Comment

This comment addresses the following topics:

1. 33.2.6 and 33.2.7.4 Contains editorial errors.
2. Ipeak text was planned to be with the same concept as Icon text regarding all PD types and Ipeak, Ipeak-2P, Ipeak-2P_unb etc. however, dual-signature PD with the same class and different class was not addressed properly.
3. To update 33.2.6 and 33.2.7.4 per agreement made in offline discussions that Dual Signature PDs will be responsible to meet Pclass-2P over each pairset.
4. Does DS signature PDs need to meet unbalance requirements i.e:

a) PSE PI Rpse_min/max?: YES. PD is affected by PSE unbalance and will change Pclass-PD-2P vendor design.

b) Icon-2P_unb?: **No**. Pclass-2P is controlled by PD so we need just to meet Icont-2P=Pclass-2P/VPSE.

c) PD PI unbalance requirements?: **No**. Pclass-2P is controlled by PD so whatever PD unbalance is, the PD need to handle it or by reducing Pclass-PD so Pclass-PD-2P will meet PD advertised class over that pairset or use current balancing techniques for utilization of maximum power available.

As a result, the working assumptions are:

DS PDs with the same class is a single load PD as well as SS PD does. This means that:

a) PSE PI Rpse_min/max requirements apply for all connected PDs (SS and DS)DS

b) PD PI unbalance (requirements per 33.3.7.10) need to be updated for DS PDs to meet Icon-2P=Pclass-2P/Vpse over each pair set and not Icon-2P_unb. In addition DS PDs and SS PDs will be continue to be tested per the test circuit I n33.3.7.10.

c) DS PDs with different class is treated as DS PDs with the same class which resulted with no differentiation in the spec for DS PD with same class or different class.

Suggested Remedy

Suggested Remedy

33.2.6 PSE classification of PDs and mutual identification

Change text of Section 33.2.6 as follows:

The ability for the PSE to query the PD in order to determine the power requirements of that PD is called classification. The interrogation and power classification function is intended to establish mutual identification and is intended for use with advanced features such as power management.

Mutual identification is the mechanism that allows a Type 2, Type 3, or Type 4 PD to differentiate between Type 1, Type 2, Type 3, and Type 4 PSEs. Additionally, mutual identification allows Type 2, Type 3 or Type 4 PSEs to differentiate between Type 1, Type 2, Type 3, and Type 4 PDs. PDs or PSEs that do not implement classification will not be able to complete mutual identification and can only perform as Type 1 devices.

There are two forms of classification: Physical Layer classification and Data Link Layer (DLL) classification.

Physical Layer classification occurs before a PSE supplies power to a PD when the PSE asserts a voltage onto one or both pairsets and the PD responds to each class event with a current representing one of a limited number of classification signatures. Based on the response of ~~the~~ a single signature PD, the minimum power level at the output of the PSE is PClass as shown in Equation (33–3). ~~PClass applies to the total PD power.~~ Pclass is the power the PSE supports at the PI. Based on the response of a dual signature PD, the minimum power level supported for a pairset at the output of the PSE is Pclass-2P as shown in Equation 33-3a. Physical Layer classification encompasses two methods, known as Single-Event Physical Layer classification (see 33.2.6.1) and Multiple-Event Physical Layer classification (see 33.2.6.2).

The PSE shall provide V_{Class} with a current limitation of I_{Class_LIM}, as defined in Table 33–10 only for a pairset with a valid detection signature. Polarity shall be the same as defined for V_{Port_PSE-2P} in 33.2.3 and timing specifications shall be as defined in Table 33–10.

The minimum power output by the PSE for a particular PD Class, when powering a single signature PD or dual-signature PD or supplying power in 2p-mode, is defined by Equation (33–3). ~~This equation applies to 2-pair operation, and 4-pair operation when connected to a single-signature PD, or connected to a dual-signature PD that advertised the same class signature on both pairsets.~~ Alternatively, PSE implementations may use $V_{PSE} = V_{Port\_PSE-2P}$ min and $R_{Chan} = R_{Ch}$ when powering using a single pairset, or $R_{Chan} = R_{Ch}/2$ when powering using two pairsets to arrive at over-margined values as shown in Table 33–7.

$$P_{Class} = \left\{ V_{PSE} \times \left(\frac{V_{PSE} - \sqrt{V_{PSE}^2 - 4 \times R_{Chan} \times n \times P_{Class\_PD}}}{2 \times R_{Chan}} \right) \right\}_W \quad (33\text{–}3)$$

where

V_{PSE} is the voltage at the PSE PI as defined in 1.4.426~~1.4.423~~
R_{Chan} is the channel DC loop resistance
P_{Class_PD} is the PD's power classification (see Table 33–16a)
n n=2 for Type 3 or Type 4 PSEs when connected to a dual-signature PD.
n=1 for all other cases.

