Transmitter Functional Test (TFT) Updated Proposal

P802.3dj SMF Task Force Interim Meeting

IEEE 802.3 Interim Session

January 19-22, 2026

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Comments: (SC 180.9.9) 116, 74, 9, 75, 117, 125, 76, 10, 2, 11, 77 / (SC 181.9.9) 12, 97, 119, 118 / (SC 182.9.9) 129, 13, 120, 121 / (SC 183.9.9) 130, 14, 122, 123 / (SC 18n.9.15) 15, 16, 17, 18

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Outline

➢Introduction

- Proposed Response Text
- Calculation examples
- TFT examples
- RxS Conformance Test Signal
- Appendix: VOA_level Equation Change

Transmitter Functional Test (TFT) Spec Summary

- TFT is not a standalone spec, instead it's normative w/ TECQ & TDECQ, like other transmitter characteristics, ex. OMA (min) & (max), ER (min), over & undershoot (max)
- Uses 802.3 optics spec methodology of single power penalty capturing all impairments
- Functional Receiver (FRx) is not a HW Golden Receiver (GR), instead is referenced to:
  - TECQ/TDECQ scope-based SW GR
  - RxS/SRS conformance test signal from a transmitter referenced to TECQ
- Addresses TDECQ corner case problems, ex.
  - Tx Functional Test (p.15 lines 4 & 5) and Tx Dispersion Penalty spec
- Different from proposals using individual impairment electrical spec methodology, ex.
  - Tx jitter generation individual spec (even though it's not viewed as a problem)
- Different from proposals for standalone interoperability spec using HW GR, ex.
  - Tx jitter generation individual spec indirectly set by HW GR jitter tolerance mask

Transmitter Functional Test (TFT) Proposal Progress

- 1st proposal (D2.1) w/ broad support as are all others, 7/25: patch-cord only TFT spec

  FRx_OMA = Tx_DUT_OMA - Tx_power_budget - RxS_TECQ_correction + Test_margin

  - derives new term from transmitter spec: max(DUT_TDECQ - DUT_TECQ, 0)
  - introduces analogy of tasting transmitter dish after cooking to an existing recipe
- 2nd proposal, 9/25: test-fiber TFT spec (*Tx_DUT_OMA - FRx_OMA → VOA_level*)

  VOA_level = Test_SMF_correction + RxS_TECQ_correction - Test_margin
- 3rd proposal (D2.2, D2.3), 9/25: test-fiber TFT spec (→ max(DUT_TECQ, DUT_TDECQ))

  VOA_level = Tx_DUT_power_budget - Test_fiber_power_budget
  - ORx_TECQ_allocation - Test_margin
- 4th (this) proposal: back to 2nd proposal except uses max(DUT_TECQ, DUT_TDECQ)

  VOA_level = Test_fiber_correction + ORx_TECQ_correction - Test_margin

  - functionally same as previous proposals; aligns equation with other 802.3 specs

Transmitter Functional Test (TFT) Proposed SC Name Changes

180.9.9 Transmitter functional symbol error histogram → Transmitter functional test

180.9.9.1 Functional receiver (FRx) definition → *no change*

180.9.9.2 Test symbol error measurement → Transmitter functional symbol error histogram *(TFSEH)*

181.9.9 Transmitter functional symbol error histogram → Transmitter functional test

182.9.9 Transmitter functional symbol error histogram → Transmitter functional test

183.9.9 Transmitter functional symbol error histogram → Transmitter functional test

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180.9.9 Transmitter Functional Test (TFT)

The transmitter functional test uses a functional receiver (FRx) defined in 180.9.9.1 to measure a transmitter functional symbol error histogram (TFSEH) defined in 180.9.9.2. The transmitter under test is connected to the functional receiver by a test fiber which meets the requirements in 180.9.6.2. Other test fibers, including patch cords, may be used for additional tests.

The transmitter under test is configured with precoding set appropriately for the functional receiver being used in the test. The appropriate precoding state may be communicated via the ILT function or by other means.

The test symbols errors are measured using the method described in 174A.9.3.

180.9.9.1 Functional receiver (FRx) definition

The functional receiver (FRx) is a variable optical attenuator (VOA) followed by an optical receiver (ORx) that complies with characteristics as given in Table 180–8. VOA and the test fiber approximate compliance channel as given in Table 180-15. VOA level is given by Equation (180–28), in which the first and second term normalize differences in test fibers and optical receivers, respectively, so that symbol error counts are repeatable across different conditions, and is determined by the same algebraic expressions as determine normative transmitter and receiver characteristics, respectively.

VOA_level = Test_fiber_correction + ORx_TECQ_correction - Test_margin (180–28)

where:

—*Test_fiber_correction* is given by Equation (180-29), and is the difference between the power budget used to determine the transmitter under test OMA (min) (180-30) and the best estimate of the test fiber power budget (180-31).

—*ORx_TECQ_correction* is the difference between receiver sensitivity (max) and ORx receiver sensitivity, both at transmitter under test TECQ, and is given by Equation (180–32).

—*Test_margin* is additional ORx_OMA, to improve SNR of transmitter under test measurement. It equals 1.5dB, which decreases the required ORx operating BER to 2.4×10^{-5}.

180.9.9.1 Functional receiver (FRx) definition

Test_fiber_correction = Tx_DUT_power_budget – Test_fiber_power_budget (180-29)

where:

—*Tx_DUT_power_budget* is the transmitter under test power budget as given in Table 180-9, except uses measured instead of max TDECQ value as shown in Fig. 180-5, same as used in determining transmitter OMA (min) as per Table 180-7, and is given by Equation (180–30).

—*Test_fiber_power_budget* is the test fiber power budget as given in Table 180-9, except uses best estimates of the test fiber channel insertion loss, MPI, DGD and TDECQ penalties instead of their max values, and is given by Equation (180–31).

Tx_DUT_power_budget = Channel_insertion_loss + MPI_DGD_penalty_allocation + max(DUT_TECQ, DUT_TDECQ) (180–30)

where:

—*Channel_insertion_loss* is “Channel insertion loss” as given in Table 180–9.

—*MPI_DGD_penalty_allocation* is “MPI DGD penalty allocation” as given in Table 180–9.

—*DUT_TECQ* is the TECQ measured for the transmitter under test.

—*DUT_TDECQ* is the TDECQ measured for the transmitter under test.

