IEEE802.3at Task Force

Vport ad hoc

PD Load Current - Technical Analysis

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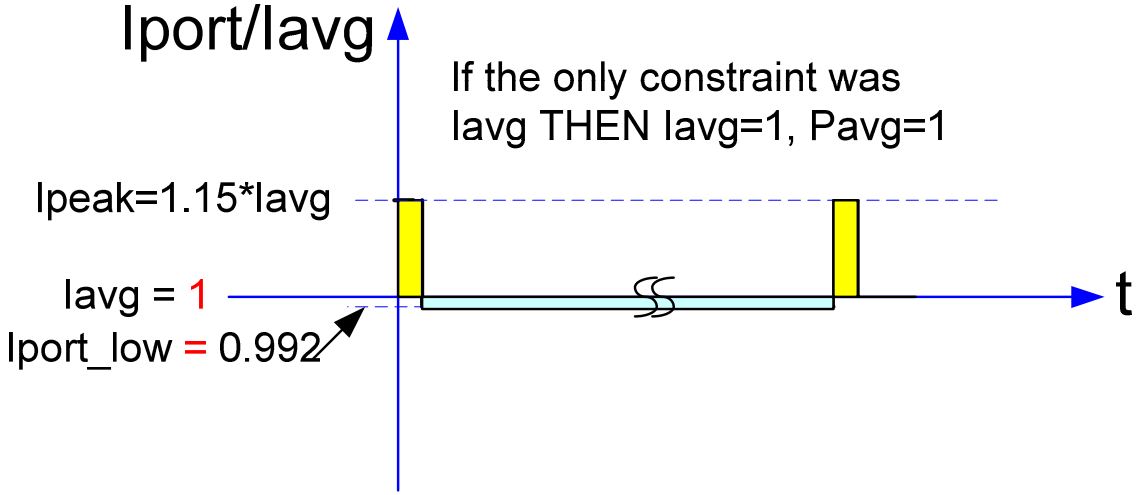
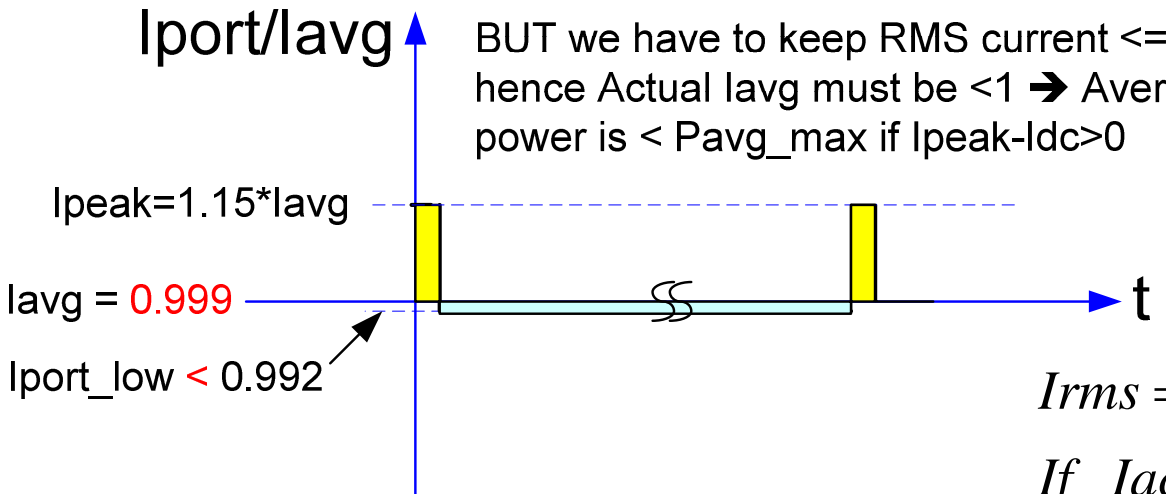
Objectives

- To compare between the current 802.3af concept regarding PD load current parameters and other alternatives

- To recommend the a concept in which is not depend on the value of the max. average cable current.

What the spec. says…….





$$Irms = \sqrt{Iavg^2 + Iac\_rms^2}$$

$$If \quad Iac = 0 \quad then \quad Irms = Iavg$$

What the spec. says……..

- The relationship between Average (DC) and RMS current

$$Irms = \sqrt{Iavg^2 + Iac\_rms^2}$$

$$If \;\; Iac = 0 \;\; then \;\; Irms = Iavg$$

Current 802.3af PD load behavior concept

Requirements

- PD average current shall not be more then Iport_avg = X
- PD RMS current shall not be more then Iport_RMS = X

Meaning

- PD input average power is always **Port_avg**
- PSE output average power is always **Port_avg**
- **PSE** and **PD RMS losses** are **similar** to the losses in full average power

AND

The **peak current** may reach up to **~15% above the average** current for **50msec max,** **5% duty max.**

- PD can utilize max. average power due to the fact that it can work near Iport_avg.
- PD has 15% design margin due to:
  - Application load accuracy
  - PD DC/DC converter accuracy
  - PD DC/DC accuracy
  - PD Input interface accuracy

Type 1 System

Magic Numbers : Duty<=5%, Ip/Iavg~1.15

Allows getting Irms=~Iavg ➔ {dPower, dLoss} =0

Ip	0.402		Ip/Iavg	1.15
D	0.050			
Ilow	0.347		Ilow/Iavg	0.992105
Iavg	0.3498			
Iac	0.012		Iac/Irms	0.03439
Irms	0.3500		Irms/Idc	1.00059

Type 2 System

Magic Numbers : Duty<=5%, Ip/Iavg~1.15

Allows getting Irms=~Iavg ➔ dPower=0

Ip	0.828		Ip/Iavg	1.15
D	0.050			
Ilow	0.714		Ilow/Iavg	0.992105
Iavg	0.7196			
Iac	0.025		Iac/Irms	0.03439
Irms	0.7200		Irms/Idc	1.00059

How sensitive we are to these results? See example below:
If Ipeak/Iavg>3.07 (207%) then Iavg=0.65A for Irms=0.72A..
- The average power will not changed.
- Power Loss will be also be negligible
- *But the circuit breaker may JUMP for 96 ports*2A peak / 3msec and/or*
- *PSE DC/DC will be in Current LIMIT (Current Mode) which ever faster (Vport Ad Hoc to address this issue)*

Ip	1.999	Ip/Iavg	3.07546
D	0.050		
Ilow	0.579	Ilow/Iavg	0.890765
Iavg	0.6501		
Iac	0.310	Iac/Irms	0.4299
Irms	0.7200	Irms/Idc	1.10757

The other Alternative..

- Ipeak=Iavg ➔
- PD needs 15% design margin for the load application, DC/DC Converter and PD interface.
- Hence actual power will be 15% less then the max. Cable average current.
- 2P will not meet project objective (~30W) for no justified reason (i.e. Ipeak>Iavg for limited time).

Conclusion

- This is an example of a system optimization case in which allowing 15% margin in a parameter (AC wave form) results robust system, easy to design, utilize max. power available with negligible effect on other key parameters (<0.4%)
- Recommendation:
  - Use the 802.3af concept. It is the best alternative.
  - Just replace 350mA with the new max. average current
  - Keep the same Ipeak / Iavg ratio (14 -15%)
  - Keep the same 50msec, 5% duty (Magic Numbers - keep Irms~Iavg hence allow all benefits)
  - and move on.

Discussion

Motion

- Move that the IEEE 802.3at Task Force adopt presentation darshan___.pdf slide 10 to be incorporated in the next P802.3at draft.
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