Add the following at the end of 33.2.6:

The minimum output power on a pairset for Type 3 and Type 4 PSEs that apply 4-pair power to a dual-signature PD ~~which requests a different class signature on each pairset~~ is defined by Equation 33-3a.

$$P_{Class-2P} = \left\{ V_{PSE} \times \left(\frac{V_{PSE} - \sqrt{V_{PSE}^{\ 2} - 4 \times R_{chan} \times P_{class\_PD-2P}}}{2 \times R_{chan}} \right) \right\}_W \qquad (33\text{-}3a)$$

[in equation 33-3a, Pclass-PD was replaced with Pclass_PD-2P]

where

V_{PSE}	is the voltage at the PSE PI as defined in ~~1.4.423~~1.4.426
R_{Chan}	is the channel DC loop resistance
P_{Class_PD-2P}	is the PD's power classification (see Table 33–16a)

If the PD connected to the PSE performs Autoclass (see 33.2.6.3, 33.3.5.3, and Annex 33C), the PSE may set its minimum power output based on $P_{Autoclass}$, the power drawn during Autoclass measurement window, increased by at least the margin P_{ac_margin} calculated from the measured power by Equation (33–3b), in order to account for potential increase in channel resistance due to temperature increase, with a maximum value defined in Table 33–7 of the corresponding PD Class and a minimum of 4.0 Watts. PSEs that have additional information about the actual channel DC resistance or temperature conditions may choose to use a lower Autoclass margin than that defined by Equation (33–3b).

The minimum supported PSE power levels at PSE output as function of PD requested class signature and actual PSE number of classification events shall be comply to Table 33-7 and 33-7b

~~*Editor's Note: Section 33.2.6 needs references to Tables 33-7 through 33-7b. Readers are encouraged to suggest text.*~~

[No changes for Table 33-7 for this document]

[Delete Table 33-7a]

[No changes for Table 33-7b for this document]

[No changes for the rest of 33.2.6 for this document.]

33.2.7.4 Continuous output current capability in the POWER_ON state

Replace section 33.2.7.4 as follows:

PSEs shall be able to source I_{Con}, $I_{Con\text{-}2P}$, and $I_{Con\text{-}2P\ unb}$ as specified in Table 33–11 and Equation (33–3c).

$$I_{Con\text{-}2P} = \left\{ \begin{array}{ll} P_{Class}/V_{PSE} & \text{when in 2-pair mode} \\ \min(I_{Con} - I_{Port\text{-}2P\text{-}other},\ I_{Con\text{-}2P\_unb}) & \text{when 4-pair powering a single-signature PD} \\ P_{Class\text{-}2P}/V_{PSE} & \text{when 4-pair powering a dual-signature PD} \end{array} \right\}_A \qquad (33\text{–}3c)$$

where

P_{Class}	is P_{Class} as defined in Table 33–7
$P_{Class\text{-}2P}$	is $P_{Class\text{-}2P}$ as defined in Table 33–7b
V_{PSE}	is the voltage at the PSE PI as defined in 1.4.426
I_{Con}	is the total current a PSE is able to source as defined in Table 33–11
$I_{Port\text{-}2P\text{-}other}$	is the output current on the other pairset (see 33.2.4.9)
$I_{Con\text{-}2P\ unb}$	is the current a PSE is able to source on a pairset due to unbalance as defined in Table 33–11.

$I_{Con\text{-}2P}$ is the current the PSE supports on each pairset and is defined by Equation (33–3c). I_{Con} is the total current of both pairs with the same polarity that a PSE supports. $I_{Con\text{-}2P\ unb}$ is the maximum current the PSE supports over one of the pairs of same polarity under maximum unbalance condition (see 33.2.7.4.1) in the POWER ON state. A PSE is not required to support $I_{Con\text{-}2P}$ values greater than $I_{Con\text{-}2P\ unb}$.

