A Quick Review of Major Changes in 802.3cp Draft 1.0

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10/8/2019

September Meeting Motions

Motion #5

Move to use 6.3, 13, and 18 dB as the loss budgets for the BR10, BR20, and BR40 links, respectively.

Moved: Helen Xu Second: Tony Shuai

For: 8 Against: 0 Abstain: 1

Technical (≥75%) Motion Passed

Motion #6

Move to use the existing LR and ER specs as the basis of the BR10 and BR40 links of the next draft and use the ER spec as the basis for BR20 by reducing the Tx levels by 5dB.

Moved: Mark Laubach Second: Ray Nering

For: 7 Against: 0 Abstain: 0

Technical (≥75%) Motion Passed

Motion #8

Move to create a new set of link types (BR40+), that is based on the BR40 link types, with a new link budget of 23 dB, and Tx levels increased by 5 dB.

Moved: Mark Laubach Second: Marek Hajduczenia

For: 5 Against: 0 Abstain: 0

Technical (≥75%) Motion Passed

Motion #7

Move to use the following wavelengths as a starting point for our 9 link types.

Down / Up	10km	20km	40km
10Gb/s NRZ	1330 / 1270 ±10nm	1330 / 1270 ±10nm	1330 / 1270 ±10nm
25Gb/s NRZ	1330 / 1270 ±10nm	1310 / 1290 ±8nm	1310 / 1290 ±8nm
50Gb/s PAM4	1330 / 1270 ±10nm	1310 / 1290 ±8nm	1310 / 1290 ±8nm

Moved: Yuanqiu Luo Second: Ray Nering

For: 7 Against: 0 Abstain: 2

Technical (≥75%) Motion Passed

Table 158–6—10GBASE-BRx-D transmit characteristics

Description	10GBASE-BR10-D	10GBASE-BR20-D	10GBASE-BR40-D	10GBASE-BR40+-D	Unit
Signaling speed (nominal)		10.3125			GBd
Signaling speed variation from nominal (max)		± 100			ppm
Center wavelength (range)		1320 to 1340			nm
Side Mode Suppression Ratio (min)	30		30		dB
Average launch power (max)	0.5		4.0		dBm
Average launch power[a] (min)	–8.2		–4.7		dBm
Launch power (min) in OMA minus TDP[b]	–6.2		–2.1		dBm
Optical Modulation Amplitude[c] (min)	–5.2		–1.7		dBm
Transmitter and dispersion penalty (max)	3.2		3.0		dB
Average launch power of OFF transmitter[d] (max)	–30		–30		dBm
Extinction ratio (min)	3.5		3		dB
$RIN_{12}OMA$ (max)	–128				dB/Hz
$RIN_{21}OMA$ (max)			–128		dB/Hz
Optical Return Loss Tolerance (max)	12		21		dB
Transmitter Reflectance[e] (max)	–12				dB
Transmitter eye mask definition[f] A {X1, X2, X3, Y1, Y2, Y3}	{0.25, 0.40, 0.45, 0.25, 0.28, 0.40}				
Transmitter eye mask definition[f] B {X1, X2, X3,	{0.235, 0.395, 0.45, 0.235, 0.265, 0.4}				

Guidelines:

- BR40 Tx is 1.8 dB higher than BR10 Tx
- BR20 is 6.8 dB higher than BR10
- BR40+ is 6.8 dB higher than BR10

BR20	BR40	BR40+
4.0	4.0	4.0
-1.4	-6.4	-1.4
+0.6	-4.8	+0.6
+1.6	-3.4	+1.6

Pg. 54 in D1.0

Table 158–7—10GBASE-BRx-U transmit characteristics

Description	10GBASE-BR10-U	10GBASE-BR20-U	10GBASE-BR40-U	10GBASE-BR40+-U	Unit
Signaling speed (nominal)		10.3125			GBd
Signaling speed variation from nominal (max)		± 100			ppm
Center wavelength (range)		1260 to 1280			nm
Side Mode Suppression Ratio (min)	30		30		dB
Average launch power (max)	0.5		4.0		dBm
Average launch power[a] (min)	–8.2		–4.7		dBm
Launch power (min) in OMA minus TDP[b]	–6.2		–2.1		dBm
Optical Modulation Amplitude[c] (min)	–5.2		–1.7		dBm
Transmitter and dispersion penalty (max)	3.2		3.0		dB
Average launch power of OFF transmitter[d] (max)	–30		–30		dBm
Extinction ratio (min)	3.5		3		dB
$RIN_{12}OMA$ (max)	–128				dB/Hz
$RIN_{21}OMA$ (max)[e]			–128		dB/Hz
Optical Return Loss Tolerance (max)	12		21		dB
Transmitter Reflectance[f] (max)	–12				dB
Transmitter eye mask definition[g] A {X1, X2, X3, Y1, Y2, Y3}	{0.25, 0.40, 0.45, 0.25, 0.28, 0.40}				
Transmitter eye mask definition[g] B {X1, X2, X3	{0.235, 0.395, 0.45, 0.235, 0.265, 0.4}				

