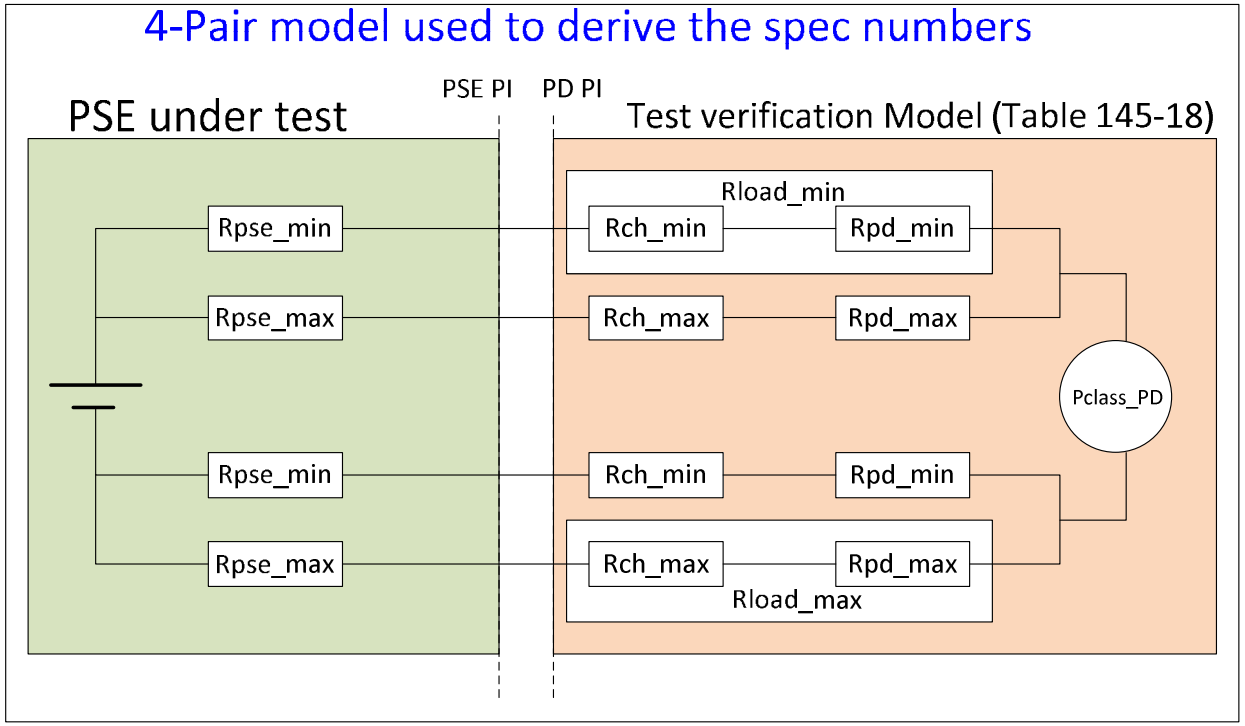
Comment (Page 170, Line 10, Clause 145.2.10)
This comment is marked UNB_REQ.
1. In our spec, we concluded that Icon-2P_unb need to be split to two parameters:
a) Iunbalance-2P = the max pair current due to unbalance when connected to the test verification model.
b) Icon-2P_unb = the minimum pair current the PSE will have to support under unbalance condition.
c) It is obvious that Icon-2P_unb need to be higher than Iunbalance-2P.
2. In D3.2 we set the numbers of Iunbalance-2P and Icon-2P_unb per the following principles:
a) Icon-2P_unb=simulation results + 5mA[1]. (Setting it as Icon-2P_unb is the 1st wrong action. It should be Iunbalance-2P!)
b) Iunbalance-2P = Icon-2P_unb - 10mA (which is the 2nd wrong action. Now we have lower Iunbalance-2P then the actual sim results which will fail the compliance test with the test verification model).

