Detail of IEEE 802.3bt edits to clause 33 to put back in 2.5G/5G/10GBASE-T at draft 2.25 status

- Should align with Clause 145 treatment of 2.5G/5G/10GBASE-T, which is independent of PSE Type
-

Contribution to IEEE P802.3bt Task Force at the March 2017 Plenary meeting in Vancouver

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14 March 2017

PAGE NUMBERS ARE FROM D2.25 v. 802.3-2015

Page	Line	Subclause	Edit
1	19	33.1	DTE powering is intended to provide a 10BASE-T, 100BASE-~~-~~TX, 1000BASE-T, 2.5GBASE-T, 5GBASE-T, or ~~1000BASE-~~10GBASE-T device with a single interface to both the data it requires and the power to process this data.
2	1	33.1.1	c) *Compatibility*—Clause 33 utilizes the MDIs of 10BASE-T, 100BASE-TX, ~~and~~ 1000BASE-T, 2.5GBASE-T, 5GBASE-T, and 10GBASE-T without modification. Type 1 operation adds no significant requirements to the cabling. Type 2 operation requires ISO/IEC 11801:1995 Class D or better cabling and a derating of the cabling maximum ambient operating temperature. ~~The clause does not address the operation of 10GBASE-T. For 10GBASE-T operation, the channel model specified in Clause 55 needs to be met without regard to DTE Power via MDI presence or operation.~~ d)*Simplicity*—The powering system described here is no more burdensome on the end users than the requirements of 10BASE-T, 100BASE-TX, ~~or~~ 1000BASE-T, 2.5GBASE-T, 5GBASE-T, or 10GBASE-T.
8	11	33.2.2	PSEs can be compatible with 10BASE-T, 100BASE-TX~~, and/or~~ 1000BASE-T, 2.5GBASE-T, 5GBASE-T, and/or 10GBASE-T. PSEs may support either Alternative A, Alternative B or both.
8	16	33.2.3	There are ~~two types~~ several variants of Midspan PSEs defined ***Insert (after 1000BASE-T Midspan PSE description):*** 2.5GBASE-T Midspan PSE: A Midspan PSE that results in a link that can support 1000BASE-T and 2.5GBASE-T operation, and optionally support 10BASE-T and 100BASE-TX operation (see Figure 33–9). 5GBASE-T Midspan PSE: A Midspan PSE that results in a link that can support 1000BASE-T, 2.5GBASE-T, and 5GBASE-T operation, and optionally support 10BASE-T and 100BASE-TX operation (see Figure 33–9).” 10GBASE-T Midspan PSE: A Midspan PSE that results in a link that can support 1000BASE-T, 2.5GBASE-T, 5GBASE-T, and 10GBASE-T operation, and optionally support 10BASE-T and 100BASE-TX operation (see Figure 33–9).”
10	46	33.2.3	Figure 33-5 caption, ***change*** “1000BASE-T” to “1000/2.5G/5G/10GBASE-T” same ***change*** to Figure 33-7
17	41	33.2.3	Figure 33-9 caption, ***change*** “1000BASE-T” to “1000BASE-T, 2.5G, 5G, or 10GBASE-T” Same ***change*** on Figure 33-11
155	23	33.4	The requirements of 33.4 are consistent with the requirements of the 10BASE-T MAU and the 100BASE-TX ~~and~~, 1000BASE-T, 2.5GBASE-T, 5GBASE-T, and 10GBASE-T PHYs.
158	45	33.4.3	***(note 33.4.3, 33.4.4, and 33.4.6 should be exactly as 145.4.3, 145.4.4, and 145.4.6)*** ***Change*** “shall exceed:” to “shall exceed the limits in Table 33-30a for all supported PHY speeds. ***Delete equations 33-15 and 33-16 (and associated text)*** ***Insert Table 33-30a:*** **Table 33-30a Impedance Balance Limits vs Supported Speeds**