180.9.9.1 Functional receiver (FRx) definition

Test_fiber_power_budget = Test_fiber_loss + Test_fiber_MPI+DGD_penalty + Test_fiber_DUT_TDECQ (180–31)

where:

—*Test_fiber_loss* is best estimate of the actual channel insertion loss of the test fiber.

—*Test_fiber_MPI+DGD*_penalty is best estimate of the actual MPI and DGD penalty of the test fiber.

—*Test_fiber_DUT_TDECQ* is best estimate of the transmitter under test actual TDECQ over the test fiber (equals DUT_TECQ + best estimate of the transmitter under test CD penalty over the test fiber).

ORx_TECQ_correction = RxS_OMA@DUT_TECQ - ORx_RxS@DUT_TECQ (180–32)

where:

—*RxS_OMA@DUT_TECQ* is the receiver sensitivity OMA (max) spec for TECQ >= 0.9 dB, as shown in Figure 180-4, extrapolated to TECQ = 0 dB (-4.3 dBm), at the TECQ measured for the transmitter under test.

—*ORx_RxS@DUT_TECQ* is the actual ORx receiver sensitivity OMA at the TECQ measured for the transmitter under test.

180.9.9.2 Transmitter functional symbol error histogram (TFSEH)

The transmitter functional symbol error histogram mask for each 200G lane is given in Table 180–18 and is measured using the test pattern as given in Table 180–14.

The limit $H_{max}(k)$ is calculated based on 174A.9.5 using ORx operating BER = 2.4×10^{-5} and p = 1. This operating BER is ORx_RxS BER decreased by amount corresponding to Test_margin increase of ORx_RxS OMA. This improves the measurement SNR of the transmitter functional test. ORx and Test_margin are defined in 180.9.9.1.

Minimum measurement time is 60 seconds, which fills the mask in Table 180–18.

A probable failure is indicated by exceeding the transmitter functional symbol error histogram mask in Table 180-18, or one or more counts in test symbol errors k per test block with k greater than 8.

180.9.9.2 Transmitter functional symbol error histogram

Table 180–18—Transmitter functional symbol error mask

Test symbol errors k per test block	Probability $H_{max}(k)$
1	1.15×10^{-1}
2	7.47×10^{-3}
3	3.24×10^{-4}
4	1.05×10^{-5}
5	2.73×10^{-7}
6	5.88×10^{-9}
7	1.08×10^{-10}
8	1.75×10^{-12}

180.9.1 Test patterns for optical parameters

Table 180–14—Mapping of parameters to test patterns and related subclauses

Parameter	Pattern	Related subclause
Transmitter functional test	3	180.9.9

181.9.9 Transmitter functional test

The transmitter functional test is defined in 180.9.9 with the following exceptions:

—The transmitter under test is connected to the functional receiver by a test fiber which meets the requirements in 181.9.6.1. Other test fibers, including patch cords, may be used for additional tests.

where in 180.9.9.1

—The functional receiver (FRx) is a variable optical attenuator (VOA) followed by an optical receiver (ORx) that complies with characteristics as given in Table 181–6. VOA and the test fiber approximate the compliance channel as given in Table 181–13.

where in Equation (180-29):

—Tx_DUT_power_budget is the transmitter under test power budget as given in Table 181-7, except uses measured instead of max TDECQ value as shown in Fig. 181-5, same as used in determining transmitter OMA (min) as given in Table 181-5, and is given by Equation (180–30).

—Test_fiber_power_budget is the test fiber power budget as given in Table 181-7, except uses best estimates of the test fiber channel insertion loss, MPI, DGD and TDECQ penalties instead of their max values, and is given by Equation (180–31).

181.9.9 Transmitter functional test

where in Equation (180–30)

—Channel_insertion_loss is “Channel insertion loss” as given in Table 181–7.

—MPI_DGD_penalty_allocation is “MPI DGD penalty allocation” as given in Table 181–7.

where in Equation (180–32)

—RxS_OMA@DUT_TECQ is the receiver sensitivity OMA (max) spec for TECQ >= 0.9 dB, as shown in Figure 181-4, extrapolated to TECQ = 0 dB (-4.1 dBm), at the TECQ measured for the transmitter under test.

where in 180.9.9.2

—The transmitter functional symbol error histogram mask per each 200G lane is given in Table 180–18 and is measured using the test pattern as given in Table 181–12.

181.9.1 Test patterns for optical parameters

Table 181–12—Mapping of parameters to test patterns and related subclauses

Parameter	Pattern	Related subclause
Transmitter functional test	3	181.9.9

182.9.9 Transmitter functional test

The transmitter functional test is defined in 180.9.9 with the following exceptions:

—The transmitter under test is connected to the functional receiver by a test fiber which meets the requirements in 182.9.6.1. Other test fibers, including patch cords, may be used for additional tests.

where in 180.9.9.1

—The functional receiver (FRx) is a variable optical attenuator (VOA) followed by an optical receiver (ORx) that complies with characteristics as given in Table 182–8. VOA and the test fiber approximate compliance channel as given in Table 182–15.

where in Equation (180-29):

—Tx_DUT_power_budget is the transmitter under test power budget as given in Table 182-9, except uses measured instead of max TDECQ value as shown in Fig. 182-5, same as used in determining transmitter OMA (min) as given in Table 182-7, and is given by Equation (180–30).

—Test_fiber_power_budget is the test fiber power budget as given in Table 182-9, except uses best estimates of the test fiber channel insertion loss, MPI, DGD and TDECQ penalties instead of their max values, and is given by Equation (180–31).

182.9.9 Transmitter functional test

where in Equation (180–98)

—Channel_insertion_loss is “Channel insertion loss” as given in Table 182–9.

—MPI_DGD_penalty_allocation is “MPI DGD penalty allocation” as given in Table 182–9.

where in Equation (180–32)

—RxS_OMA@DUT_TECQ is the receiver sensitivity OMA (max) spec for TECQ >= 0.9 dB, as shown in Figure 182-4, extrapolated to TECQ = 0 dB (-5.3 dBm), at the TECQ measured for the transmitter under test.

where in 180.9.9.2

—The transmitter functional symbol error histogram mask per each 200G lane is given in Table 180–18 and is measured using the test pattern as given in Table 182–14.

