



Contribution in support of P802.3cz/D2.1 comment #33 resolution

Rubén Pérez-Aranda, KDPOF

How aging penalty affect the specifications



- Comment #33 suggests adding 0.4 dB cable attenuation aging penalty as a placeholder until more data can be generated to verify for 40 meter length
- This has effect on several characteristics that need carefully recalculated and technical feasibility to support extra 0.4 dB attenuation also needs to be demonstrated
- perezaranda_3cz_02b_080222_TXRX_characteristics.pdf included an annex with the link budget analysis that is behind the specifications. For every considered data-rate we can see that the RX sensitivity specifications have implementation margin to support extra cable attenuation. See column “Other penalties” of row OMA_{TP3}
 - Implementation margin for 50 Gb/s: 3.0 dB
 - Implementation margin for 25 Gb/s: 2.3 dB
 - Implementation margin for 10 Gb/s: 3.2 dB
 - Implementation margin for 5 Gb/s: 4.1 dB
 - Implementation margin for 2.5 Gb/s: 5.4 dB
- Therefore, extra 0.4 dB insertion loss is feasible

How aging penalty affect the specifications



Table 166–10— BASE-AU PMD receiver optical characteristics

Parameter	2.5GBASE-AU	5GBASE-AU	10GBASE-AU	25GBASE-AU	50GBASE-AU	Units
Signaling rate (range)	2.65625 ±100 ppm	5.3125 ±100 ppm	10.625 ±100 ppm	26.5625 ±100 ppm		Gbd
Modulation format	NRZ				PAM4	
Center wavelength (range)	970 to 990					nm
Damage threshold ^a (max)	4.9				6.0	dBm
Average receive power (max)	3.9				5.0	dBm
Average receive power ^b (min)	-19.9	-17.9	-15.7	-12.7	-7.9	dBm
Receive power (OMA _{outer}) (max)	3.2				4.3	dBm
Receiver reflectance (max)	-12					dBm
Stressed receiver sensitivity ^c (OMA _{outer}), condition 1 (max)	-17.0	-14.9	-11.4	-7.7	-2.4	dBm
Stressed receiver sensitivity ^d (OMA _{outer}), condition 2 (max)	-18.0	-16.0	-13.8	-10.8	-6.0	dBm
Receiver sensitivity (OMA _{outer}) (max)	max (C, TDFOM + D)					dBm
C	-18.0	-16.0	-13.8	-10.8	-6.0	dBm
D	-18.0	-15.9	-13.4	-10.2	-5.4	dBm
Conditions of stressed receiver sensitivity test ^e :						
Stressed TDFOM (STDFOM), condition 1	1.0	1.0	2.0	2.5	3.0	dB
Stressed TDFOM (STDFOM), condition 2	0.0	-0.1	-0.4	-0.6	-0.6	dB

^aThe receiver shall be able to tolerate, without damage, continuous exposure to an optical input signal having this average power level. The receiver does not have to operate correctly at this input power.

^bAverage receive power (min) is informative and not the principal indicator of signal strength. A received power below this value cannot be compliant; however, a value above this does not ensure compliance.

^cMeasured with condition 1 conformance test signal at TP3 (see 166.7.10.2) for the BER specified in 166.1.

^dMeasured with condition 2 conformance test signal at TP3 (see 166.7.10.2) for the BER specified in 166.1.

^eThese test conditions are for measuring stressed receiver sensitivity for condition 1 and 2 respectively. They are not characteristics of the receiver.