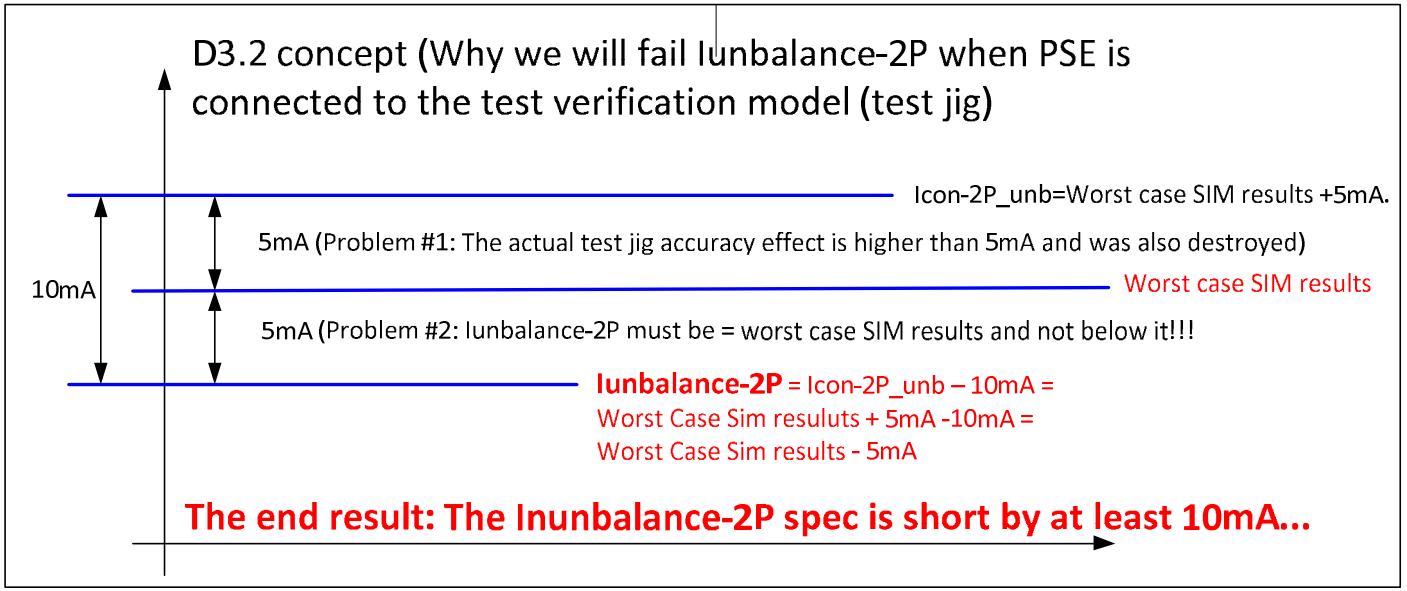
As a result, when connecting the PSE to the test verification model, we will fail Iunbalance-2P in Class 5,6 and 7 and 8. The reason for the failure:
Eq-1: Icon-2P_unb=sim_results + 5mA.
Eq-2: Iunbalance-2P = Icon-2P_unb -10mA = sim_results + 5mA -10mA =sim_results -5mA
➔ Actual sim results < Iunbalance_2P spec value➔ failing the test. The worst-case SIM result is the minimum spec value for Iunbalance-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 Iunbalance-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



The facts:

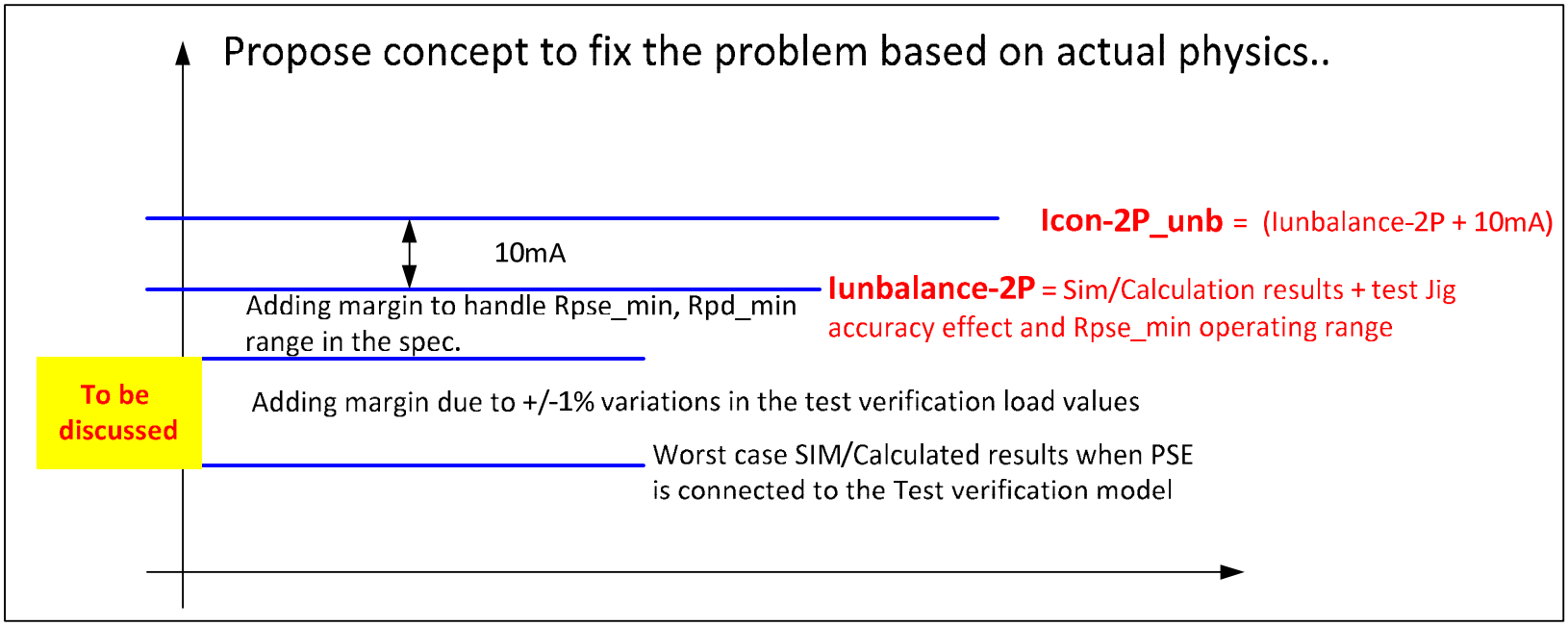
- The above is our 4-pair model used to derive the PSE and PD equations and Imax at worst case unbalance conditions.
- It is impossible that if the sim results for class 5 Imax=0.5493A we will pass the Iunbalance-2P test =0.455A!
- We must pass the test for all PSE operating range from 50V to 52V.
- The same problem for all classes.
- For Extended power class 8:
  - The test verification model values of Rpd_min/max (which is Rload2_min, Rload2_max in Table 145–18) are not valid for this case.
  - Equation 145-26 is not valid. Tighter Rpd_max/Rpd_min ratio is required.