182.9.1 Test patterns for optical parameters

Table 182–14—Mapping of parameters to test patterns and related subclauses

Parameter	Pattern	Related subclause
Transmitter functional test	8	182.9.9

183.9.9 Transmitter functional test

The transmitter functional test is defined in 180.9.9 with the following exceptions:

—The transmitter under test is connected to the functional receiver by a test fiber which meets the requirements in 183.9.6.1. Other test fibers, including patch cords, may be used for additional tests.

where in 180.9.9.1

—The functional receiver (FRx) is a variable optical attenuator (VOA) followed by an optical receiver (ORx) that complies with characteristics as given in Table 183–7. VOA and the test fiber approximate compliance channel as given in Table 183–15.

where in Equation (180-29):

—Tx_DUT_power_budget is the transmitter under test power budget as given in Table 183-8, except uses measured instead of max TDECQ value as shown in Fig. 183-5, same as used in determining transmitter OMA (min) as given in Table 183-6, and is given by Equation (180–30).

—Test_fiber_power_budget is the test fiber power budget as given in Table 183-8, except uses best estimates of the test fiber channel insertion loss, MPI, DGD and TDECQ penalties instead of their max values, and is given by Equation (180–31).

183.9.9 Transmitter functional test

where in Equation (180–30)

—Channel_insertion_loss is “Channel insertion loss” as given in Table 183–8.

—MPI_DGD_penalty_allocation is “MPI DGD penalty allocation” as given in Table 183–8.

where in Equation (180–32)

—RxS_OMA@DUT_TECQ is the receiver sensitivity OMA (max) spec for TECQ >= 0.9 dB for 800GBASE-FR4 and TECQ >= 1.4 dB for 800GBASE-LR4, as shown in Figure 183-4, extrapolated to TECQ = 0 dB (-4.6 dBm for 800GBASE-FR4, -6.9 dBm for 800GBASE-LR4), at the TECQ measured for the transmitter under test.

where in 180.9.9.2

—The transmitter functional symbol error histogram mask per each 200G lane is given in Table 180–18 and is measured using the test pattern as given in Table 183–14.

183.9.1 Test patterns for optical parameters

Table 183–14—Mapping of parameters to test patterns and related subclauses

Parameter	Pattern	Related subclause
Transmitter functional test	8	183.9.9

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VOA_level Equation (180-28)

VOA_level = Test_fiber_correction + ORx_TECQ_correction - Test_margin

Test_fiber_correction normalizes differences in test fibers so that symbol error counts are repeatable across different conditions, and is determined by the same algebraic expressions as determine normative transmitter characteristics.

ORx_TECQ_correction normalizes differences in optical receivers so that symbol error counts are repeatable across different conditions, and is determined by the same algebraic expressions as determine normative receiver characteristics.

Test_margin is additional ORx_OMA, to improve SNR of transmitter under test measurement. It equals 1.5dB, which decreases the required ORx operating BER to 2.4×10^{-5}.

Tx_margin = Tx_DUT_OMA - Tx_OMA (min)

Test_fiber_correction using referenced Table 180-9

Test_fiber_correction = Tx_DUT_power_budget - Test_fiber_power_budget (180-29)

—Tx_DUT_power_budget, given by Equation (180–30), uses measured instead of max TDECQ value in link power budget below, same as used in determining transmitter OMA (min)

—Test_fiber_power_budget, given by Equation (180–31), uses best estimates of the test fiber channel insertion loss, MPI, DGD and TDECQ penalties instead of max values in link power budget below

Table 180–9—Illustrative link power budget

Parameter	Value	Unit
Power budget (for max TDECQ)	6.7	dB
Operating distance	500	m
Channel insertion loss[a, b]	3	dB
Maximum discrete reflectance	–35	dB
Allocation for penalties[c] (for max TDECQ)	3.7	dB
Additional insertion loss allowed	0	dB

Test_fiber_correction over range of conditions

Test_fiber_correction = Tx_DUT_power_budget - Test_fiber_power_budget (180-29)

CIL ≡ Channel Insertion Loss

- Tx_DUT_power_budget = CIL + MPI+DGD_penalty (max) + DUT_TDECQ

Ex1. Zero CIL & zero penalties test fiber (patch cord TECQ test condition)

- Test_fiber_power_budget = DUT_TECQ
- Test_fiber_correction = Tx_DUT_power_budget - DUT_TECQ

Ex2. Max CIL & max penalty values test fiber

- Test_fiber_power_budget = Tx_DUT_power_budget
- Test_fiber_correction = 0

  (positive Test_margin requires negative VOA_level, i.e. gain)

Ex3. Fraction α CIL (α < 1) & max penalty values test fiber (TDECQ test condition)

- Test_fiber_power_budget = α CIL + MPI+DGD_penalty (max) + DUT_TDECQ
- Test_fiber_correction = (1 - α) CIL

Test_fiber_correction using referenced Figure 180-5

Test_fiber_correction = Tx_DUT_power_budget - Test_fiber_power_budget (180-29)

