

Comment (Page 170, Line 10, Clause 145.2.10)

This comment is marked UNB\_REQ.

1. In our spec, we concluded that Icon-2P\_unb need to be split to two parameters:

a) lunbalance-2P = the max pair current due to unbalance when connected to the test verification model.

b) Icon-2P\_unb = the minimum pair current the PSE will have to support under unbalance condition.

c) It is obvious that Icon-2P\_unb need to be higher than lunbalance-2P.

2. In D3.2 we set the numbers of lunbalance-2P and Icon-2P\_unb per the following principles:

a) Icon-2P\_unb=simulation results + 5mA<sup>1</sup>. (Setting it as Icon-2P\_unb is the 1<sup>st</sup> wrong action. It should be lunbalance-2P!)

b) lunbalance-2P = Icon-2P\_unb - 10mA (which is the 2<sup>nd</sup> wrong action. Now we have lower lunbalance-2P then the actual sim results which will fail the compliance test with the test verification model).

As a result, when connecting the PSE to the test verification model, we will fail lunbalance-2P in Class 5,6 and 7 and 8. The reason for the failure:

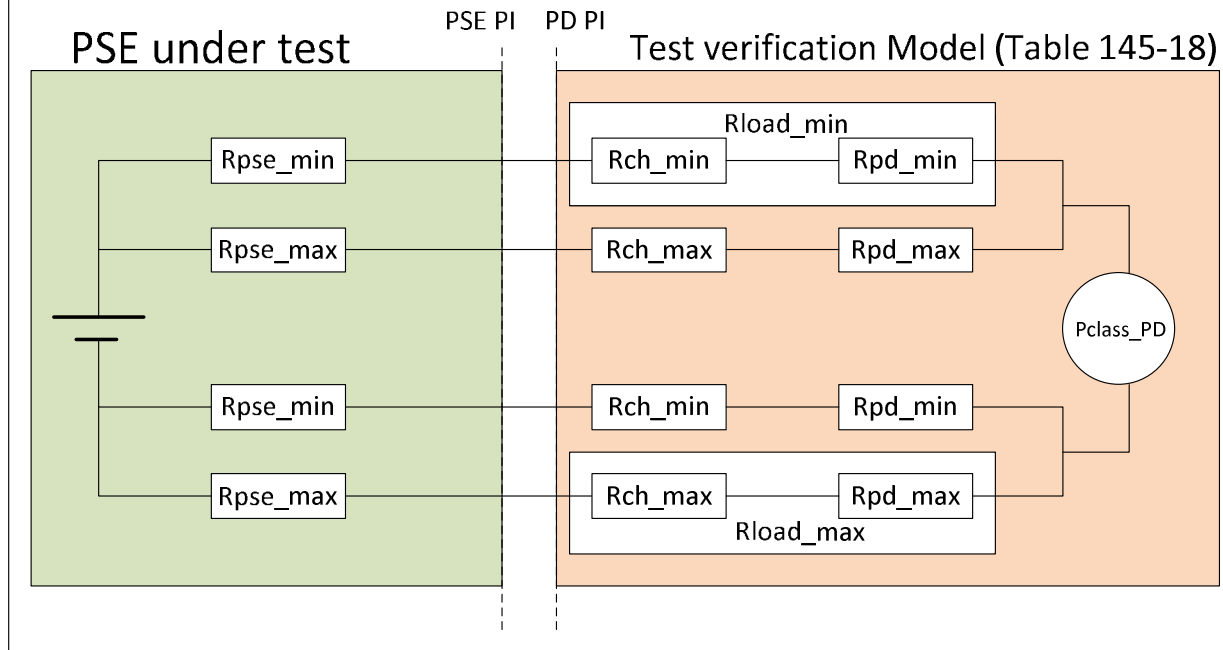
Eq-1: Icon-2P\_unb=sim\_results + 5mA.

Eq-2: lunbalance-2P = Icon-2P\_unb -10mA = sim\_results + 5mA -10mA =sim\_results -5mA

→ Actual sim results < lunbalance\_2P spec value → failing the test. The worst-case SIM result is the minimum spec value for lunbalance-2P. (and to add to the other margin in the next tables.