How aging penalty affect the specifications



Table 166–10— BASE-AU PMD receiver optical characteristics

Parameter	2.5GBASE-AU	5GBASE-AU	10GBASE-AU	25GBASE-AU	50GBASE-AU	Units
Signaling rate (range)	2.65625 ±100 ppm	5.3125 ±100 ppm	10.625 ±100 ppm	26.5625 ±100 ppm		Gbd
Modulation format	NRZ				PAM4	
Center wavelength (range)	970 to 990					nm
Damage threshold ^a (max)	4.9				6.0	dBm
Average receive power (max)	3.9				5.0	dBm
Average receive power ^b (min)	-19.9	-17.9	-16.1	-13.1	-8.3	dBm
Receive power (OMA _{outer}) (max)	3.2				4.3	dBm
Receiver reflectance (max)	-12					dBm
Stressed receiver sensitivity ^c (OMA _{outer}), condition 1 (max)	-17.0	-14.9	-11.8	-8.1	-2.8	dBm
Stressed receiver sensitivity ^d (OMA _{outer}), condition 2 (max)	-18.0	-16.0	-14.2	-11.2	-6.4	dBm
Receiver sensitivity (OMA _{outer}) (max)	max (C, TDFOM + D)					dBm
C	-18.0	-16.0	-14.2	-11.2	-6.4	dBm
D	-18.0	-15.9	-13.8	-10.6	-5.8	dBm
Conditions of stressed receiver sensitivity test ^e :						
Stressed TDFOM (STDFOM), condition 1	1.0	1.0	2.0	2.5	3.0	dB
Stressed TDFOM (STDFOM), condition 2	0.0	-0.1	-0.4	-0.6	-0.6	dB

^aThe receiver shall be able to tolerate, without damage, continuous exposure to an optical input signal having this average power level. The receiver does not have to operate correctly at this input power.

^bAverage receive power (min) is informative and not the principal indicator of signal strength. A received power below this value cannot be compliant; however, a value above this does not ensure compliance.

^cMeasured with condition 1 conformance test signal at TP3 (see 166.7.10.2) for the BER specified in 166.1.

^dMeasured with condition 2 conformance test signal at TP3 (see 166.7.10.2) for the BER specified in 166.1.

^eThese test conditions are for measuring stressed receiver sensitivity for condition 1 and 2 respectively. They are not characteristics of the receiver.

How aging penalty affect the specifications



Table 166–11— BASE-AU illustrative link power budget

Parameter	2.5GBASE-AU	5GBASE-AU	10GBASE-AU	25GBASE-AU	50GBASE-AU	Units
Effective modal bandwidth at 980 nm ^a	950					MHz·km
Power budget	13.0	12.0	10.7	8.7	5.0	dB
Operating distance (max)	0.2 to 40					m
Channel insertion loss ^b (max)	10.1			8.1	4.1	dB
Channel insertion loss (min)	0					dB
Allocation for penalties ^c	0.7		0.6		0.9	dB
Additional insertion loss allowed	2.2	1.2	0.0			dB

^aPer IEC 60793-2-10.

^bThe channel insertion loss is calculated using the maximum distance specified in Table 166–7 and cabled optical fiber attenuation of 2 dB/km at 980 nm plus an allocation for connection given in 166.9.2.1.

^cLink penalties are used for link budget calculations. They are not requirements and are not meant to be tested.

How aging penalty affect the specifications



Table 166–11— BASE-AU illustrative link power budget

Parameter	2.5GBASE-AU	5GBASE-AU	10GBASE-AU	25GBASE-AU	50GBASE-AU	Units
Effective modal bandwidth at 980 nm ^a	950					MHz·km
Power budget	13.0	12.0	11.1	9.1	5.4	dB
Operating distance (max)	0.2 to 40					m
Channel insertion loss ^b (max)	10.5			8.5	4.5	dB
Channel insertion loss (min)	0					dB
Allocation for penalties ^c	0.7		0.6		0.9	dB
Additional insertion loss allowed	1.8	0.8	0.0			dB

^aPer IEC 60793-2-10.

^bThe channel insertion loss is calculated using the maximum distance specified in Table 166–7 and cabled optical fiber attenuation of 2 dB/km at 980 nm plus an allocation for connection given in 166.9.2.1.

^cLink penalties are used for link budget calculations. They are not requirements and are not meant to be tested.

Change footnote b as:

The channel insertion loss is calculated using the maximum distance specified in Table 166–7, cabled optical fiber attenuation of 2 dB/km at 980 nm plus an allocation for cable attenuation penalty and connection given in 166.9.2.1.



Thank you