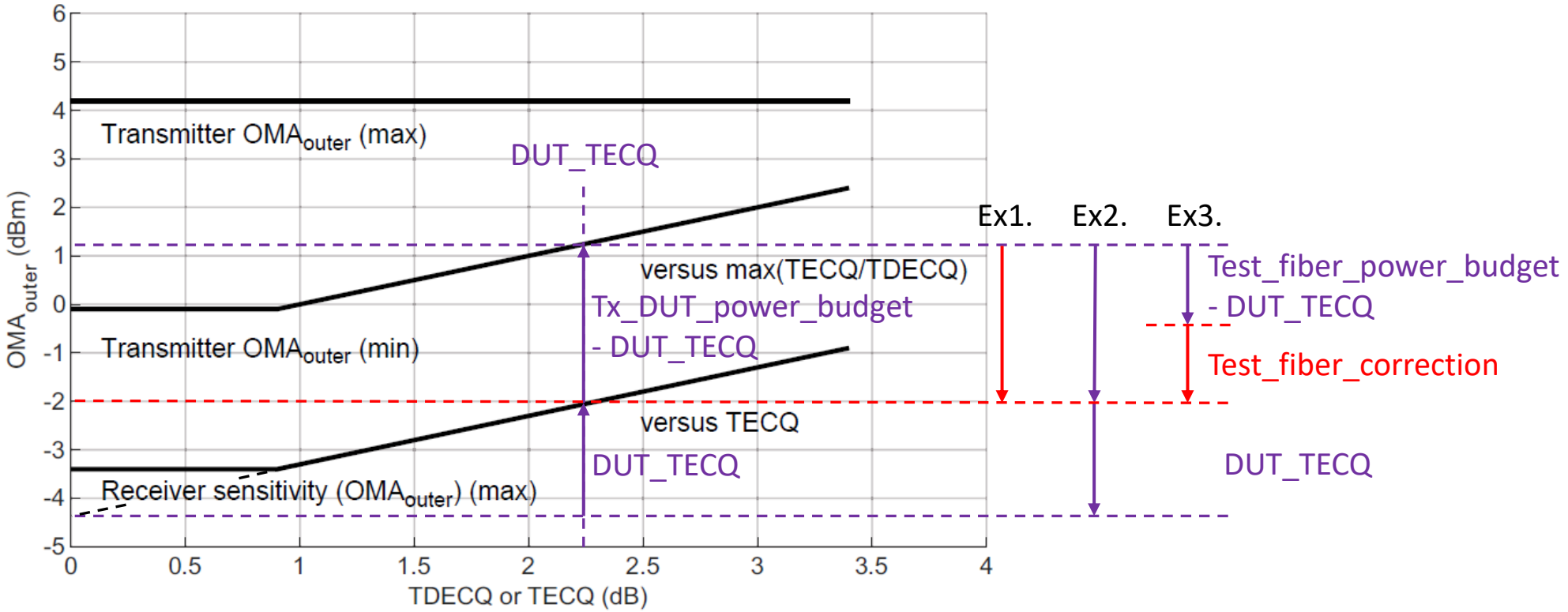

Figure 180–5—Transmitter OMA$_{outer}$ each lane versus max(TECQ, TDECQ) and receiver sensitivity (OMA$_{outer}$) each lane versus TECQ

ORx_TECQ_correction using referenced Figure 180-4

ORx_TECQ_correction = RxS_OMA@DUT_TECQ - ORx_RxS@DUT_TECQ (180–32)

—RxS_OMA@DUT_TECQ is the receiver sensitivity OMA (max) spec for TECQ >= 0.9 dB, extrapolated to TECQ = 0 dB (-4.3 dBm), at the TECQ measured for the transmitter under test

—ORx_RxS@DUT_TECQ is the actual ORx receiver sensitivity OMA at the TECQ measured for the transmitter under test

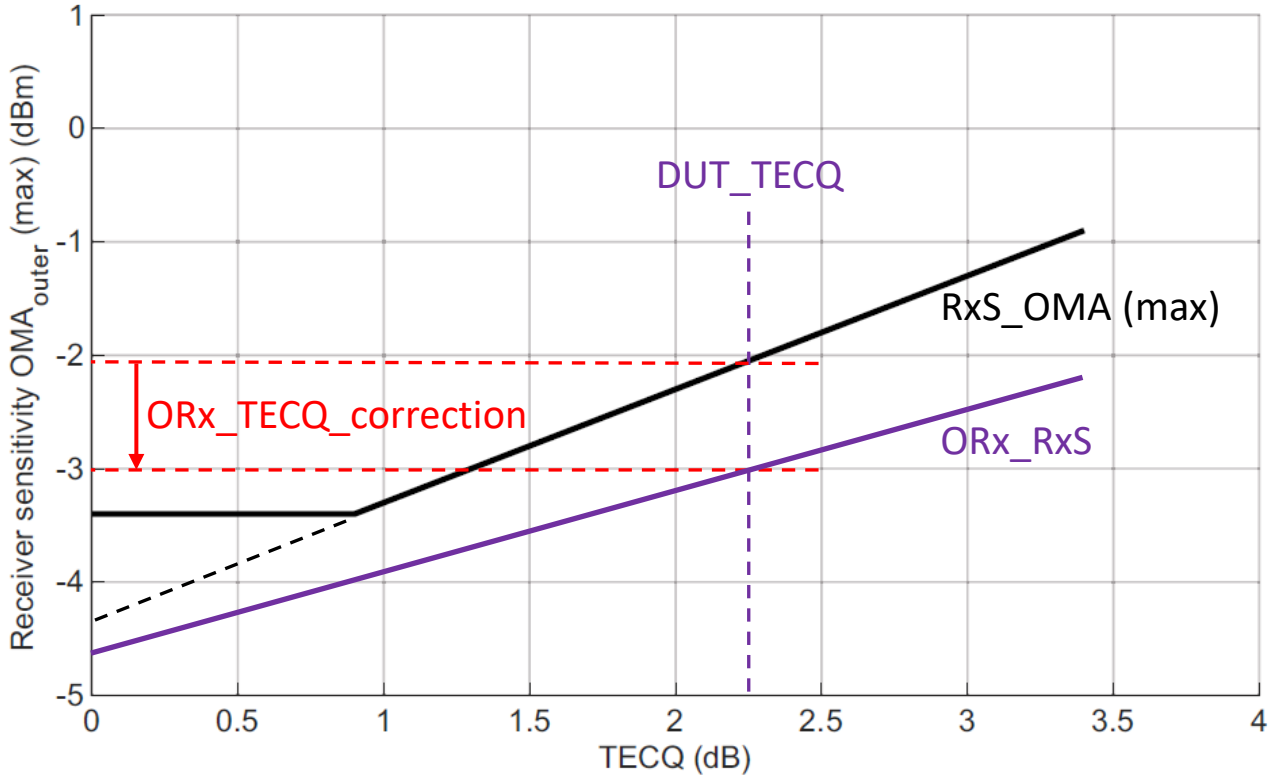

Figure 180–4—Receiver sensitivity (OMA$_{outer}$), each lane (max)

Test_margin of Transmitter Under Test

Test_margin is additional ORx_OMA, to improve SNR of transmitter under test measurement. It equals 1.5dB, which decreases the required ORx operating BER to 2.4×10^{-5}.