In addition to I_{Con}, $I_{Con\text{-}2P}$ and $I_{Con\text{-}2P\ unb}$ as specified in Table 33–11, the PSE shall support the following AC current waveform parameters, while within the operating voltage range of $V_{Port\ PSE\text{-}2P}$:

I_{Peak}, $I_{Peak\text{-}2P\ unb}$, and $I_{Peak\text{-}2P}$ minimum for $T_{CUT\text{-}2P}$ minimum and 5% duty cycle minimum on each powered pairset, where

[Issues to correct:

1. Rch is defined for 2P and equation 33-4 addresses 4P.
2. KIpeak was calculated for the ratio of Ipeak-2P_unb/Ipeak-2P. Need to check if it is still OK with the modified equations.]

$$I_{Peak} = \left\{ \frac{V_{PSE} - \sqrt{V_{PSE}^2 - 4 \times R_{Chan} \times P_{Peak\_PD}}}{2 \times R_{Chan}} \right\}_A \qquad (33\text{–}4)$$

where

V_{PSE}	is the voltage at the PSE PI as defined in 1.4.426
R_{Chan}	is the channel loop resistance; this parameter has a worst-case value of R_{Ch} which is defined in Table 33–1.
$P_{Peak\ PD}$	is the total peak power a PD may draw for its Class; see Table 33–18.

I_{Peak} is the total current of both pairs with the same polarity that a PSE supports. $I_{Peak\text{-}2P\ unb}$ is the minimum current due to unbalance effects that a PSE must support on a pairset as defined by Equation (33–4a). $I_{Peak\text{-}2P}$ is the minimum current a PSE must support on every powered pairset, as defined by Equation (33–4c).

$$I_{Peak\text{-}2P\_unb} = \left\{ (1 + K_{IPeak}) \cdot \frac{I_{Peak}}{2} \right\}_A \qquad (33\text{–}4a)$$

where

K_{IPeak}	The value of K_{IPeak}, defined in Equation 33–4b, is based on a curve fit and is dimensionless.
I_{Peak}	is the total peak current a PSE supports per Equation 33–4

$$K_{IPeak} = \begin{cases} \min(0.214 \times R_{chan}^{-0.363}, 0.330) & \text{for Class 5} \\ \min(0.199 \times R_{chan}^{-0.350}, 0.300) & \text{for Class 6} \\ \min(0.180 \times R_{chan}^{-0.326}, 0.270) & \text{for Class 7} \\ \min(0.176 \times R_{chan}^{-0.325}, 0.260) & \text{for Class 8} \end{cases} \quad (33\text{–}4b)$$

where

R_{Chan} is the channel DC loop resistance

$$I_{Peak\text{-}2P} = \begin{cases} I_{Peak} & \text{when in 2-pair mode} \\ \min(I_{Peak} - I_{Port\text{-}2P\text{-}other}, I_{Peak\text{-}2P\_unb}) & \text{when 4-pair powering a single-signature PD} \\ \dfrac{V_{PSE} - \sqrt{V_{PSE}^2 - 4 \times R_{Chan} \times P_{Peak\_PD\text{-}2P}}}{2 \times R_{Chan}} & \text{when 4-pair powering a dual-signature PD} \end{cases} \quad (33\text{–}4c)$$

where

I_{Peak}	is the total peak current a PSE supports per Equation (33–4)
$I_{Port\text{-}2P\text{-}other}$	is the output current on the other pairset (see 33.2.4.4)
$I_{Peak\text{-}2P\ unb}$	is the minimum current due to unbalance effects a PSE must support on a pairset as defined by Equation (33–4a).
V_{PSE}	is the voltage at the PSE PI as defined in 1.4.426
R_{Chan}	is the channel loop resistance; this parameter has a worst-case value of R_{Ch} which is defined in Table 33–1.
$P_{Peak\ PD\text{-}2P}$	is the total peak power a dual-signature PD may draw per its Class on a pairset; see Table 33–18.

Add the following Editor Note:

Editor Note: To add text in 33.3.7.10 to address DS PD test requirements to be done with unbalance PSE and channel that meets PSE PI unbalance requirements. This is required to ensure that DS PD that is policing its Pclass-PD-2P will not be affected by PSE and channel unbalance.
[Note: See darshan_01_0116.pdf for a solution.]