Guidelines:

- BR40 Tx is 1.8 dB higher than BR10 Tx
- BR20 is 6.8 dB higher than BR10
- BR40+ is 6.8 dB higher than BR10

BR20	BR40	BR40+
4.0	4.0	4.0
-1.4	-6.4	-1.4
+0.6	-4.8	+0.6
+1.6	-3.4	+1.6

Pg. 55 in D1.0

Table 158–8—10GBASE-BRx-D receive characteristics

Description	10GBASE-BR10-D	10GBASE-BR20-D	10GBASE-BR40-D	10GBASE-BR40+-D	Unit
Signaling speed (nominal)		10.3125			GBd
Signaling speed variation from nominal (max)		± 100			ppm
Center wavelength (range)		~~1260 to 1280~~1320 to 1340			nm
Average receive power[a] (max)	0.5		–1.0		dBm
Average receive power[b] (min)	–14.4		–15.8		dBm
Maximum receive power (for damage)			4.0		
Receiver sensitivity (max) in OMA[c]	0.055 (–12.6)		0.039 (–14.1)		mW (dBm)
Receiver Reflectance (max)	–12		–26		dB
Stressed receiver sensitivity (max) in OMA[d, e]	0.093 (–10.3)		0.074 (-11.3)		mW (dBm)
Vertical eye closure penalty[f] (min)	2.2		2.7		dB
Stressed eye jitter[g] (min)	0.3		0.3		UI pk-pk
Receive electrical 3 dB upper cutoff frequency (max)	12.3		12.3		GHz

Guidelines:

- BR40 Rx is 10 dB better than BR10 Rx
- BR20 the same as BR10
- BR40+ is the same as BR40

BR20	BR40	BR40+
0.5	-10	-10
-14.4	-24.4	-24.4
4	4	4
-12.6	-22.6	-22.6
-10.3	-20.3	-20.3

Pg. 56 in D1.0

Table 158–9—10GBASE-BRx-U receive characteristics

Description	10GBASE-BR10-U	10GBASE-BR20-U	10GBASE-BR40-U	10GBASE-BR40+-U	Unit
Signaling speed (nominal)		10.3125			GBd
Signaling speed variation from nominal (max)		± 100			ppm
Center wavelength (range)		~~1320 to 1340~~ 1260 to 1280			nm
Average receive power[a] (max)	0.5		–1.0		dBm
Average receive power[b] (min)	–14.4		–15.8		dBm
Maximum receive power (for damage)			4.0		
Receiver sensitivity (max) in OMA[c]	0.055 (–12.6)		0.039 (–14.1)		mW (dBm)
Receiver Reflectance (max)	–12		–26		dB
Stressed receiver sensitivity (max) in OMA[d, e]	0.093 (–10.3)		0.074 (-11.3)		mW (dBm)
Vertical eye closure penalty[f] (min)	2.2		2.7		dB
Stressed eye jitter[g] (min)	0.3		0.3		UI pk-pk
Receive electrical 3 dB upper cutoff frequency (max)	12.3		12.3		GHz

Guidelines:

- BR40 Rx is 10 dB better than BR10 Rx
- BR20 the same as BR10
- BR40+ is the same as BR40

	BR20	BR40	BR40+
	0.5	-10	-10
	-14.4	-24.4	-24.4
	4	4	4
	-12.6	-22.6	-22.6
	-10.3	-20.3	-20.3

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Table 158–10—10GBASE-BRx link power budget[a], [b]

Parameter	10GBASE-BR10	10GBASE-BR20	10GBASE-BR40	10GBASE-BR40+	Unit
Power budget	9.4		15		dB
Operating distance	10	20	40[c]	40	km
Channel insertion loss[d], [e]	6.2		10.9		dB
Maximum Discrete Reflectance (max)			–26		dB
Allocation for penalties	3.2		4.1		dB
Additional insertion loss allowed	0.0		0.0		dB