- Model: Tx_DUT → Channel → Rx
  - SNR_M ≡ SNR of transmitter under test measurement
  - ch_loss < 1 ≡ Channel loss (linear)
- SNR_M = Tx_DUT_Signal * ch_loss / (Tx_DUT_Noise * ch_loss + Rx_Noise)
  - SNR_M objective: SNR_M ≈ Tx_DUT_Signal / Tx_DUT_Noise → Tx_DUT_Noise * ch_loss > Rx_Noise
  - At receiver sensitivity: Tx_DUT_Noise * ch_loss < Rx_Noise
  - test_margin > 1 ≡ offset gain to reduce effect of ch_loss (linear)
- SNR_M = Tx_DUT_Signal * ch_loss * test_margin / (Tx_DUT_Noise * ch_loss * test_margin + Rx_Noise)
- Transmitter only test operating BER must be decreased from full link (PMD to PMD) BER = 2.28×10^{-4}
- Experimental validation
- Example of common SNR_M improvement: after fiber eye measurement
  - Tx_DUT → Fiber → Gain → DCA

VOA_level no Tx_margin using referenced Figure 180-5

VOA_level = Test_fiber_correction + ORx_TECQ_correction – Test_margin (180–28)

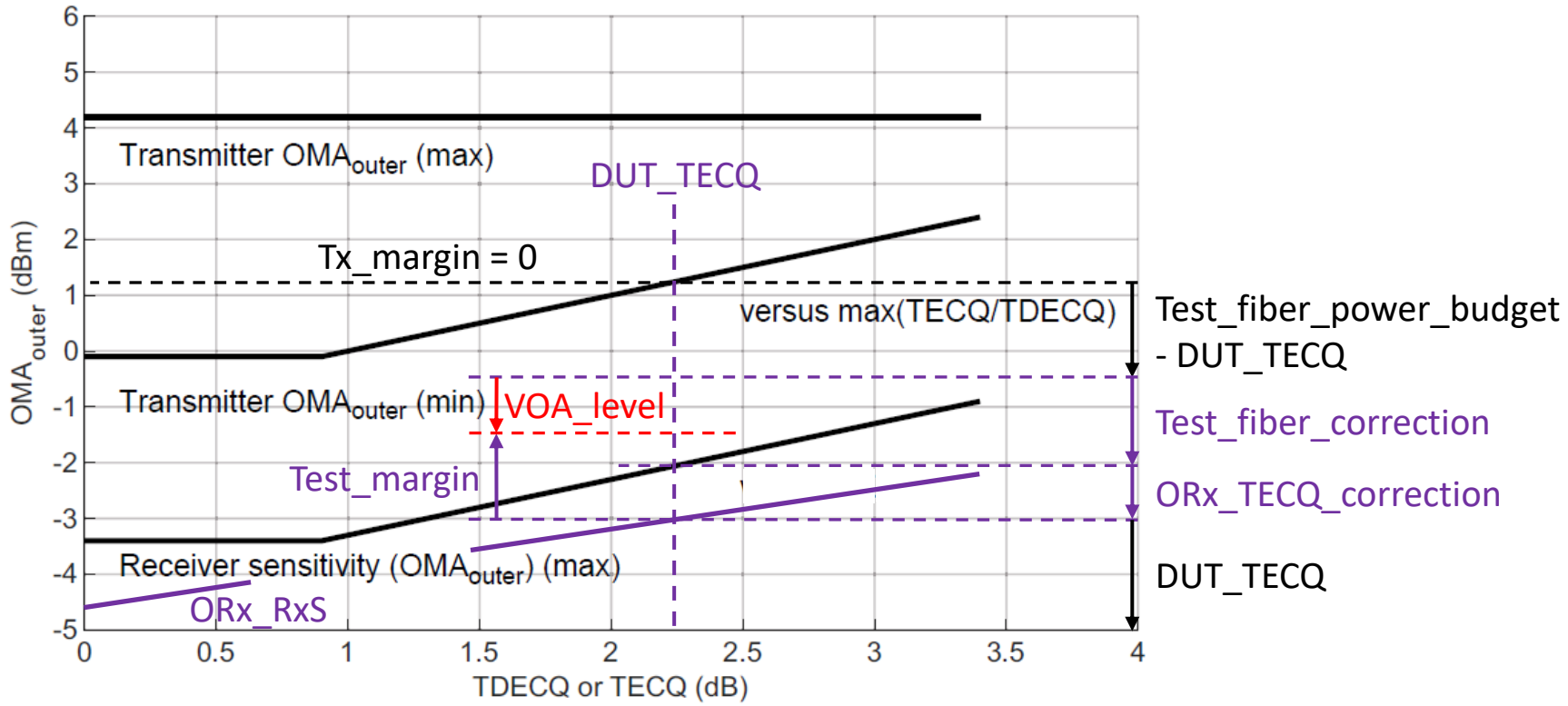

Figure 180–5—Transmitter OMA$_{outer}$ each lane versus max(TECQ, TDECQ) and receiver sensitivity (OMA$_{outer}$) each lane versus TECQ

VOA_level w/ Tx_margin using referenced Figure 180-5

VOA_level = Test_fiber_correction + ORx_TECQ_correction - Test_margin (180–28)