The correct approach is:

1. Iunbalance-2P = Worst case sim results + Margins due to test jig component accuracy.
2. Icon-2P_unb=Iunbalance-2P + 10mA

- 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..
Icon-2P_unb = (Iunbalance-2P + 10mA)
10mA
Iunbalance-2P = Sim/Calculation results + test Jig accuracy effect and Rpse_min operating range
Adding margin to handle Rpse_min, Rpd_min range in the spec.
To be discussed
Adding margin due to +/-1% variations in the test verification load values
Worst case SIM/Calculated results when PSE is connected to the Test verification model

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.
5 (short cable)	**0.5786**	0.580
6 (short cable)	**0.7164**	0.717➔ 0.720
7 (short cable)	**0.8504**	0.851 ➔0.85
8 Extended (short cable)	**No Change**	----------
8 (long cable)	**1.0018**	1.002➔1.005 ?

Proposed Remedy

1. Make the following changes for Icon-2P_unb:

Option 1:

a) Change Icon-2P_unb for Class 5,6,7,8 from:
0.555, 0.687, 0.789, 0.943
To: 0.560, 0.692, 0.794, 0.948

b) In Table 145-18, additional information column, make the following changes:
b1) Change from: " Low link section resistance conditions. All resistances within ± 1% range."
To: "Low link section resistance conditions. Resistances within the following range:
Class 5: ±0.3%
Class 6: ±0.2%
Class 7: ±0.18%
Class 8: ±0.1%
b2) Change from: " Low link section resistance conditions. All resistances within ± 1% range."
To: "High link section resistance conditions. Resistances within the following range:
Class 5: ±0.3%
Class 6: ±0.2%
Class 7: ±0.18%
Class 8: ±0.1%

Option 2 (keeping the same ±1% range for the components and add their effect to Iunbalance-2P spec):

a) Change Icon-2P_unb for Class 5,6,7,8 from:
0.555, 0.687, 0.789, 0.943
To: 0.563, 0.696, 0.799, 0.957

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 Iunbalance-2P Calculated with +/- 1% test jig accuracy. ***TO CANCLE test jig accuracy effect: change settings above [A]***	Iunbalance-2P spec [A]	Icon-2P_unb Spec [A]	**PASS/FAIL Iunbalance-2P**	Missing Delta to PASS the test [A]	Add the following to D3.3 to meet the Iunbalance-2P spec per sim/test jig results [A]	New Iunbalance-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 Iunbalance [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 Iunbalance-2P Calculated with 0% test jig accuracy. ***TO CANCLE test jig accuracy effect: change settings above [A]***	Iunbalance-2P spec [A]	Icon-2P_unb Spec [A]	**PASS/FAIL Iunbalance**	Missing Delta to PASS the test [A]	Add the following to D3.3 to meet the Iunbalance-2P spec per sim/test jig results [A]	New Iunbalance-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 Iunbalance [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. ***TO CANCLE test jig accuracy effect: change setings above.***	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.
SHORT CABLE									
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**	
LONG CABLE									
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 ?**