	BR20	BR40	BR40+
	16.2	21.2	26.2
	13	18	23
	-26	-26	-26
	3.2	3.2	3.2
	0	0	0

Guidelines:

- BR40 budget (18) is 11.8 dB higher than BR10
- BR20 is 6.8 dB higher than BR10
- BR40+ is 16.8 dB higher than BR10

Pg. 58 in D1.0

Table 158–15—Transmitter compliance channel specifications

PMD Type	Dispersion[a] (ps/nm)		Insertion loss[b]	Optical return loss[c] (max)
	Minimum	Maximum		
10GBASE-BR10			Minimum	12
10GBASE-BR20	$0.2325 \cdot \lambda \cdot [1 - (1324 / \lambda)^4]$	$0.2325 \cdot \lambda \cdot [1 - (1300 / \lambda)^4]$	Minimum	21 dB
10GBASE-BR40, 10GBASE-BR40+	0 (maximum)	$0.93 \cdot \lambda \cdot [1 - (1300 / \lambda)^4]$	Minimum	See ORLT in Table 158–6 or Table 158–7

- The equations in the green box are generally applicable for 10km (any rate).
For 20km, the coefficient should be 2*0.2325 = 0.465.
Fro 40km, the coefficient should be 4*0.2325 = 0.93.

- This insertion loss for the test is ok to leave as “minimum”.

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Table 158–16—Fiber optic cabling (channel) characteristics

Description	Type B1.1, B1.3 SMF								Unit
Nominal wavelength	1270[a]				1330				nm
Operating distance (max)	10	20	40	40+	10	20	40	40+	km
Channel insertion loss (max)[a,b,c,d]	6.2	13	18	23	6.2	13	18	23	dB
Channel insertion loss (min)	0	5	10	15??	0	5	10	15??	dB
Dispersion (max)	See Table 158-15[e]								ps/nm
Dispersion (min)									ps/nm
DGD_max[f]	10	10	10	10	10	10	10	10	ps
Optical return loss	21	21	21	21	21	21	21	21	dB

Pg. 65 in D1.0

Guidelines:

- Use the formulas in Table 158-15 to calculate the min and max dispersion values*
- DGD can be copied from LR and ER specs
- Copy ORL from LR and ER specs
- DGD and ORL values are from Table 52-24

* Use the extremal wavelengths. For nominal 1270, minimum dispersion will happen at 1260 at ZD=1324nm. Maximum dispersion will happen at 1280nm and ZD=1300nm.

Table 159–6—25GBASE-BRx-D transmit characteristics

Description	25GBASE-BR10-D	25GBASE-BR20-D	25GBASE-BR40-D	25GBASE-BR40+-D	Unit
Signaling rate (range)		25.78125 ± 100 ppm			GBd
Center wavelength (range)	~~1300 to~~ 1320 to 1340		1302 to 1318		nm
Side-mode suppression ratio (SMSR), (min)		30			dB
Average launch power (max)	2		6		dBm
Average launch power[a] (min)	–7		–3		dBm
Optical Modulation Amplitude (OMA), (max)	2.2		6		dBm
Optical Modulation Amplitude (OMA)[b], (min)	–4		0		dBm
Launch power in OMA minus TDP (min)	–5		–1		dBm
Transmitter and dispersion penalty (TDP), (max)	2.7		2.7		dB
Average launch power of OFF transmitter (max)		–20			dBm
Extinction ratio (min)	3		4		dB
$RIN_{20}OMA$ (max)		–130			dB/Hz
Optical return loss tolerance (max)		20			dB
Transmitter reflectance[c] (max)		–26			dB

Guidelines:

- BR20 Tx is 5 dB lower than BR40 Tx
- BR40+ is 5 dB higher than BR40

	BR20	BR40	BR40+
Average launch power (max)	6.0	6.0	6.0
Average launch power[a] (min)	-8	-3	+2
Optical Modulation Amplitude (OMA), (max)	6	6	6
Optical Modulation Amplitude (OMA)[b], (min)	-5	0	5
Launch power in OMA minus TDP (min)	-6	-1	4
Transmitter and dispersion penalty (TDP), (max)	2.7	2.7	2.7
Extinction ratio (min)	4	4	4