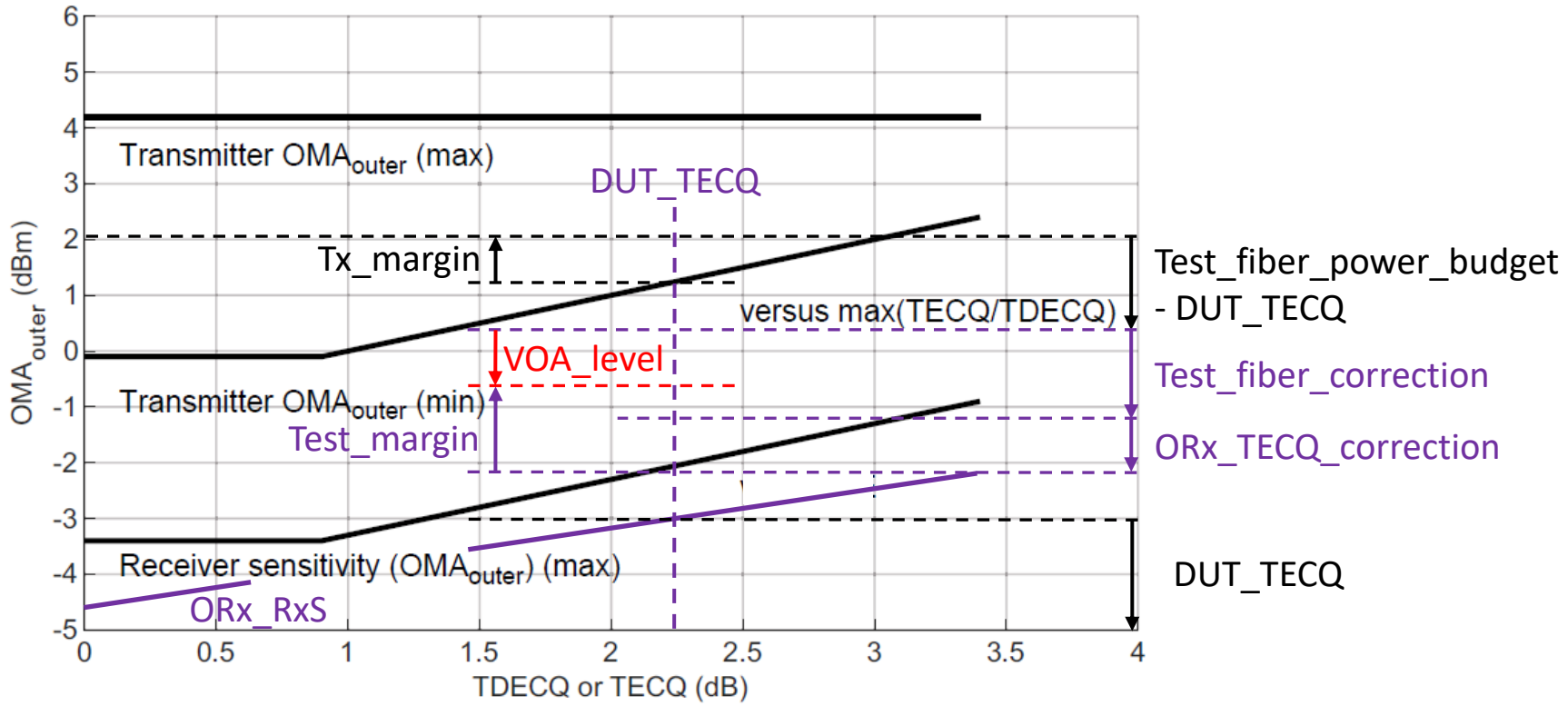

Figure 180–5—Transmitter OMA$_{outer}$ each lane versus max(TECQ, TDECQ) and receiver sensitivity (OMA$_{outer}$) each lane versus TECQ

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CL 181 FR4-500 Over-fiber & BtB Tests

CL 181		RxS_OMA(max)@TECQ=0 -4.1					Channel_insertion_loss 3.5			MPI+DGD_penalty_allocation 0.6			Tx_OMA(min)@TECQ=0 0.0				
Case		Tx_DUT (per Table 181-5)					Test_SMF (per Table 181-7)						FRx (per 181.9.7)				
No.	Test_SMF actual DUT_CD	TECQ	TDECQ	max(TECQ, TDECQ)	margin	OMA dBm	actual			estimated			ORx_RxS @DUT _TECQ	Test _margin	VOA _level	ORx _OMA dBm	Test _margin _error
							loss	MPI+DGD	TDECQ	loss	MPI+DGD	TDECQ					
1	max pos penalty	2.0	3.0	3.0	1.0	4.0	3.5	0.6	3.0	3.5	0.6	3.0	-2.1	1.5	-1.5	2.0	0.0
2		2.0	3.0	3.0	0.0	3.0	3.5	0.6	3.0	3.5	0.6	3.0	-2.1	1.5	-1.5	1.0	0.0
3		2.0	3.0	3.0	1.0	4.0	2.0	0.3	3.0	2.0	0.3	3.0	-2.1	1.5	0.3	1.7	0.0
4	typ. pos	2.0	3.0	3.0	0.0	3.0	2.0	0.3	2.7	2.0	0.3	2.7	-2.1	1.2	0.9	0.1	0.0
5	0 penalty	2.0	3.0	3.0	0.0	3.0	0.0	0.0	2.0	0.0	0.0	2.0	-2.1	1.5	3.6	-0.6	0.0
6		2.0	2.0	2.0	1.0	3.0	0.0	0.0	2.0	0.0	0.0	2.0	-2.1	1.5	2.6	0.4	0.0
7		3.0	2.0	3.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	-1.1	1.5	2.6	0.4	0.0
8	min neg penalty	3.0	2.0	3.0	1.0	4.0	2.0	0.3	2.0	2.0	0.3	2.0	-1.1	1.5	1.3	0.7	0.0
9		3.0	2.0	3.0	0.0	3.0	3.5	0.6	2.0	3.5	0.6	2.0	-1.1	1.5	-0.5	0.0	0.0
10		3.0	2.0	3.0	1.0	4.0	3.5	0.6	2.0	3.5	0.6	2.0	-1.1	1.5	-0.5	1.0	0.0

Test_margin_error = (ORx_OMA = Tx_DUT_OMA - Test_SMF_actual_loss - VOA_level) - (ORx_RxS@TECQ=0 + Test_SMF_actual_MPI+DGD_penalty + TDECQ + Tx_margin + Test_margin)

CL 183 LR4 Over-fiber & BtB Tests

CL 183		RxS_OMA(max)@TECQ=0 -6.9					Channel_insertion_loss 6.3			MPI+DGD_penalty_allocation 1.1			Tx_OMA(min)@TECQ=0 0.5				
Case		Tx_DUT (per Table 183-5)					Test_SMF (per Table 183-7)						FRx (per 183.9.7)				
No.	Test_SMF actual DUT_CD	TECQ	TDECQ	max(TECQ, TDECQ)	margin	OMA dBm	actual			estimated			ORx_RxS @DUT _TECQ	Test _margin	VOA _level	ORx _OMA dBm	Test _margin _error
							loss	MPI+DGD	TDECQ	loss	MPI+DGD	TDECQ					
1	max pos penalty	2.0	3.5	3.5	1.0	5.0	6.3	1.1	3.5	6.3	1.1	3.5	-4.9	1.5	-1.5	0.2	0.0
2		2.0	3.5	3.5	0.0	4.0	6.3	1.1	3.5	6.3	1.1	3.5	-4.9	1.5	-1.5	-0.8	0.0
3		2.0	3.5	3.5	0.0	4.0	5.3	0.5	3.5	5.3	0.5	3.5	-4.9	1.5	0.1	-1.4	0.0
4		2.0	**5.5**	5.5	1.0	7.0	5.3	0.5	3.5	5.3	0.5	**5.5**	-4.9	1.5	0.1	1.6	**2.0**
5		2.0	**3.5**	3.5	1.0	5.0	5.3	0.5	3.5	5.3	0.5	**3.5**	-4.9	1.5	0.1	-0.4	**0.0**
6	typ. pos	2.0	3.5	3.5	1.0	5.0	5.3	0.5	3.0	5.3	0.5	3.0	-4.9	0.5	1.6	-1.9	0.0
7	0 penalty	2.0	3.5	3.5	0.0	4.0	0.0	0.0	2.0	0.0	0.0	2.0	-4.9	1.5	7.4	-3.4	0.0
8		2.0	2.5	2.5	0.0	3.0	0.0	0.0	2.0	0.0	0.0	2.0	-4.9	1.5	6.4	-3.4	0.0
9		**1.0**	1.5	1.5	1.0	3.0	0.0	0.0	2.0	0.0	0.0	1.0	**-5.9**	1.5	6.4	-3.4	**-1.0**
10		**2.0**	2.5	2.5	1.0	4.0	0.0	0.0	2.0	0.0	0.0	2.0	**-4.9**	1.5	6.4	-2.4	**0.0**