<table>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th>Supported Speed</th><th>Impedance Balance Limit</th><th>Frequency Range</th></tr>
<tr><td>10 Mb/s MAU</td><td>29.0 - 17.0 × $\log_{10}$ (f/10.0) dB</td><td>1 ≤ f ≤ 20 MHz</td></tr>
<tr><td>100 Mb/s or
1000 Mb/s PHY</td><td>34.0 – 19.2 × $\log_{10}$ (f/50.0) dB</td><td>1 ≤ f ≤ 100 MHz</td></tr>
<tr><td>2.5 Gb/s PHY</td><td>48.0 dB
48.0 – 20.0 × $\log_{10}$ (f/10.0) dB
42.0 - 15.0 × $\log_{10}$ (f/20.0) dB</td><td>1 ≤ f < 10 MHz
10 ≤ f < 20 MHz
20 ≤ f ≤ 125 MHz</td></tr>
<tr><td>5 Gb/s PHY</td><td>48.0 dB
44.0 – 19.2 × $\log_{10}$ (f/50.0) dB</td><td>1 ≤ f < 30 MHz
30 ≤ f ≤ 250 MHz</td></tr>
<tr><td>10 Gb/s PHY</td><td>48 dB
44.0 – 19.2 × $\log_{10}$ (f/50.0) dB</td><td>1 ≤ f < 30 MHz
30 ≤ f ≤ 500 MHz</td></tr>
</table>
Change Value/Comment in PICS EL13 (P183 L45): change Value/Comment from:
“Exceeds Equation (33–31) for 10Mb/s PHYs and Equation (33–32) for 100Mb/s or greater PHYs”
TO:
“Exceeds value in Table 33-30a for all supported PHY speeds.”
</td></tr>
<tr><td>159</td><td>47</td><td>33.4.4</td><td>
Change as follows: “E_{cm_out} shall not exceed 50 mV peak ~~when operating at 10 Mb/s, and 50 mV peak-to-peak when operating at 100 Mb/s or greater. The frequency of the measurement shall be from 1 MHz to 100 MHz. For 10GBASE-T systems, 50 mVpp (TBD), for 1 MHz to 500 MHz.~~ the values in Table 33-30b while operating at the specified speed, when measured over the specified bandwidth.
Insert Table 33-30b as shown:
Table 33-30b- Common-mode output voltage vs Operating Speed
<table>
<tr><th>Operating Speed</th><th>Common-mode output voltage (E_{cm_out})</th><th>Measurement Bandwidth</th></tr>
<tr><td>10 Mb/s MAU</td><td>50 mV peak</td><td>1 ≤ f ≤ 100 MHz</td></tr>
<tr><td>100 Mb/s or
1000 Mb/s PHY</td><td>50 mVpp</td><td>1 ≤ f ≤ 100 MHz</td></tr>
<tr><td>2.5 Gb/s PHY</td><td>50 mVpp</td><td>1 ≤ f ≤ 100 MHz</td></tr>
<tr><td>5 Gb/s PHY</td><td>50 mVpp</td><td>1 ≤ f ≤ 250 MHz</td></tr>
<tr><td>10 Gb/s PHY</td><td>50 mVpp</td><td>1 ≤ f < 500 MHz</td></tr>
</table>
</td></tr>
<tr><td>164</td><td>33</td><td>33.4.6</td><td>
Change 33.4.6 as follows:
~~The~~ For 10/100/1000 Mb/s, the coupled noise, Ed_out in Figure 33–49, from a PSE or PD to the differential transmit and receive pairs shall not exceed 10 mV peak-to-peak when measured from 1 MHz to 100 MHz under the conditions specified in 33.4.4, item 1) and item 2).
Insert after the above paragraph:
For 2.5GBASE-T, 5GBASE-T, or 10GBASE-T, the coupled noise, Ed_out in Figure 33–49, from a PSE or PD to the differential transmit and receive pairs shall not exceed the requirements Equation (33–17a) under the conditions specified in 33.4.4, item 1) and item 2).
Insert Equation 33-17a: (from equation 145-34)
</td></tr>
</table>

