non-valid detection signature when attached to the PSE via the PI. The first case is while a PD is in a state where it will not accept power via the PI. The second case occurs once a PD becomes powered via the PI, and it must present a non-valid detection signature on the set of pairs from which it is not drawing power.

**Test Setup:** Connect the Mode A positive  $V_{port}$  pins of the DUT to the positive terminal of the power supply, and the negative  $V_{port}$  pins to the negative terminal of the power supply.

**Procedure:**

1. Limit the power supply current between 4 to 5 mA.
2. Apply power onto the PI using Alternative A, and confirm the DUT is drawing power via the PI.
3. Applying voltage to the non-powered pairs, vary the power supply voltage,  $V_N$ , from 0.0 V to 3.0 V in steps of 50 mV and measure the corresponding current,  $I_N$ , drawn by the DUT.
4. Vary the power supply voltage,  $V_N$ , from 3.2 V to 10.2 V in steps of 200 mV and measure the corresponding current,  $I_N$ , drawn by the DUT.
5. Calculate  $R_{sigN}$  using a 1 V chord between measurement points.
6. Repeat steps 1-5; however, connect the DUT to accept power on Mode B.

**Observable Results:**

- a. In step 5 verify that  $R_{sigN} < 12\text{ K}\Omega$  or  $R_{sigN} > 45\text{ K}\Omega$ .

**Possible Problems:** None

### 33.1.5: Input Average Power

**Purpose:** To verify that the DUT will turn on once power has been applied to the power interface (PI), will remain on over the entire port voltage range, and turn off once power is removed.

**Reference:**

[1] IEEE DraftP802.3at™/D3.1: subclause 33.3.7, 33.3.7.2, Table 33-18

**Resource Requirements:**

- Power Supply
- Current meter

**Last Modification:** June 12, 2008

**Discussion:** For a PD that supports classification, the maximum power that the PD may draw across all input voltages and operational modes is governed by the limits specified in table 33-18. This value is known as  $P_{CLASS\_PD}$ .

Table 33-18 - PD Power classification

| Class | Usage    | Maximum power available to PD |
|-------|----------|-------------------------------|
| 0     | Default  | 12.95 Watts                   |
| 1     | Optional | 3.84 Watts                    |
| 2     | Optional | 6.49 Watts                    |
| 3     | Optional | 12.95 Watts                   |
| 4     | Optional | $I_{CABLE} * V_{portmin}$     |

**Test Setup:** Connect the Mode A positive  $V_{port}$  pins of the DUT to the positive terminal of the power supply, and the negative  $V_{port}$  pins to the negative terminal of the power supply through a 20Ω series resistance.

**Procedure:**

1. If possible, configure the DUT for desired Class operation.
2. Apply a port voltage of 44 V onto the PI using Alternative A.
3. Measure the current drawn by the DUT and calculate the input power averaged over a 1 second period.
4. Repeat steps 1-2, however, apply power using Alternative B and a port voltage of 57 V.
5. Repeat steps 1-3 for all supported classes.

**Observable Results:**

- a. The maximum power drawn by the DUT for each supported class should be below the maximum value specified in table 33-14.

**Possible Problems:** None.

### **33.1.6: Backfeed Voltage**

**Purpose:** To verify that the backfeed voltage measured across the non-powered power interface (PI) conductors of the DUT falls within the conformance limits.

**Reference:**

[1] IEEE *Draft*P802.3at™/D3.1: subclause 33.3.7.10, Table 33-18.

**Resource Requirements:**

- Power Supply
- Voltage meter

**Last Modification:** June 23, 2008

**Discussion:** When  $V_{\text{PORTMAX}}$  is applied across the PI for a given Mode, the voltage measured across the PI, regardless of polarity, for the opposite Mode with a 100 k $\Omega$  load resistor connected must be less than 2.8 V, the backfeed voltage ( $V_{\text{bfd}}$ ) limit specified in the PD power supply limits of table 33-18.