Test_margin_error = (ORx_OMA = Tx_DUT_OMA - Test_SMF_actual_loss - VOA_level) - (ORx_RxS@TECQ=0 + Test_SMF_actual_MPI+DGD_penalty + TDECQ + Tx_margin + Test_margin)

Outline

- Introduction
- Proposed Text
- Calculation examples
- TFT examples

➢ RxS Conformance Test Signal

- Appendix: VOA_level Equation Change

Incomplete RxS Conformance Test Signal Spec in 180.9.15

The receiver sensitivity (OMA_{outer}) of each lane shall be within the limits given in Table 180–8 if measured using a test pattern for receiver sensitivity in Table 180–14. The conformance test signal at TP3 meets the requirements for a transmitter followed by an attenuator.

The TECQ of the conformance test signal is measured according to 180.9.6, except that the test fiber is not used. The measured value of TECQ is then used to calculate the limit for receiver sensitivity (OMA_{outer}) as specified in Table 180–8.

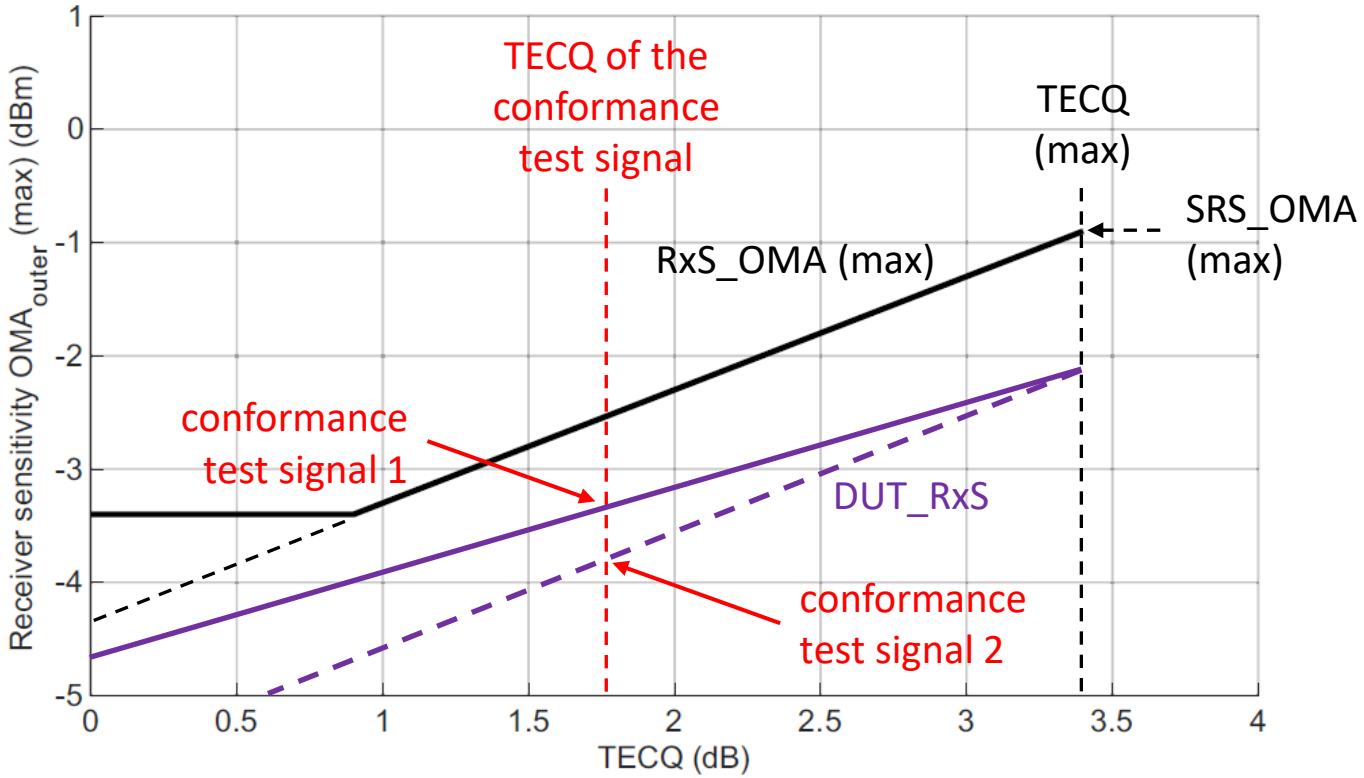

Figure 180–4—Receiver sensitivity (OMA_{outer}), each lane (max)

180.9.15 RxS Spec Proposed Remedy

180.9.15 Receiver sensitivity

The receiver sensitivity (OMA_{outer}) of each lane shall be within the limits given in Table 180–8 if measured using a test pattern for receiver sensitivity in Table 180–14. ~~The conformance test signal at TP3 meets the requirements for a transmitter followed by an attenuator.~~

The conformance test signals at TP3 are at least three sperate signals, as specified in 180.9.16: 1) with no changes, 2) with the Gaussian noise generator and sinusoidal interferer turned off, and sinusoidal jitter on, and 3) with the Gaussian noise generator, sinusoidal interferer and sinusoidal jitter turned off.

Remedy to comments: 15, 16, 17, 18, 117, 119, 121, 123

The stressed receiver sensitivity conformance test signal, specified in 180.9.16, will benefit from complete review. Any changes will benefit the proposed receiver sensitivity conformance test signal.