			$E_{d\_out} = \left\{ \begin{array}{ll} \frac{10mVpp}{f} & \text{for } (1 \le f < 10) \\ 1mVpp & \text{for } (10 \le f < f_{max}) \end{array} \right\}$ (145–34) where f is the frequency in MHz for a 10 Gb/s PHY f_{max} is the frequency in MHz, 100 MHz for 2.5GBASE-T, 250 MHz for 5GBASE-T, and 500 MHz for 10GBASE-T
165	3	33.4.7	***Change to insert 2.5G, 5G and 10G references:*** The differential impedance of the transmit and receive pairs at the PHY's MDI shall be such that any reflection shall meet the return loss requirements as specified in 14.3.1.3.4 for a 10 Mb/s PHY, in ANSI X3.263:1995 for a 100 Mb/s PHY, ~~and~~ in 40.8.3.1 for a 1000 Mb/s PHY, 126.8.2.2 for a 2.5 Gb/s or 5 Gb/s PHY, and 55.8.2.1 for a 10 Gb/s PHY .
171	12	33.4.9.1	***Change*** "six variants" to "10 variants"
152	18	33.4.9.1	***Insert*** after item (4) (this will match 145.4.9.1) "5) 2.5GBASE-T connector or telecom outlet Midspan PSE 6) 2.5GBASE-T work area or equipment cable Midspan PSE 7) 5GBASE-T connector or telecom outlet Midspan PSE 8) 5GBASE-T work area or equipment cable Midspan PSE 9) 10GBASE-T connector or telecom outlet Midspan PSE 10) 10GBASE-T work area or equipment cable Midspan PSE"
171	28	33.4.9.1.1	***Change as shown: (to match 145.4.9.1.1)*** NEXT loss is a measure of the unwanted signal coupling from a transmitter at the near-end into neighboring pairs measured at the near-end. NEXT loss is expressed in dB relative to the received signal level. For operation with 2.5GBASE-T and lower rates, NEXT loss for Midspan PSE devices shall meet the values determined by Equation (33–48) when measured for the transmit and receive pairs from 1 MHz to 100 MHz. For 5GBASE-T, NEXT loss for Midspan PSE devices shall meet the values determined by Equation (33–48) when measured for the transmit and receive pairs from 1 MHz to 250 MHz. ~~However~~For operation with 5GBASE-T and lower rates, for frequencies that correspond to calculated values greater than 65 dB, the requirement reverts to the minimum requirement of 65 dB. ***Insert the next paragraph from 145.4.9.1.1:*** For 10GBASE-T operation, NEXT loss for Midspan PSE devices shall meet the values determined by Equation (145–36) when measured for the transmit and receive pairs from 1 MHz to 500 MHz. However, for frequencies that correspond to calculated values greater than 75 dB, the requirement reverts to the minimum requirement of 75 dB. $\{NEXTconn\}_{dB} \le \left\{ \begin{array}{ll} 54.0 - 20.0 \times \log_{10}\left(\frac{f}{100}\right) & \text{for } (1 \le f \le 250) \\ 46.04 - 40.0 \times \log_{10}\left(\frac{f}{250}\right) & \text{for } (250 < f \le 500) \end{array} \right\}_{dB}$ (145–36) where *NEXTconn* is the Near End Crosstalk loss in dB *f* is the frequency expressed in MHz
172	12	33.4.9.1.2	***Change as shown:*** Insertion loss is a measure of the signal loss between the transmitter and receiver, expressed in dB relative to the received signal level. For other than 5GBASE-T or 10GBASE-T operation, insertion ~~Insertion~~ loss for Midspan PSE devices shall meet the values determined by Equation (33–50) when measured for the transmit and receive pairs from 1 MHz to 100 MHz. ~~However for~~For 5GBASE-T capable midspans, insertion loss for Midspan PSE devices shall meet the values determined by Equation (33–50) when measured for the transmit and receive pairs from 1 MHz to 250 MHz. For frequencies

<table>
<tr><td></td><td></td><td></td><td>that correspond to calculated values less than 0.1 dB, the requirement reverts to the maximum requirement of 0.1 dB.</td></tr>
<tr><td>172</td><td>43</td><td>33.4.9.1.3</td><td>Delete “when measured for the transmit and receive pairs from 1 MHz to 100 MHz.” and replace table 33-20 with a duplicate of table 145-35:

Table 145–35—Connector return loss

<table>
<tr><th>Midspan PSE Variant</th><th>Frequency</th><th>Return loss</th></tr>
<tr><td rowspan="2">10/100/1000BASE-T, or 2.5G/5GBASE-T</td><td>1 MHz ≤ f < 20 MHz</td><td>23 dB</td></tr>
<tr><td>20 MHz ≤ f ≤ 100 MHz</td><td>14 dB</td></tr>
<tr><td>5GBASE-T</td><td>100 MHz ≤ f ≤ 250 MHz</td><td>14 dB</td></tr>
<tr><td rowspan="2">10GBASE-T</td><td>1 MHz ≤ f < 79 MHz</td><td>30 dB</td></tr>
<tr><td>79 MHz ≤ f ≤ 500 MHz</td><td>28 - 20 $\log_{10}$(f/100)</td></tr>
</table></td></tr>
<tr><td>173</td><td>16</td><td>33.4.9.1.4</td><td>Change (to read as 145.4.9.1.4) as follows: “This cable shall meet the requirements of this clause and the specifications for a ~~Category 5~~ (jumper) cord ~~as specified in ISO/IEC 11801:2002 or ANSI/TIA/EIA-568-A~~ for insertion loss, NEXT, and return loss for the transmit and receive pairs, as shown in Table 33-32.”