Pg. 77 in Clean
Pg. 78 in Markup

Table 159–7—25GBASE-BRx-U transmit characteristics

Description	25GBASE-BR10-U	25GBASE-BR20-U	25GBASE-BR40-U	25GBASE-BR40+-U	Unit
Signaling rate (range)	25.78125 ± 100 ppm				GBd
Center wavelength (range)	1260 to 1280	~~1293~~1282 to ~~1310~~1298			nm
Side-mode suppression ratio (SMSR), (min)		30			dB
Average launch power (max)	2		6		dBm
Average launch power[a] (min)	–7		–3		dBm
Optical Modulation Amplitude (OMA), (max)	2.2		6		dBm
Optical Modulation Amplitude (OMA)[b], (min)	–4		0		dBm
Launch power in OMA minus TDP (min)	–5		–1		dBm
Transmitter and dispersion penalty (TDP), (max)	2.7		2.7		dB
Average launch power of OFF transmitter (max)		–20			dBm
Extinction ratio (min)	3		4		dB
$RIN_{20}OMA$ (max)		–130			dB/Hz
Optical return loss tolerance (max)	20				dB
Transmitter reflectance[c] (max)	–26				dB
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}	{0.31, 0.4, 0.45, 0.34, 0.38, 0.4}				

Guidelines:

- BR20 Tx is 5 dB lower than BR40 Tx
- BR40+ is 5 dB higher than BR40

BR20	BR40	BR40+
6.0	6.0	6.0
-8	-3	+2
6	6	6
-5	0	5
-6	-1	4
2.7	2.7	2.7
4	4	4

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Table 159–8—25GBASE-BRx-D receive characteristics

Description	25GBASE-BR10-D	25GBASE-BR20-D	25GBASE-BR40-D	25GBASE-BR40+-D	Unit
Signaling rate (range)		25.78125 ± 100 ppm			GBd
Center wavelength (range)	~~1260~~1320 to ~~1280~~1340	~~1300~~1302 to ~~1320~~1318			nm
Damage threshold[a] (min)	3		–3		dBm
Average receive power (max)	2		–4		dBm
Average receive power[b] (min)	–13.3		–21		dBm
Receive power (OMA), (max)	2.2		–4		dBm
Receiver reflectance (max)		–26			dB
Receiver sensitivity (OMA)[c], (max)	–12		–19		dBm
Stressed receiver sensitivity (OMA)[d], (max)	–9.5		–16.5		dBm
Conditions of stressed receiver sensitivity tes					
Stressed eye closure[e]	2.5		2.5		dB
Stressed eye J2 Jitter[e]	0.27		0.27		UI
Stressed eye J4 Jitter[e]	0.39		0.39		UI
SRS eye mask definition {X1, X2, X3, Y1, Y2, Y3} Hit ratio 5×10^{-5} hits per sample.	{0.31, 0.4, 0.45, 0.34, 0.38, 0.4}				

Guideline:

- BR20, BR40, and BR40+ all share the same Rx

BR20	BR40	BR40+
-3	-3	-3
-4	-4	-4
-21	-21	-21
-4	-4	-4
-19	-19	-19
-16.5	-16.5	-16.5

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Pg. 80 in Markup

Table 159–9—25GBASE-BRx-U receive characteristics

Description	25GBASE-BR10-U	25GBASE-BR20-U	25GBASE-BR40-U	25GBASE-BR40+-U	Unit
Signaling rate (range)	25.78125 ± 100 ppm				GBd
Center wavelength (range)	~~1300~~1260 to ~~1320~~1280	~~1293~~1282 to ~~1325~~1298			nm
Damage threshold (min)	3		–3		dBm
Average receive power (max)	2		–4		dBm
Average receive power[a] (min)	–13.3		–21		dBm
Receive power (OMA), (max)	2.2		–4		dBm
Receiver reflectance (max)		–26			dB
Receiver sensitivity (OMA)[b], (max)	–12		–19		dBm
Stressed receiver sensitivity (OMA)[c], (max)	–9.5		–16.5		dBm
Conditions of stressed receiver sensitivity test					
Stressed eye closure[d]	2.5		2.5		dB
Stressed eye J2 Jitter[e]	0.27		0.27		UI
Stressed eye J4 Jitter[e]	0.39		0.39		UI
SRS eye mask definition {X1, X2, X3, Y1, Y2, Y3}	{0.31, 0.4, 0.45, 0.34, 0.38, 0.4}				

