TDL #510 from D2.0 - Response to David Stover regarding comment #510 D2.0
Addresses Comments on D2.1: #51, #164, #222.

Supporter: Victor Renteria / BELF

D2.1 Table 33-19 item 22 page 116 line 37.
David comment:
Intra-pair current unbalance I_unb is specified as 3% I_Peak for Type 2, 3, and 4 PSEs in 802.3bt D2.0.
For higher Class PDs, this may preclude low-speed data implementations due to higher inductance requirements on those magnetics.

SuggestedRemedy
TFTD. Especially looking for opinions from magnetics vendors here.

Response
Add to TDL: Stover, Darshan, Bullock, and Yseboodt to review Iunb values (Ipeak vs. Ipeak-2p_unb, etc.)

Starting discussion:

Yair:
Historically in 802.3af Iunbalance was specified as 3%*Icable. Icable was the 2-pair DC current. This definition was a mistake and need to be 3%*Ipeak current. Ipeak is the overload current that can be calculated per equation 33-10.

In 802.3at we have corrected this mistake and specified Iunb=3%*Ipeak. In this case Ipeak=0.6825A.
In all the above cases the current is the total current flowing into the center tape of the transformer which is always the 2-pair system current.

In addition we add a Note in Table 33-19 item 22 (now the Note is in 33.2.8.11) that "for practical implementations, it is recommended that Type 1 PSEs will support **Type 2** Iunb requirements so the error made by 802.3af will corrected.

Now in 802.3bt the requirement is 3%*Ipeak which is incorrect for Type 3 and 4 operating over 4-pairs.
For Type 3 and 4 operating over 4-pairs it must be the maximum value of Ipeak-2P_unb per class multiplied by 3%
(The reason is that the actual maximum DC current that a transformer will see is Icon-2P_unb per Table 33-19 item 5 however the PSE port need to support overload current for at least 50msec, hence it has to support Ipeak-2P_unb per equation 33-11.)

So Table 33-19 item 22 need to be changed as follows:

Proposed baseline starts here:

1. **Make the following changes to Table 33-19, Intra-pair current unbalance.**

Item	Parameter	Symbol	Unit	Min	Max	PSE Type	Additional Information
22	Intra-pair current unbalance	Iunb	A		3% x Icable	1	See 33.2.8.4, 33.2.8.11, 33.4.8
					3%xIpeak-2P	2~~,3,4~~	
					3%xIpeak-2P_unb_max	3,4	

2. **Change the note in 33.2.8.11 page 126 line 30 as follows:**

"NOTE-For practical implementations, it is recommended that Type 1 PSEs support Type 2~~, 3, 4~~ Iunb requirements."

Baseline ends here.
See more details below.

Not part of the baseline.	
Notes	
1	The transformer sees DC bias current which is a function of the current difference between the transformer outer legs: Ibias=Iunb/2=0.03*0.5*max_operating_pair_current. For 2-pair mode: max_operating_pair_current =Ipeak. For 4-pair mode: max_operating_pair_current =Ipeak-2P_unb
2	We can't use absolute number for Iunb since it is Pclass dependent and cost optimization considerations requires keep it as 0.03* max_operating_pair_current=0.03* Ipeak-2P_unb i.e. not the same Ibias in abs mA or Iunb in abs mA for every transformer.

Iunb=|I1-I2|=3% x Max_operating_pair_current

Ibias=Iunb/2

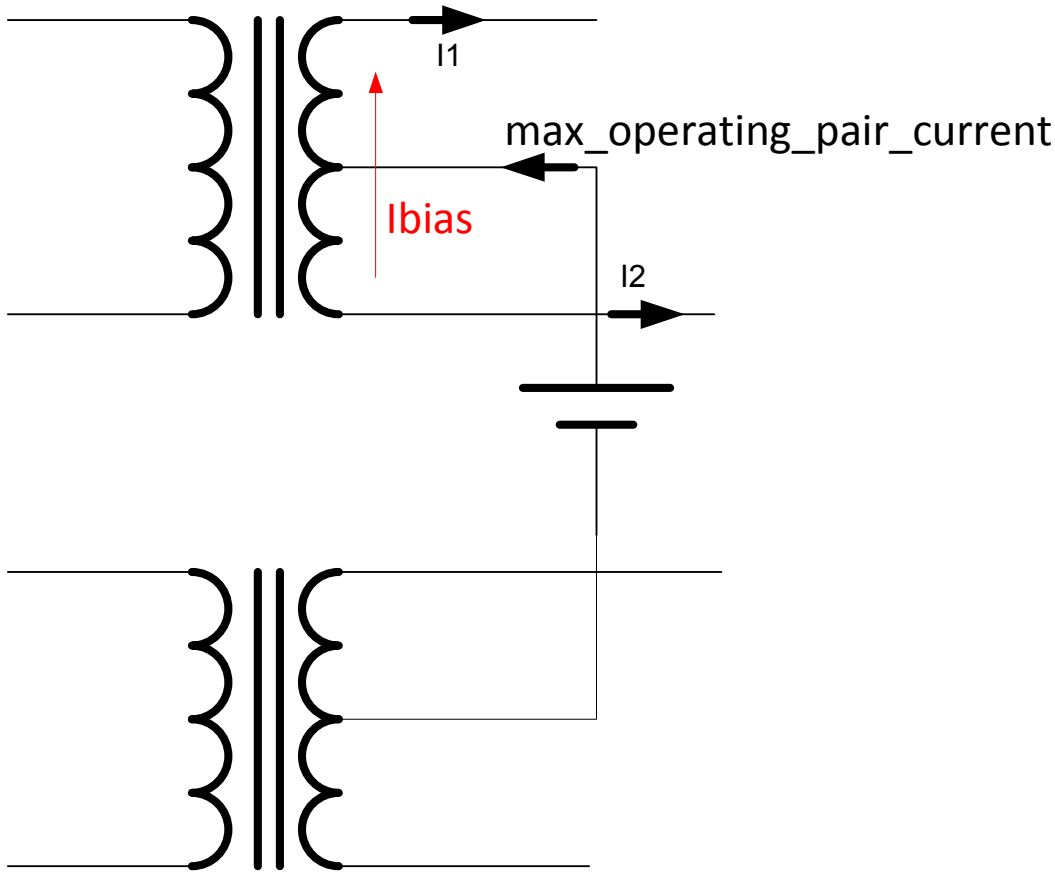

Figure 1 – Iunb and Ibias

Calculations of Iunb[A] and Ibias[A] without design margins

PSE Type (at max power)	Spec: max_pair _current	Actual max_pair_ current	Icable	Icon_2P _unb	Ipeak-2P	Ipeak_2P_unb	Iunb= 0.03*Actual max_pair_current	Ibias to Supports 100BT	Total Ibias without supporting 100BT	Total Ibias WITH supporting 100BT
Type 1	Icable	Ipeak	0.35		0.4		0.012	0.008	0.006	0.014
Type 2	Ipeak	Ipeak	0.6		0.682		0.02046	0.008	0.01023	0.01823
Type 3	Ipeak-2P_unb	Ipeak-2P_unb	0.6	0.682		0.7	0.021	0.008	0.0105	0.0185
Type 4	Ipeak-2P_unb	Ipeak-2P_unb	0.96	0.925		0.988	0.02964	0.008	0.01482	0.02282