**Test Setup:** Connect the Mode A positive  $V_{\text{port}}$  pins of the DUT to the positive terminal of the power supply, and the negative  $V_{\text{port}}$  pins to the negative terminal of the power supply. Connect the Mode B positive  $V_{\text{port}}$  pins of the DUT to the positive terminal of the voltage meter, and the negative  $V_{\text{port}}$  pins to the negative terminal of the voltage meter with a 100 k $\Omega$  load connected.

**Procedure:**

1. Apply 57 V across the PI using Alternative A MDI.
2. Measure the voltage across the PI for Mode B.
3. Repeat steps 1-2, however, apply power using Alternative A MDI-X.
4. Repeat steps 1-3, however, apply power using Alternative B MDI and measure  $V_{\text{bfd}}$  across the PI for Mode A.

**Observable Results:**

- a. In all cases, the measured voltage should not exceed 2.8 V.

**Possible Problems:** None

### **33.1.7: PD Input Voltage**

**Purpose:** To verify that the DUT will turn on once power has been applied to the power interface (PI), will remain on over the entire port voltage range, and turn off once power is removed.

**Reference:**

[1] IEEE *DraftP802.3at*<sup>TM</sup>/D3.1: subclause 33.3.7.1, Table 33-18.

**Resource Requirements:**

- Power Supply
- Current meter

**Last Modification:** June 23, 2008

**Discussion:** After startup, a PD is required to turn on its power supply before the input voltage ( $V_{port}$ ) level reaches 42 V. Once turned on, the power supply then must remain on over the entire range of  $V_{port}$ , which is specified from 37 V to 57 V for a Type 1 PD and 50V to 57V for a Type 2 PD, as the attached PSE may vary the applied voltage on the PI over this range at any time. If the minimum value of  $V_{port}$  is not maintained by the PSE, the PD must turn off before the input voltage level reaches 30 V.

**Test Setup:** Connect the Mode A positive  $V_{port}$  pins of the DUT to the positive terminal of the power supply, and the negative  $V_{port}$  pins to the negative terminal of the power supply through a 20 $\Omega$  series resistance.

**Procedure:**

1. Apply 42 V across the PI.
2. Observe the operational status of the DUT.
3. Repeat steps 1 and 2, however, increment the applied voltage by 1 V until the DUT has become fully operational.
4. Once operational, increase the applied voltage to 57 V in 1 V increments, and then decrease the voltage to 49 V.
5. Observe the operational status of the DUT.
6. Decrease the applied voltage by 1 V.
7. Observe the status of the DUT.
8. Repeat steps 6 and 7 until the DUT turns off.
9. Repeat steps 1-8, however, connect the DUT to accept power on Mode B.

**Observable Results:**

- a. The DUT should become fully operational at a port voltage less than 42 V.
- b. Once the DUT has turned on, it should remain operational for  $V_{PORT}$  between 37 V and 57 V for a Type 1 PD and 50V to 57V for a Type 2 PD.
- c. The DUT should turn off at a port voltage greater than 30V and less than 37 V for a Type 1 PD. A Type 2 PD should turn off at a port voltage greater than 30V and less than 41 V.

**Possible Problems:** None

### 33.1.8: PD Maintain Power Signature

**Purpose:** To verify that DUT provides a valid Maintain Power Signature (MPS) at the PI.

**Reference:**

[1] IEEE Draft P802.3at™/D3.1: Subclause 33.3.8, Table 33-19.

**Resource Requirements:**

- Power Supply
- Voltage Meter
- Current Meter

**Last Modification:** June 23, 2008

**Discussion:** A PD must provide a valid Maintain Power Signature (MPS) so that a PSE will remain powering the PD. The MPS must be valid for both DC and AC components. The DUT must provide valid DCMPS, which is a current draw equal to or above  $I_{port}$  for a minimum duration of 75ms followed by an optional dropout for a maximum of 250ms. The DUT must also provide a valid ACMPS, which requires the DUT to have a maximum input resistance of  $R_{pd\_d}$  and a minimum input capacitance of  $C_{pd\_d}$ . These values are outlined in Table 33-19.

