IEE802.3 4P Task Force

Updating 33.3.7.10 PD PI pair-to-pair resistance and current unbalance
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D1.6   Clause 33.3.7.10

Comment:

The proposed updates is addressing the following discussion on D1.6 and still address previous comments on D1.3-D1.5:

David Abramson: Clarifying that the requirements need to be met at Rsorce_min/max and not below it.

Yair Darshan: Addressing Type 4 that worst case unbalance happen at short cable but worst case Icon-2P_unb happens at long channels by specifying a range for Rsource_min/max values. Using ONLY the lower range of Rsource_min/max is still possible if the tested parameter is E2EP2PRunb and not Icon-2P_unb but Icon-2P_unb is more practical to use so it is better to check the two use cases of Rsource_min/max.

Lennart Yseboodt: To quantify the common source voltage.

Yair Darshan: To use table with the conditions and link the text to it, it may simplify the text.

David Abramson: To use the proposed minimum channel resistance range and for the maximum use 1.16*Minimum range. Yair: It looks OK but the factor is 1.186.

Proposed Remedy (update per page 2 and 3 in darshan_01_0316.pdf):

33.3.7.10 PD PI pair-to-pair resistance and current unbalance
Single-signature PDs assigned to Class 5 or higher shall not exceed Icon-2P-unb for longer than TCUT-2P min as defined in Table 33-17 on any pair when PD PI pairs of the same polarity are connected to a common source voltage in the range of Vport_pse-2P through two common mode resistances in the range of Rsource_min=0.168 Ω to Rsource_min=5.28 Ω and one with Rsource_max=1.186* Rsource_min for all PD operating conditions as shown in Figure 33-36.

Dual Signature PDs shall not exceed Icon-2P as defined in Equation 33-7 for longer than TCUT-2P min as defined in Table 33-17 on any pair when PD PI pairs of the same polarity are connected to a common source voltage in the range of Vport_pse-2P through two common mode resistances in the range of Rsource_min=0.168 Ω to Rsource_min=5.28 Ω and one with Rsource_max=1.186* Rsource_min for all PD operating conditions as shown in Figure 33-36.

Rsource_min and Rsource_max represent the Vin source common mode effective resistance that consists of the PSE PI components (Rpse_min and Rpse_max as specified in 33.2.8.4.1, Vport_PSE_diff as specified in table 33-17 and the channel resistance). Common mode effective resistance is the resistance of two conductors of the same pair and their other components connected in parallel including the effect of Vport_PSE_diff. IA and IB are the pair currents of pairs with the same polarity. See Annex 33A.5 for design guide lines for meeting the above requirements.
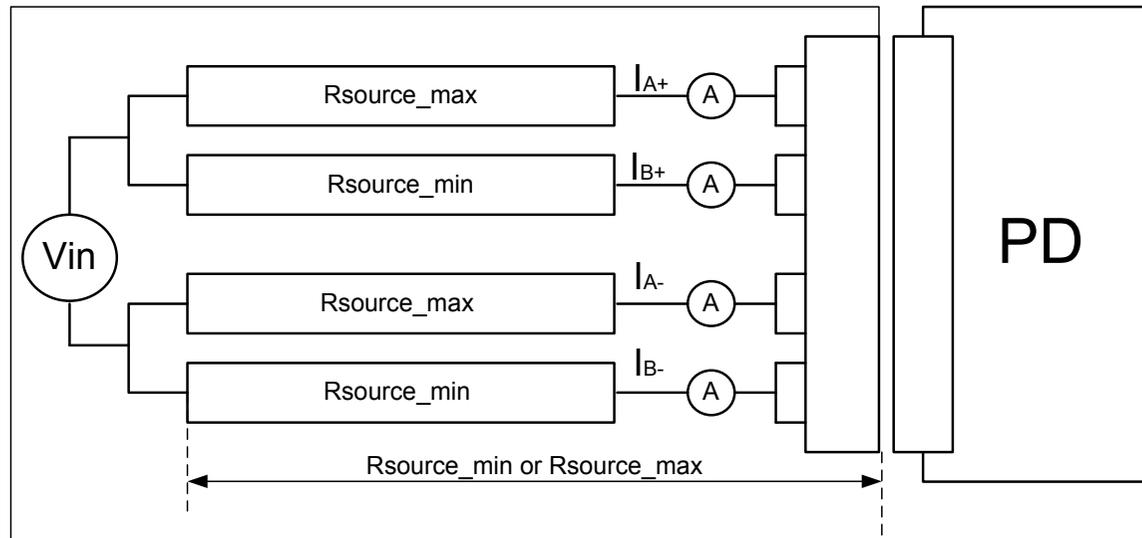
Figure 33-36 – PD PI pair-to-pair test ~~circuit~~