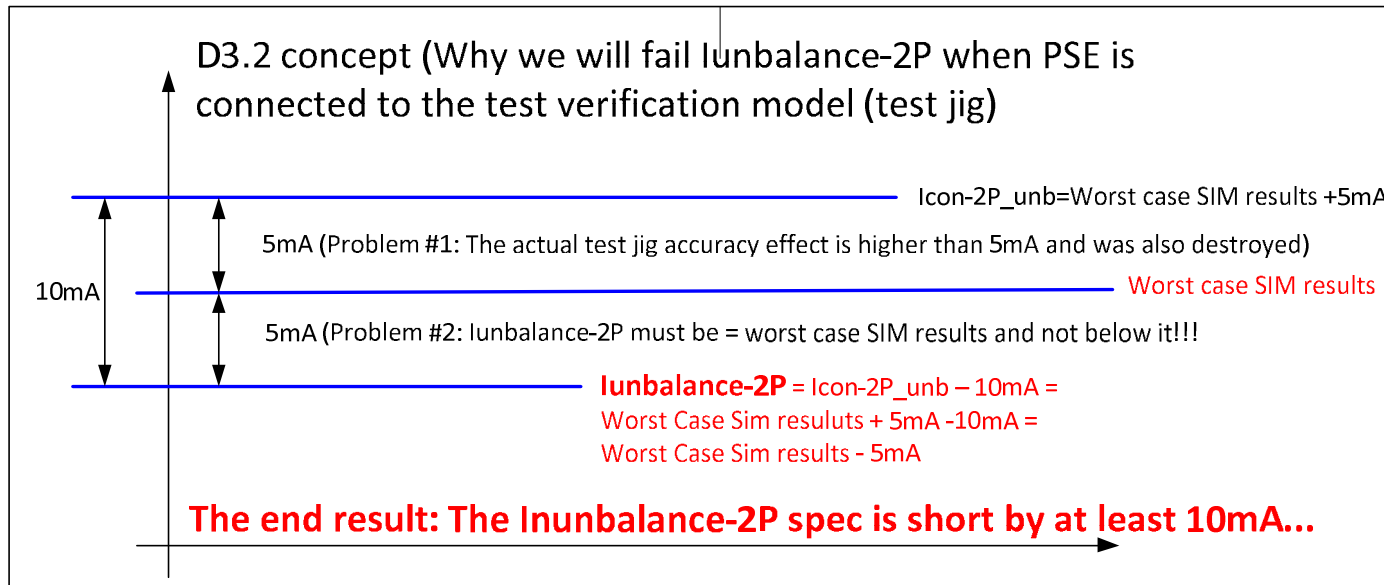
- Notes 1: The contribution of the test verification model components (+/-1% accuracy) on the worst case lunbalance-2P is 3.5mA to 9mA pending the class. The margins topic needs a discussion to conclude if we need it and how much we need from it

## 4-Pair model used to derive the spec numbers



### The facts:

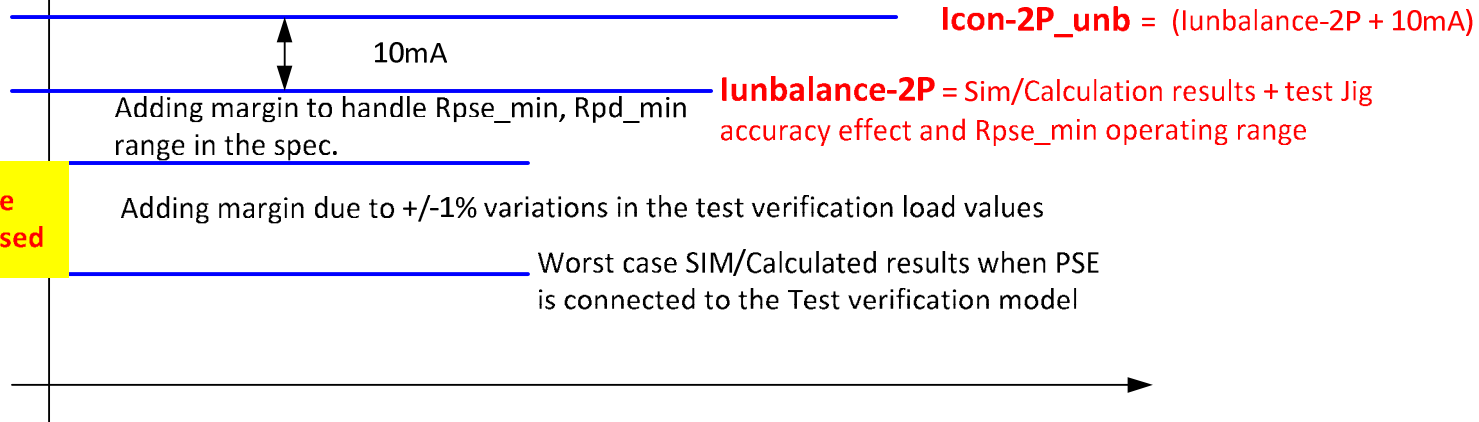
- The above is our 4-pair model used to derive the PSE and PD equations and  $I_{max}$  at worst case unbalance conditions.
- It is impossible that if the sim results for class 5  $I_{max}=0.5493A$  we will pass the  $I_{unbalance-2P}$  test  $=0.455A!$
- We must pass the test for all PSE operating range from 50V to 52V.
- The same problem for all classes.
- For Extended power class 8:
  - The test verification model values of  $R_{pd\_min}/max$  (which is  $R_{load2\_min}$ ,  $R_{load2\_max}$  in Table 145–18) are not valid for this case.
  - Equation 145-26 is not valid. Tighter  $R_{pd\_max}/R_{pd\_min}$  ratio is required.