Table 33-19—PD Maintain Power Signature

| Item | Parameter         | Symbol          | Unit       | Min  | Max   | Additional information |
|------|-------------------|-----------------|------------|------|-------|------------------------|
| 1    | Input current     | $I_{port\_MPS}$ | mA         | 10   |       | See 33.3.8             |
| 2    | Input resistance  | $R_{pd\_d}$     | k $\Omega$ |      | 26.25 |                        |
| 3    | Input capacitance | $C_{pd\_d}$     | $\mu$ F    | 0.05 |       | See Table 33-12        |

**Test Setup:** Connect the Mode A positive  $V_{port}$  pins of the DUT to the positive terminal of the power supply, and the negative  $V_{port}$  pins to the negative terminal of the power supply. Monitor voltage and current.

**Procedure:**

1. Apply 44 Volts to the PI.
2. Measure the current draw.
3. Repeat steps 1 and 2 for voltages in the range of 44-57 Volts, in 0.2 Volt increments.
4. Calculate the input resistance from the measurements obtained in steps 1-3.
5. Repeat steps 1-4; however, connect the DUT to accept power on Mode B.

**Observable Results:**

- a. The current draw is greater than or equal to 10mA ( $I_{port}$ ) over the range of 44-57 Volts.
- b. The input resistance is less than or equal to 26.25k $\Omega$  ( $R_{pd\_d}$ ) over the range 44-57 Volts.

**Possible Problems:** None



## **GROUP 2: PD CLASSIFICATION TESTS**

**Scope:** The following tests cover classification tests specific to Type 1 and Type 2 Powered Devices (PDs) that support 10BASE-T, 100BASE-TX, and 1000BASE-T devices.

**Overview:** The following group of tests pertains to the determination of various parametric values as defined in IEEE DraftP802.3at™/D3.1. Note, successfully passing these tests, or failing these tests does not necessarily indicate that the DUT will, or will not, be interoperable. Devices that pass these tests are more inclined to be interoperable with, not only existing products, but also all future standard compliant devices.

### 33.2.1: Single Event Physical Layer Classification

**Purpose:** To verify that a PD returns the correct classification current draw.

**Reference:**

[1] IEEE *Draft*P802.3at™/D3.1: Subclause 33.3.5.1, Table 33-16

**Resource Requirements:**

- Power Supply
- Class Pulse Circuit
- DSO

**Last Modification:** June 23, 2008

**Discussion:** The purpose of PD classification is to provide the PSE information about the maximum power that the PD will draw across all input voltages and operational modes. A PD should present one and only one classification signature during classification. By default, a PD is Class 0; however, to improve power management for the PSE, a PD may provide a signature for Class 1 to 4, which are outlined in table 33-15.

Table 33-16 - Classification signature, measured at PD input connector

| Parameter           | Conditions       | Minimum | Maximum | Unit |
|---------------------|------------------|---------|---------|------|
| Current for Class 0 | 14.5 V to 20.5 V | 0       | 4       | mA   |
| Current for Class 1 | 14.5 V to 20.5 V | 9       | 12      | mA   |
| Current for Class 2 | 14.5 V to 20.5 V | 17      | 20      | mA   |
| Current for Class 3 | 14.5 V to 20.5 V | 26      | 30      | mA   |
| Current for Class 4 | 14.5 V to 20.5 V | 36      | 44      | mA   |

**Test Setup:** Connect the Mode A positive  $V_{port}$  pins of the DUT to the positive terminal of the power supply, and the negative  $V_{port}$  pins to the negative terminal of the power supply.

**Procedure:**

1. Apply power onto the PI using Alternative A, varying the power supply voltage from 12.5V to 22.5V.
2. Measure the corresponding current drawn by the DUT.
3. Repeat steps 1-2, however, connect the DUT to accept power on Mode B.

**Observable Results:**

- a. In step 2 the current drawn by the DUT for each supported class should be within the range (inclusive) specified in table 33-16.
- b. The DUT should only present one classification signature during classification.