Guideline:
- BR20, BR40, and BR40+ all share the same Rx

BR20	BR40	BR40+
-3	-3	-3
-4	-4	-4
-21	-21	-21
-4	-4	-4
-19	-19	-19
-16.5	-16.5	-16.5

Pg. 80 in Clean
Pg. 81 in Markup

Table 159–10—25GBASE-BRx illustrative link power budgets

Parameter	25GBASE-BR10	25GBASE-BR20	25GBASE-BR40	25GBASE-BR40+	Unit
Power budget (for maximum TDP)	9.7	20.7			dB
Operating distance	10	30	40	40	km
Channel insertion loss	6.3[a]	15[a]	See 159.9		dB
Maximum discrete reflectance	See 159.10	See 159.10			dB
Allocation for penalties[b] (for maximum TDP)	3.4	20.7 minus maximum channel insertion loss per Table 159–14			dB
Additional insertion loss allowed	0	Maximum channel insertion loss per Table 159–14 minus 15	0		dB

[a]The channel insertion loss is calculated using the maximum distance specified in Table 159–5 and fiber attenuation of 0.43 dB/km at 1295 nm plus an allocation for connection and splice loss given in 88.11.2.1.
[b]Link penalties are used for link budget calculations. They are not requirements and are not meant to be tested.

BR20	BR40	BR40+
16.2	21.2	26.2
20	40	40
13	18	23
-26	-26	-26
3.4	3.4	3.4
0	0	0

Guidelines:

- BR40 budget (18) is 11.7 dB higher than BR10
- BR20 is 6.7 dB higher than BR10
- BR40+ is 16.7 dB higher than BR10

Pg. 81 in Clean
Pg. 82 in Markup

Table 159–15—Fiber optic cabling (channel) characteristics

Description	Type B1.1, B1.3 SMF								Unit
Nominal wavelength	1270[a]	1290	1290	1290	1330	1310	1310	1310	nm
Operating distance (max)	10	20	40	40+	10	20	40	40+	km
Channel insertion loss (max)[a,b,c,d]	6.2	13	18	23	6.2	13	18	23	dB
Channel insertion loss (min)	0	5	10	15??	0	5	10	15??	dB
Dispersion (max)	See Table 158-15								ps/nm
Dispersion (min)									ps/nm
DGD_max[e]	8	10.3	10.3	10.3	8	10.3	10.3	10.3	ps
Optical return loss	21	21	21	21	21	21	21	21	dB

Pg. 86 in Clean
Pg. 88 in Markup

Guidelines:

- Computed the same way as Table 158-16, but with different wavelengths for the 20, 40, and 40+ cases
- DGD and ORL values are from LR and ER in Cl 114

Table 159–17—Channel insertion loss requirements for interoperation

Direction	Min loss	Max loss	Unit
25GBASE-BR10 transmitter to 25GBASE-BR40 receiver	6.2	13.3	dB
25GBASE-BR10 transmitter to 25GBASE-BR40+ receiver			
25GBASE-BR20 may not play well with others			
25GBASE-BR40 transmitter to 25GBASE-BR10 receiver	4	10.3	dB
25GBASE-BR40+ transmitter to 25GBASE-BR10 receiver			

Pg. 87 in Clean
Pg. 89 in Markup

Guidelines:
- For 25G and 50G, BR10 won't work with any of the others as they are in wrong wavelengths. And to connect a BR20 and BR40 together really doesn't work well.
- Recommend to mark this table for deletion (editor's note)