The correct approach is:

1.  $\text{lunbalance-2P} = \text{Worst case sim results} + \text{Margins due to test jig component accuracy.}$
  2.  $I_{con-2P\_unb} = \text{lunbalance-2P} + 10\text{mA}$
- The margins topic needs a discussion to conclude if we need it and how much we need from it

Propose concept to fix the problem based on actual physics..



**Other issue to discuss:**

ILIM-2P need to be updated in order to update Ipeak-2P\_unb as received from the SIM results (few cycles ago we set automatic voltage control that sets Vpse\_min at the PSE PI to ensure accurate results per class instead of using fixed factor in PSE power supply to compensate on Rpse\_min/max voltage drop) and we didn't update ILIM-2P. In addition, for Class 8 and Class 8 extended power at 100m, we need to verify that at the worst case, we have 90W at the PSE PI (and not less due to unbalance effect that results with lower than 6.25 ohm channel resistance).

Sim results (with 0% margin when connected to test verification model)

Class	New ILIM-2P_min for D3.4 spec in order to pass tests	Solving Lennart's OCD issue by rounding up.
<b>5 (short cable)</b>	<b>0.5786</b>	0.580
<b>6 (short cable)</b>	<b>0.7164</b>	0.717 → 0.720
<b>7 (short cable)</b>	<b>0.8504</b>	0.851 → 0.85
<b>8 Extended (short cable)</b>	<b>No Change</b>	-----
<b>8 (long cable)</b>	<b>1.0018</b>	1.002 → 1.005 ?



# Proposed Remedy

## 1. Make the following changes for Icon-2P\_unb:

a) Change Icon-2P\_unb for Class 5,6,7,8 from:

0.555, 0.687, 0.789, 0.943

To: 0.56, 0.692, 0.794, 0.948

b) Strike the requirement for +/-1% from Table 145-18.

## 2. Make the following changes to ILIM-2P.

Change ILIM-2P min in Table 145-16 from:

0.578, 0.716, 0.823, 0.992

To: 0.58, 0.72, 0.85, 1.005



## Annex – Calculations and simulation results

- With +/-1% test verification model (test jig) component accuracy

Short cable, plugging Rpse_min/max per Equation 143-13 when connected to the test verification model										
Class	Simulations (Nominal Values) Without test jig accuracy effects [A]	Actual lunbalance-2P Calculated with +/- 1% test jig accuracy. <b>TO CANCEL test jig accuracy effect: change settings above [A]</b>	lunbalance-2P spec [A]	Icon-2P_unb Spec [A]	PASS/FAIL lunbalance-2P	Missing Delta to PASS the test [A]	Add the following to D3.3 to meet the lunbalance-2P spec per sim/test jig results [A]	New lunbalance-2P in D3.4 spec to pass tests [A]	New Icon-2P_unb for D3.4 spec to pass tests [A]	The effect of test jig accuracy on lunbalance [A]
5	0.5494	0.5526	0.545	0.555	FAIL	0.008	0.008	0.5526	0.5626	0.0035
6	0.6813	0.6848	0.677	0.687	FAIL	0.008	0.008	0.6848	0.6948	0.0045
7	0.7836	0.7894	0.779	0.789	FAIL	0.010	0.010	0.7894	0.7994	0.0054
8 Ext	1.0982 (*)	1.1278	0.933	0.943	FAIL	0.195	PD must have better unbalance. No change in PSE spec.	No Change	No Change	
Long cable, plugging Rpse_min/max per Equation 143-13 when connected to the test verification model										
8	0.9150	0.9226	0.933	0.943	PASS	0.000	0	0.9380	0.9480	0.009
8 to help to meet Extended	0.9380	0.9226	0.933	0.943	FAIL	0.005	0.005	0.9380	0.9480	0.009
8 to get 90W at PSE PI	0.9375	0.9455	0.933	0.943	FAIL	0.013	0.005	0.9455	0.9555	0.032