**Possible Problems:** None.

### **33.2.2: Two Event Physical Layer Classification**

**Purpose:** To verify that a Type-2 PD correctly implements two-event physical layer classification.

**Reference:**

[1] IEEE DraftP802.3at™/D3.1: Subclause 33.3.5.2, Table 33-17, Figure 33-18

**Resource Requirements:**

- Power Supply
- Arbitrary Waveform Generator
- DMM, DSO, Current Probe

**Last Modification:** June 23, 2008

**Discussion:** A type-2 PD's behavior must conform to the state diagram defined in Figure 33-18. The PD must present valid current draws at all states within the state diagram. This test applies the appropriate voltages and checks DUT behavior to determine whether or not the DUT steps through the state diagram correctly.

**Test Setup:** Connect the power supply to the class pulse circuit, which generates the class pulses with an AWG. Attach the PI of the DUT to the class pulse circuit. Monitor PI voltage and current with the DSO.

**Procedure:**

1. Apply power to the PI on Mode A.
2. Apply a 2-event classification pulse with minimum timing and minimum amplitude parameters.
3. Check for external indication that a 2-event class pulse was received.
4. Measure current for all stages of 2-event classification.
5. Repeat steps 1-4 for all combinations of minimum and maximum timing and amplitude parameters.
6. Repeat steps 1-5 for Mode B.
7. Repeat steps 1 and 2, but in step two set  $V_{\text{MARK1}}$  between 0 and 2.8V

**Observable Results:**

- a. The DUT should successfully transition throughout the state diagram.
- b. In step 3 the DUT should indicate that a 2-event class pulse was received.
- c. In step 4,  $P_{\text{CLASS\_PD}}$  should be within 36 and 44mA
- d. In step 4,  $I_{\text{Mark}}$  should be within 0.25-2mA.
- e. In step 4, the DUT should present an invalid classification signature during  $V_{\text{MARK1}}$  or  $V_{\text{MARK2}}$
- f. In step 7, determine whether the application of  $V_{\text{RESET}}$  successfully restarts the classification process.

**Possible Problems:** This test is not applicable to Type 1 PDs.

### **33.2.3: Classification Stability Time**

**Purpose:** To verify that classification current draw of the DUT is valid within  $T_{\text{class}}$ .

**Reference:**

[1] IEEE *Draft*P802.3at™/D3.1: Subclause 33.3.7.8, Table 33-16, Table 33-17.

**Resource Requirements:**

- Power Supply
- Class Pulse Circuit
- DSO

**Last Modification:** June 23, 2008

**Discussion:** When the PSE performs a class event, the PI of a PD is probed with a voltage in the range of 15.5V to 20.5V. The classification level of the PD is determined by observing the current draw. The classification current draw of the PD must be valid before 5ms ( $T_{\text{class}}$ ), so that the PSE will properly detect the PD. The classification currents are outlined in Table 33-16.

**Test Setup:** Connect the power supply to the class pulse circuit. Attach the PI of the DUT to the class pulse circuit. Monitor PI voltage and current with the DSO.

**Procedure:**

1. Apply a class pulse at the minimum condition of 14.5 Volts.
2. Measure the delay between the rising edge of the class pulse and the point when the valid classification current level is reached.
3. Observe the current draw after  $T_{\text{class}}$ .
4. Repeat steps 1-3 with the maximum condition of 20.5 Volts.
5. Repeat steps 1-4; however, connect the DUT to accept power on Mode B.

**Observable Results:**

- a. The classification current draw is valid within 5ms ( $T_{\text{class}}$ ).
- b. The classification current draw is within the valid range for all times after  $T_{\text{class}}$ .

**Possible Problems:** None.

### **33.2.4.1: Data Link Layer Classification Support**

**Purpose:** To verify that a Type-2 PD that requires more than 12.95W supports Data Link Layer Classification.

**Reference:**

[1] IEEE DraftP802.3at™/D3.1: Subclause 33.6, Figure 33-18

**Resource Requirements:**

- Power Supply
- DSO
- Test Station
- Power/Data Splitter Test Jig
- SNMP software management tool

**Last Modification:** June 24, 2008

**Discussion:** A powered device that requires more than 12.95W is required to support Data link layer classification.

**Test Setup:** Connect the power supply to the class pulse circuit. Attach the PI of the DUT to the class pulse circuit. Monitor PI voltage and current with the DSO.

