Autoclass power margin v110

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Recap Autoclass

Autoclass is a classification mechanism that allows a PD to communicate its effective maximum power consumption to the PSE. This happens in such a way that the PSE will be able to set the power budget to the maximum PD power plus the actual channel losses.

Goal: $P_{PSE\_BUDGET} = P_{PD}$+ actual channel loss + minimal margin

This will allow more efficient use of the PSU since only the effectively used power needs to be budgeted. This feature is not offered by the current classification scheme or by LLDP.

Previous presentations: ➠yseboodt_1_0913.pdf, ➠yseboodt_3_1114.pdf

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Why is margin needed?

A PSE that implements Autoclass should allocate sufficient margin to cover effects that lead to an increase in PSE sourced power after the Autoclass measurement has finished.

Three possible causes for a power increase exist:

1. The PD consumes more power than it did during the Autoclass measurement. This is out of scope. PDs should not do this. If a PD needs margin it should draw more power during the Autoclass procedure.
2. PSE voltage droop. This is out of scope, PSEs can & may compensate their budgeting for voltage droop.
3. Rchan increases due to temperature rise of the channel. This effect will be covered in this presentation.

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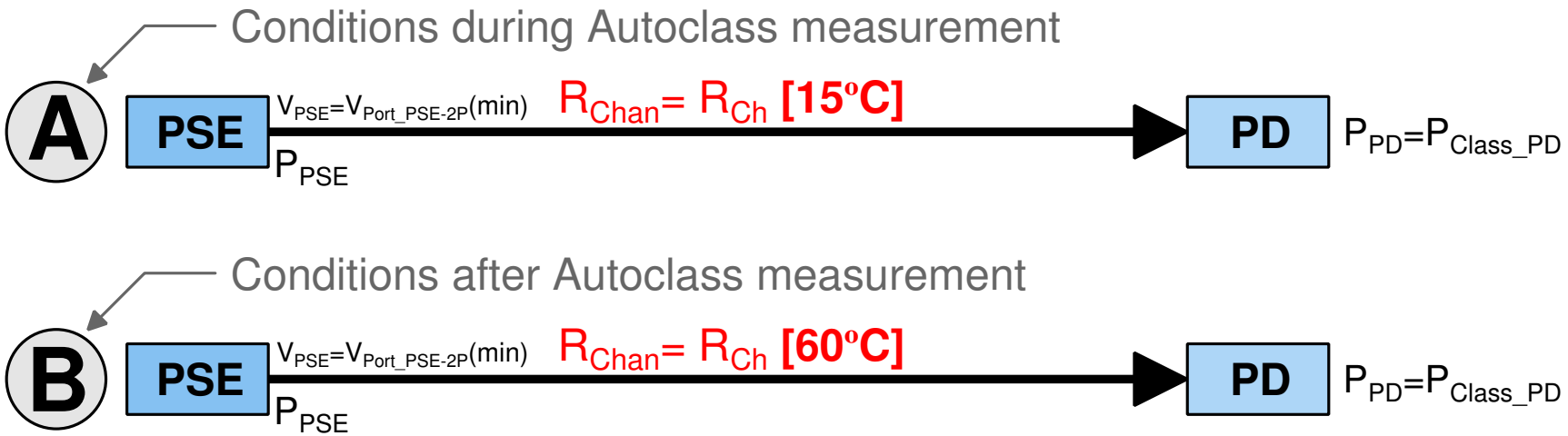
Margin calculation



The minimum margin should allow for a system to maintain operation from situation A (when it Autoclassed) to situation B (operational).
A: Worst case channel at 15°C, Autoclass measurement is performed
B: Worst case channel at 60°C.

The PD power remains constant at P_{Class_PD} and the PSE voltage is also a constant $V_{Port\_PSE\text{-}2P}(min)$.

Margin calculation II

R_{Chan} is back-calculated from the worst-case value R_{Ch} (which applies at 60°C) with $\alpha = 3.86 \cdot 10^{-3}$ K^{-1} as temperature coefficient for copper to get a worst-case value at 15°C.

$$R_{Chan} = R_{Ch}\left(1 - \alpha(60^{\circ}C - 15^{\circ}C)\right)$$

The **margin** is the relative difference in PSE output power between situation A and situation B. A PSE that measures power during situation A and applies the minimum margin will have allocated sufficient budget to handle situation B.

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Margin overview

Class	2P/4P	P_{PSE}	P_{Cable}	R_{Chan}	P_{PSE}	P_{Cable}	R_{Ch}	Margin
		Situation A			Situation B			
1	2P	3.9	0.1	10.33	3.9	0.1	12.50	0.4%
1	4P	3.9	0.0	5.16	3.9	0.0	6.25	0.2%
2	2P	6.7	0.2	10.33	6.7	0.2	12.50	0.6%
2	4P	6.6	0.1	5.16	6.6	0.1	6.25	0.3%
3	2P	13.8	0.8	10.33	14.0	1.0	12.50	1.4%
3	4P	13.4	0.4	5.16	13.5	0.5	6.25	0.6%
4	2P	29.0	3.5	10.33	30.0	4.5	12.50	3.6%
4	4P	27.0	1.5	5.16	27.4	1.9	6.25	1.4%
5	4P	44.0	4.0	5.16	45.1	5.1	6.25	2.5%
6	4P	57.9	6.9	5.16	60.0	9.0	6.25	3.6%
7	4P	71.9	9.9	5.16	75.0	13.0	6.25	4.4%
8	4P	85.1	13.8	5.16	90.0	18.7	6.25	5.7%

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Conclusion

- Autoclass PSE minimum power margin is specified on a per-class basis. Baseline numbers are rounded up to half-percent values.
- $V_{Port\_PSE\text{-}2P}$ droop and PD power increase is out of scope and must be handled by PSE and PD respectively
- Margin is calculated based on worst case cable heating from 15°C to 60°C
- Baseline text provides an escape clause for the minimum margin in case the PSE has additional information on actual channel resistance. This is mostly useful to class 7-8 PDs attached via short cables.

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