Table 160–6—50GBASE-BRx-D transmit characteristics

Description	50GBASE-BR10-D	50GBASE-BR20-D	50GBASE-BR40-D	50GBASE-BR40+-D	Unit
Signaling rate (range)	26.5625 ± 100 ppm				GBd
Modulation format	PAM4				—
Wavelengths (range)	~~1304.5~~1320 to ~~1317.5~~1340	1302 to 1318			nm
Side-mode suppression ratio (SMSR), (min)	30				dB
Average launch power (max)	4.2	4.2	6.63	6.63	dBm
Average launch power[a] (min)	–4.5	-4.5	0.4	5.4	dBm
Outer Optical Modulation Amplitude (OMA_{outer}) (max)	4	4	7.4	7.4	dBm
Outer Optical Modulation Amplitude (OMA_{outer}) (min)[b]	–1.5	-1.5	3.4	8.4	dBm
Launch power in OMA_{outer} minus TDECQ (min)	–2.9	-2.9	2	7	dBm
Transmitter and dispersion eye closure for PAM4 (TDECQ) (max)	3.2	3.2	3.2	3.2	dB
TDECQ – $10\log_{10}(C_{eq})$[c] (max)	3.2	3.2	3.2	3.2	dB
Average launch power of OFF transmitter (max)	–16	-15	-15	-15	dBm
Extinction ratio (min)	3.5	6	6	6	dB
Transmitter transition time (max)	34			34	ps
$RIN_{17.1}OMA$ (max)	—	—	—	—	dB/Hz
$RIN_{15.6}OMA$ (max)	–132	-132	-132	-132	dB/Hz
$RIN_{15}OMA$ (max)	—	-132	–132	-132	dB/Hz
Optical return loss tolerance (max)	15.6	15	15	15	dB
Transmitter reflectance[d] (max)	–26			-26	dB

Guidelines:

- BR20 Tx is 5 dB lower than BR40 Tx
- BR40+ is 5 dB higher than BR40

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Pg. 98 in Markup

Table 160–7—50GBASE-BRx-U transmit characteristics

Description	50GBASE-BR10-U	50GBASE-BR20-U	50GBASE-BR40-U	50GBASE-BR40+-U	Unit
Signaling rate (range)	26.5625 ± 100 ppm				GBd
Modulation format	PAM4				—
Wavelengths (range)	~~1304.5 to 1317.5~~1260 to 1280	1282 to 1298			nm
Side-mode suppression ratio (SMSR), (min)	30			30	dB
Average launch power (max)	4.2	4.2	6.63	6.63	dBm
Average launch power[a] (min)	–4.5	-4.5	0.4	5.4	dBm
Outer Optical Modulation Amplitude (OMA_{outer}) (max)	4	4	7.4	12.4	dBm
Outer Optical Modulation Amplitude (OMA_{outer}) (min)[b]	–1.5	3.4	3.4	8.4	dBm
Launch power in OMA_{outer} minus TDECQ (min)	–2.9	-2.9	2	7	dBm
Transmitter and dispersion eye closure for PAM4 (TDECQ) (max)	3.2	3.2	3.2	3.2	dB
TDECQ – $10\log_{10}(C_{eq})$[c] (max)	3.2	3.2	3.2	3.2	dB
Average launch power of OFF transmitter (max)	–16	-15	-15	-15	dBm
Extinction ratio (min)	3.5	6	6	6	dB
Transmitter transition time (max)	34			34	ps
$RIN_{17.1}OMA$ (max)	—	—	—	—	dB/Hz
$RIN_{15.6}OMA$ (max)	–132	–132	–132	–132	dB/Hz
$RIN_{15}OMA$ (max)	—	–132	–132	–132	dB/Hz
Optical return loss tolerance (max)	15.6	15	15	15	dB
Transmitter reflectance[d] (max)	–26			-26	dB

Guidelines:

- BR20 Tx is 5 dB lower than BR40 Tx
- BR40+ is 5 dB higher than BR40

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Pg. 100 in Markup

Table 160–8—50GBASE-BRx-D receive characteristics

Description	50GBASE-BR10-D	50GBASE-BR20-D	50GBASE-BR40-D	50GBASE-BR40+-D	Unit
Signaling rate (range)	26.5625 ± 100 ppm				GBd
Modulation format	PAM4				—
Wavelengths (range)	~~1304.5 to 1317.5~~1320 to 1340	1302 to 1318			nm
Damage threshold[a]	5.2	-2.37	–2.37	–2.37	dBm
Average receive power (max)	4.2	–3.37	–3.37	–3.37	dBm
Average receive power[b] (min)	–10.8	–17.6	–17.6	–17.6	dBm
Receive power (OMA_{outer}) (max)	4	–2.6	–2.6	–2.6	dBm
Receiver reflectance (max)	–26			-26	dB
Receiver sensitivity (OMA_{outer})[c] (max)	Equation (160–1)	Equation (160–2)	Equation (160–2)	Equation (160–2)	dBm
Stressed receiver sensitivity (OMA_{outer})[d] (max)	–6.6	–13.3	–13.3	–13.3	dBm
Conditions of stressed receiver sensitivity test:[e]					
Stressed eye closure for PAM4 (SECQ)	3.2	3.2	3.2	3.2	dB
SECQ – $10\log_{10}(C_{eq})$[f] (max)	3.2	3.2	3.2	3.2	dB