**Procedure:**

1. Determine whether the DUT requires more than 12.95W.
2. Connect DUT to Test Station.
3. Start Capture on Test Station.
4. Wait 30+ seconds.
5. Extract LLDP.

**Observable Results:**

- a. The DUT should source LLDP frames with a valid PDU.

**Possible Problems:** This test is only applicable to type 2 PDs.

### 33.2.4.2: DTE Power via MDI Classification Type, Length, Value (TLV) Field

**Purpose:** To verify that a PSE or PD that supports Data Link Layer classification correctly formats its TLV.

**Reference:**

[1] IEEE *DraftP802.3at*<sup>TM</sup>/D3.1: Subclause 33.6.2, Figure 33-29

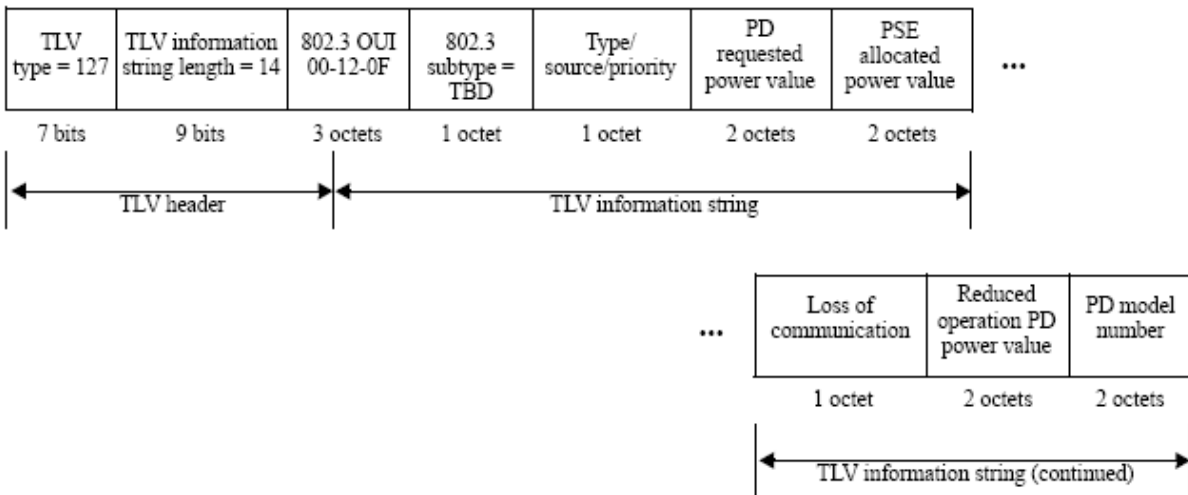
**Resource Requirements:**

- DSO
- Testing Station
- Power/Data Splitter Test Jig

**Last Modification:** June 27, 2008

**Discussion:** A PD or a PSE that supports Data Link Layer classification “shall comply with all mandatory parts of IEEE Std 802.1AB<sup>TM</sup>-200X; shall support the DTE Power via MDI classification Type, Length, Value (TLV) defined in 33.6.2; and shall support the control state diagrams defined in 33.6.6.”

This test determines whether or not the DUT successfully formats it’s TLV as defined in Subclause 33.6.2. The standard also defines that a PD or PSE supporting Data Link Layer classification shall send power management Protocol Data Units (PDUs) at least once every 30 seconds, and each of these PDU is required to contain the DTE Power Via MDI classification TLV. This test also implicitly verifies this timing requirement.



**Figure 33–29—DTE Power via MDI classification TLV format**

**Test Setup:** Connect the powered-on DUT to the test station.

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**Procedure:**

1. Ensure the default values are configured on the DUT.
2. Enable transmission of the Power Via MDI classification TLV.
3. Start Capture on Test Station.
4. Wait 31 seconds.
5. Extract LLDP information from DUT.