Ex. Proposed RxS Conformance Test Signal at TP3

Proposed RxS Conformance Test Signal at TP3 specified in 180.9.16 except			
TECQ	Gaussian noise generator	sinusoidal interferer	sinusoidal jitter
max	on	on	on
mid	off	off	on
low	off	off	off

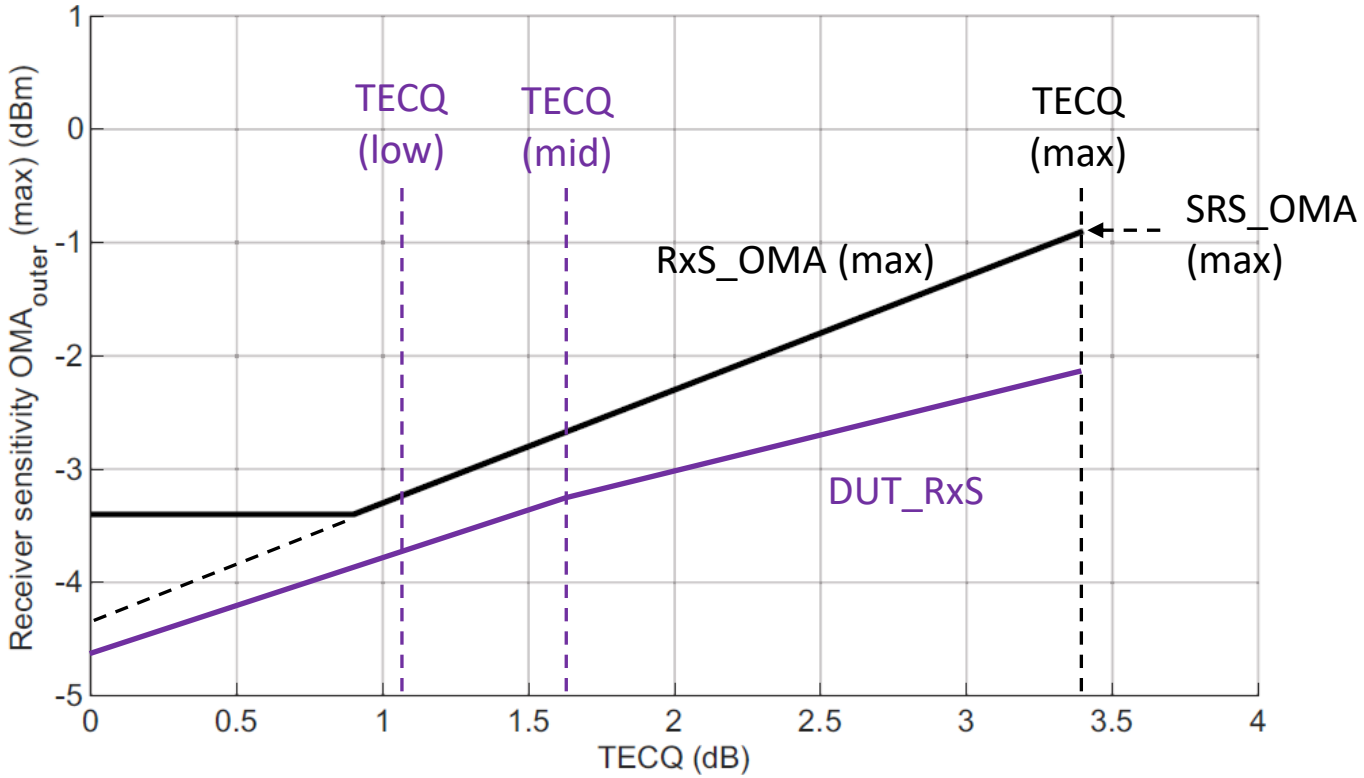

Figure 180–4—Receiver sensitivity (OMA$_{outer}$), each lane (max)

Outline

- Introduction
- Proposed Text
- Calculation examples
- TFT examples
- RxS Conformance Test Signal

➢Appendix: VOA_level Equation Change

TFT VOA_level Equation D2.3 → This Proposal

- 3rd proposal (D2.3), 9/25: test-fiber TFT spec (→ max(DUT_TECQ, DUT_TDECQ))
- VOA_level = Tx_DUT_power_budget – Test_fiber_power_budget – ORx_TECQ_allocation
- – Test_margin (180–28)
- Tx_DUT_power_budget = Channel_insertion_loss + MPI_DGD_penalty_allocation
- + max(DUT_TDECQ, DUT_TECQ) (180–29)
- Test_fiber_power_budget = Test_fiber_loss + Test_fiber_MPI+DGD_penalty + Test_fiber_DUT_CD (180–30)
- ORx_TECQ_allocation = ORx_RxS@DUT_TECQ – RxS_OMA@TECQ=0 (180–31)
- Test_fiber_power_budget + ORx_TECQ_allocation = Test_fiber_loss + Test_fiber_MPI+DGD_penalty + Test_fiber_DUT_CD + ORx_RxS@DUT_TECQ – RxS_OMA@TECQ=0
  = Test_fiber_loss + Test_fiber_MPI+DGD_penalty + (Test_fiber_DUT_CD + DUT_TECQ)
  + ORx_RxS@DUT_TECQ – (RxS_OMA@TECQ=0 + DUT_TECQ)

TFT VOA_level Equation D2.3 → This Proposal, cont.

- Test_fiber_power_budget + ORx_TECQ_allocation = Test_fiber_loss + Test_fiber_MPI+DGD_penalty + (Test_fiber_DUT_CD + DUT_TECQ) + ORx_RxS@DUT_TECQ – (RxS_OMA@TECQ=0 + DUT_TECQ)
  = Test_fiber_loss + Test_fiber_MPI+DGD_penalty + (Test_fiber_DUT_TDECQ)
  + ORx_RxS@DUT_TECQ – RxS_OMA@DUT_TECQ
- 4th (this) proposal: back to 2nd proposal except uses max(DUT_TECQ, DUT_TDECQ)
- VOA_level = Test_fiber_correction + ORx_TECQ_correction – Test_margin (180–28)
- Test_fiber_correction = Tx_DUT_power_budget – Test_fiber_power_budget (180-29)
- Tx_DUT_power_budget = Channel_insertion_loss + MPI_DGD_penalty_allocation + max(DUT_TECQ, DUT_TDECQ) (180–30)
- Test_fiber_power_budget
  = Test_fiber_loss + Test_fiber_MPI+DGD_penalty + Test_fiber_DUT_TDECQ (180–31)
- ORx_TECQ_correction
  = RxS_OMA@DUT_TECQ – ORx_RxS@DUT_TECQ (180–32)

Transmitter Functional Test Updated Proposal

Thank you