Notes:
1. Rsource includes test setup plug resistance Rcon. The maximum recommended Rcon value is 0.02 Ω however it is test setup implementation specific choice how to meet Rsource_min and Rsource_max.
2. The pairset current limits shall also be met when Rsource_max and Rsource_min are swapped between pairs of the same polarity. ~~test needs to be conducted when in one test the two pairs of the same polarity contain Rsource_min and Rsource_max and in the 2nd test it flips values.~~

Simulation Results

Simulation results for unbalanced PSE and Channel values of Rsource_min and Rsource_max for the 100 meter channel case.

-The worst case channel resistance over 2-pairs is 12.5 Ω

-The worst case maximum common mode channel resistance over 2-pairs is 6.25 Ω

-Due to the P2P unbalance, the maximum common mode resistance at 100m under unbalance conditions will be lower than 6.25 Ω.

-To get 12.5 Ω at 100m including 4 connectors with the resistance used in this model, a 0.121 Ω/meter cable was used in the simulation.

Rsource_min=5.28 Ω
Rsource_max=6.24 Ω

Notes:

1. The original simulation values for Rsource_min and max for short channel length were 0.15 Ω and 0.192 Ω consecutively however due to a comment for D1.5 we changed it to account for test setup tolerance at very low resistance and as a result was increase to Rsource_min= 0.168 Ω ± 5% and one with Rsource_max= 0.2 Ω ± 5% while keeping the same system unbalance effect and negligible changes in Icon-2P_unb. The factor 1.186 in the baseline was calculated by averaging 0.2/0.168 and 6.24/5.28.

2. The values of Rsource_min and Rsource_max for the short channel and long channel are derived at maximum Type 3 and 4 power level and are the same for both types. See details in Annex A.

Annex A - Simulation Data

Parameter	Ppd=51W Vpse=50.3V 2.65m cable 0.0926 ohm/m cordage and 0.074 for cable 0 connectors	Ppd=71W Vpse=52.31V 2.65m cable	Units		Ppd=51W Vpse=50.3V 100m cable 0.121 ohm/m to account for 4 connectors each with 0.05 ohm max for common mode resistance max of 6.25 ohm at 100m . 4 connectors	Ppd=71W Vpse=52.31V 100m cable	Units
Veqv1	100.34	133.715	mV		3.4088	4.8479	V
Veqv2	64.828	92.041	mV		3.3286	4.7565	V
Veqv3	-286.65	-379.254	mV		-3.7149	-5.2828	V
Veqv4	-220.692	-305.342	mV		-3.6279	-5.183	V
I1	682.293	888.671	mA		645.618	917.381	mA
I2	338.496	480.587	mA		533.346	762.143	mA
I3	-594.779	-786.927	mA		-627.014	-891.632	mA
I4	-426.01	-582.331	mA		-551.95	-787.892	mA
Lowest Rsource_min/max (pairs of the same polarity with lowest resistances)							
Rsource_min	**0.147**	**0.150**	ohms		5.280	5.285	ohms
Rsource_max	**0.192**	**0.192**	ohms		6.241	6.241	ohms

Veqv_i is the voltage across the components from the PSE internal voltage source to the PD PI common mode input.
I_i is the current through those components.
The results are based on the simulation model and the database used to derive all P2P unbalance parameters.