**Observable Results:**

- (a) The Test Station must capture properly formatted LLDPUs containing the Power Via MDI classification TLV
  - a. The power type field should be set to 01 for a PD and 00 for a PSE
  - b. The power source field should be set according to the power type field:
    - i. If the power type field is set to PD, the power source field should be set to 01 when the PD is being powered only through the PI; it should be set to 10 when the PD is being powered from a local supply; it should be set to 11 when the PD is being powered by both a local supply and through the PI; it should be set to 00 when no information is available.
    - ii. If the power type field is set to PSE, the power source field should be set to 01 when the PSE is sourcing its power through the PI from its primary supply; it should be set to 10 when the PSE is sourcing its power through the PI from a backup source; it should be set to 00 when this information is not available.
  - c. The power priority field should be set according to the power type field:
    - i. If the power type field is set to PD, the power priority should be set to the power priority configured for the device. If a PD is unable to determine its power priority, this field should be set to 00.
    - ii. If the power type is PSE, this field shall be set to 00.
  - d. The Requested PD power value should contain the currently required power level as defined in Table 33-23.
  - e. The Actual power type/source/priority field should contain a bit-map of the actual power type, source, and priority as defined in Table 33-22
  - f. The PD actual power value field should contain the current actual PD power value as defined in Table 33-23
  - g. The acknowledge field should contain a value to indicate the response of the last change in the requested power value, according to Table 33-24
    - i. This field shall be set to 00 unless the state machine enters the REMOTE ACK or REMOTE NACK states. Following entry into the REMOTE NACK state, the device shall send a PDU with this field set to 0.
- (b) This PDU must be received at least once over a period of 30 seconds

**Possible Problems:** This test is only applicable to devices that support Data Link Layer classification. Information about device powering status may or may not be available.

### **33.2.4.3: Data Link Layer Classification timing Requirements**

**Purpose:** To verify that a PSE or PD that supports Data Link Layer classification meets the LLDPDU timing requirements.

**Reference:**

[1] IEEE *Draft*P802.3at™/D3.1: Subclause 33.6.5

**Resource Requirements:**

- DUT
- DSO
- Testing Station
- Power/Data Splitter Test Jig

**Last Modification:** September 22, 2008

**Discussion:** A PD or a PSE that supports Data Link Layer classification must successfully transmit Data Link Layer Classification information. There are three timing requirements that must be met.

First, an LLDPDU containing a DTE Power via MDI classification TLV shall be sent within 5 minutes of Data Link Layer classification being enabled in a PD as indicated by the variable `pd_dll_enabled`, if the `pse_power_type` variable is set to 2 and the power draw exceeds 12.95 W..

Second, “during normal operation when the PSE MIB variables `aDLLPSEAllocatedPowerValue` and `aReceivedDLLPDRrequestedPowerValue` are equal, an LLDPDU containing a DTE Power via MDI classification TLV with an updated value for the “PSE allocated power value” field shall be sent within 10 seconds of receipt of an LLDPDU containing a DTE Power via MDI classification TLV where the “PD requested power value” field is different from the previously communicated value.”

Finally, during normal operation, “an LLDPDU containing a DTE Power via MDI classification TLV with an updated value for the “PD requested power value” field shall be sent within 10 seconds of receipt of an LLDPDU containing a DTE Power via MDI classification TLV where the “PSE allocated power value” field is different from the previously communicated value.”

This test determines whether the DUT meets these timing requirements.

**Test Setup:** Connect the powered-on DUT to the test station.

**Procedure:**

1. Ensure the default values are configured on the DUT.
2. Enable transmission of the Power Via MDI classification TLV.
3. Start capture on Test Station.
4. Wait 5 minutes.



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5. Extract LLDP information from DUT.

**Observable Results:** After 5 minutes, the DUT should have transmitted valid LLDPDUs in each of the three circumstances outlined in the discussion.

**Possible Problems:** This test is only applicable to devices that support Data Link Layer classification. Information about device powering status may or may not be available.