Guideline:
- BR20, BR40, and BR40+ all share the same Rx

Pg. 100 in Clean
Pg. 101 in Markup

Table 160–9—50GBASE-BRx-U receive characteristics

Description	50GBASE-BR10-U	50GBASE-BR20-U	50GBASE-BR40-U	50GBASE-BR40+-U	Unit
Signaling rate (range)	26.5625 ± 100 ppm				GBd
Modulation format	PAM4				—
Wavelengths (range)	~~1304.5 to 1317.5~~1260 to 1280	1282 to 1298			nm
Damage threshold[a]	5.2	–2.37	–2.37	–2.37	dBm
Average receive power (max)	4.2	–3.37	–3.37	–3.37	dBm
Average receive power[b] (min)	–10.8	-17.6	–17.6	-17.6	dBm
Receive power (OMA_{outer}) (max)	4	–2.6	–2.6	–2.6	dBm
Receiver reflectance (max)	–26			-26	dB
Receiver sensitivity (OMA_{outer})[c] (max)	Equation (160–1)	Equation (160–2)	Equation (160–2)	Equation (160–2)	dBm
Stressed receiver sensitivity (OMA_{outer})[d] (max)	–6.6	–13.3	–13.3	–13.3	dBm
Conditions of stressed receiver sensitivity test:[e]					
Stressed eye closure for PAM4 (SECQ)	3.2	3.2	3.2	3.2	dB
SECQ – $10\log_{10}(C_{eq})$[f] (max)	3.2	3.2	3.2	3.2	dB

Guideline:
- BR20, BR40, and BR40+ all share the same Rx

Pg. 100 in Clean
Pg. 102 in Markup

Table 160–10—50GBASE-BRx illustrative link power budgets

Parameter	50GBASE-BR10	50GBASE-BR20	50GBASE-BR40	50GBASE-BR40+	Unit
Power budget (for maximum TDECQ)	7.4	10.1			dB
Operating distance	2	10			km
Channel insertion loss	4[a]	6.3[b]	c		dB
Maximum discrete reflectance	See 160.10.2.2	See 160.10.2.2			dB
Allocation for penalties[d] (for maximum TDECQ)	2.4	3.8			dB
Additional insertion loss allowed	0	0			dB

[a]The channel insertion loss is calculated using the maximum distance specified in Table 160–5 for 50GBASE-BR10 and

BR10	BR20	BR40	BR40+
7.4	16.2	21.2	26.2
10	20	40	40
6.3	13	18	23
-26	-26	-26	-26
3.8	3.8	3.8	3.8
0	0	0	0

Guidelines:

- BR40 budget (18) is 11.7 dB higher than BR10
- BR20 is 6.7 dB higher than BR10
- BR40+ is 16.7 dB higher than BR10

Pg. 101 in Clean
Pg. 103 in Markup

Table 160–14—Fiber optic cabling (channel) characteristics

Description	Type B1.1, B1.3 SMF						Unit
Nominal wavelength	1270[a]			1330			nm
Operating distance (max)	10	20	40	10	20	40	km
Channel insertion loss (max)[a,b,c,d]	See Table 159-15						dB
Channel insertion loss (min)							dB
Dispersion (max)							ps/nm
Dispersion (min)							ps/nm
DGD_max[e]							ps
Optical return loss							dB

Guideline:
- Should be identical to table 159-15 (25G spec)

Pg. 111 in Clean
Pg. 113 in Markup

Table 160–16—Maximum value of each discrete reflectance

Number of discrete reflectances above –55 dB	Maximum value for each discrete reflectance		
	50GBASE-BR10	50GBASE-BR20	50GBASE-BR40, 50GBASE-BR40+
1	–25 dB	between -25 dB and -19 dB	–19 dB
2	–31 dB	between -31 dB and -27 dB	–27 dB
4	–35 dB	between -35 dB and -32 dB	–32 dB
6	–38 dB	between -38dB and -35 dB	–35 dB
8	–40 dB	between -40 dB and -37 dB	–37 dB
10	–41 dB	between -41 dB and -39 dB	–39 dB

Pg. 112 in Clean
Pg. 114 in Markup

Suggestion:

- Make the BR20 be interpolated between the two values, mark it with an editor's note