Insert Table 33-32 as follows:
Table 33-32 – Cable specifications for use with Midspan PSEs
<table>
<tr><th>Highest PHY rate supported</th><th>Cabling Specification</th><th>Frequency Range</th></tr>
<tr><td>Up to 1000BASE-T</td><td>Category 5 cord in ISO/IEC 11801:2002 or ANSI/TIA-568-A:1995</td><td>1 ≤ f ≤ 100 MHz</td></tr>
<tr><td>Up to 2.5GBASE-T</td><td>Category 5e cord in ISO/IEC 11801:2002 or ANSI/TIA-568-C.2</td><td>1 ≤ f ≤ 100 MHz</td></tr>
<tr><td>Up to 5GBASE-T</td><td>Category 6 cord in ISO/IEC 11801:2002 or ANSI/TIA-568-C.2</td><td>1 ≤ f ≤ 250 MHz</td></tr>
<tr><td>Up to 10GBASE-T</td><td>Category 6a cord in ISO/IEC 11801-1 or ANSI/TIA-568-C.2</td><td>1 ≤ f ≤ 500 MHz</td></tr>
</table></td></tr>
<tr><td>173</td><td>39</td><td>33.4.9.1.5-33.4.9.1.9</td><td>Insert 33.4.9.1.5-33.4.9.1.9 exactly as 145.4.9.1.5-145.4.9.1.9
(add to each paragraph, “For 2.5GBASE-T, 5GBASE-T, and 10GBASE-T Midspan PSEs, …”)</td></tr>
</table>

145.4.9.1.5 Maximum link delay

The propagation delay contribution of the Midspan PSE device shall not exceed 2.5 ns from 1 MHz to the highest referenced frequency.

145.4.9.1.6 Maximum link delay skew

The propagation delay skew of the Midspan PSE device shall not exceed 1.25 ns from 1 MHz to the highest referenced frequency.

145.4.9.1.7 Coupling parameters between link segments

Midspan PSEs intended for operation with 2.5G/5G/10GBASE-T (variants 5 through 10 in 145.4.9.1) are additionally required to meet the following parameters for coupling signals between ports relating to different link segments. Noise coupled between the disturbed duplex channel in a link segment and the disturbing duplex channels in other link segments is referred to as alien crosstalk noise. To ensure the total alien NEXT loss and alien FEXT loss coupled between link segments is limited, multiple disturber alien near-end crosstalk (MDANEXT) loss and multiple disturber alien FEXT (MDAFEXT) loss is specified.

145.4.9.1.8 Multiple disturber power sum alien near-end crosstalk (PSANEXT) loss

PSANEXT loss for 2.5G/5G/10GBASE-T capable Midspan PSE devices shall meet or exceed the values determined using the equations shown in Table 145–37 for all specified frequencies. Calculations that result in PSANEXT loss values greater than 67 dB shall revert to a requirement of 67 dB minimum.

Table 145–37—PSANEXT Loss

Frequency	Return Loss (dB)
1 MHz ≤ f ≤ 500 MHz	70.5 - 20 $\log_{10}$ (f/100)

145.4.9.1.9 Multiple disturber power sum alien far-end crosstalk (PSAFEXT) loss

PSAFEXT loss for 2.5G/5G/10GBASE-T capable Midspan PSE devices shall meet or exceed the values determined using the equations shown in Table 145–38 for all specified frequencies. Calculations that result in PSANEXT loss values greater than 67 dB shall revert to a requirement of 67 dB minimum.

Table 145–38—PSAFEXT Loss

Frequency	PSAFEXT Loss (dB)
1 MHz ≤ f ≤ 500 MHz	67 - 20 $\log_{10}$ (f/100)

145.4.9.2 Midspan signal path requirements