(\*) lower value (1.098) is a result that takes also in account the diode Vdiff under extended power conditions. Its value is lower than the calculation value with test jig (1.1199) due to diode effect that was not accounted for in the test jig for Extended power (the Rpd\_mi/max is correct in Table 145-28 only for Pclass\_PD=71.3w)



- With +/-0% test verification model (test jig) component accuracy

Short cable, plugging Rpse_min/max per Equation 143-13 when connected to the test verification model										
Class	Simulations (Nominal Values) Without test jig accuracy effects [A]	Actual lunbalance-2P Calculated with 0% test jig accuracy. <b>TO CANCEL test jig accuracy effect: change settings above [A]</b>	lunbalance-2P spec [A]	Icon-2P_unb Spec [A]	PASS/FAIL lunbalance	Missing Delta to PASS the test [A]	Add the following to D3.3 to meet the lunbalance-2P spec per sim/test jig results [A]	New lunbalance-2P in D3.4 spec to pass tests [A]	New Icon-2P_unb for D3.4 spec to pass tests [A]	The effect of test jig accuracy on lunbalance [A]
5	0.5494	0.5491	0.545	0.555	FAIL	0.004	0.004	0.5494	0.5594	0.0000
6	0.6813	0.6803	0.677	0.687	FAIL	0.004	0.004	0.6813	0.6913	0.0000
7	0.7836	0.7840	0.779	0.789	FAIL	0.005	0.005	0.7840	0.7940	0.0000
8 Ext	1.0982 (*)	1.1199	0.933	0.943	FAIL	0.187	PD must have better unbalance. No change in PSE spec.	No Change	No Change	
Long cable, plugging Rpse_min/max per Equation 143-13 when connected to the test verification model										
8	0.9150	0.9142	0.933	0.943	PASS	0.000	0	0.9380	0.9480	0.000
8 to help to meet Extended	0.9380	0.9142	0.933	0.943	FAIL	0.005	0.005	0.9380	0.9480	0.000
8 to get 90W at PSE PI	0.9375	0.9369	0.933	0.943	FAIL	0.005	0.005	0.9375	0.9475	0.023

(\*) lower value (1.098) is a result that takes also in account the diode Vdiff under extended power conditions. Its value is lower than the calculation value with test jig (1.1199) due to diode effect that was not accounted for in the test jig for Extended power (the Rpd\_mi/max is correct in Table 145-28 only for Pclass\_PD=71.3w)





## Calculating ILIM-2P\_unb requirements

Class	Ipeak-2P_unb: Simulations (Nominal Values) Without test jig accuracy effects	Actual Ipeak-2P_unb Calculated with +/-0% test jig accuracy. <b>TO CANCEL test jig accuracy effect: change settings above.</b>	Ipeak-2P_unb spec	ILIM-2P_min spec.	PASS/FAIL Iunbalance	Add the following to D3.3 to meet the Iunbalance-2P spec per simulations and Equation 145-13	New Ipeak- 2P_unb in D3.4 spec to pass tests	New ILIM- 2P_min for D3.4 spec in order to pass tests	Solving Lennart's OCD issue by rounding up.
<b>SHORT CABLE</b>									
5	0.5733	0.5766	0.576	0.578	FAIL	0.001	0.5766	0.5786	0.580
6	0.7114	0.7144	0.714	0.716	FAIL	0.000	0.7144	0.7164	0.717 → 0.720
7	0.8484	0.8233	0.821	0.823	FAIL	0.027	0.8484	0.8504	0.851 → 0.85
8 Ext	1.1910	1.1761	0.990	0.992	FAIL	PD must have better unbalance. No change in PSE spec.	No Change	No Change	
<b>LONG CABLE</b>									
8	0.9748	0.9750	0.990	0.992	PASS	0	0.9996	1.0016	1.002 → 1.005 ?
8 to get 90W at PSE PI	0.9996	0.9998	0.990	0.992	FAIL	0.005	0.9998	1.0018	1.002 → 1.005 ?

