



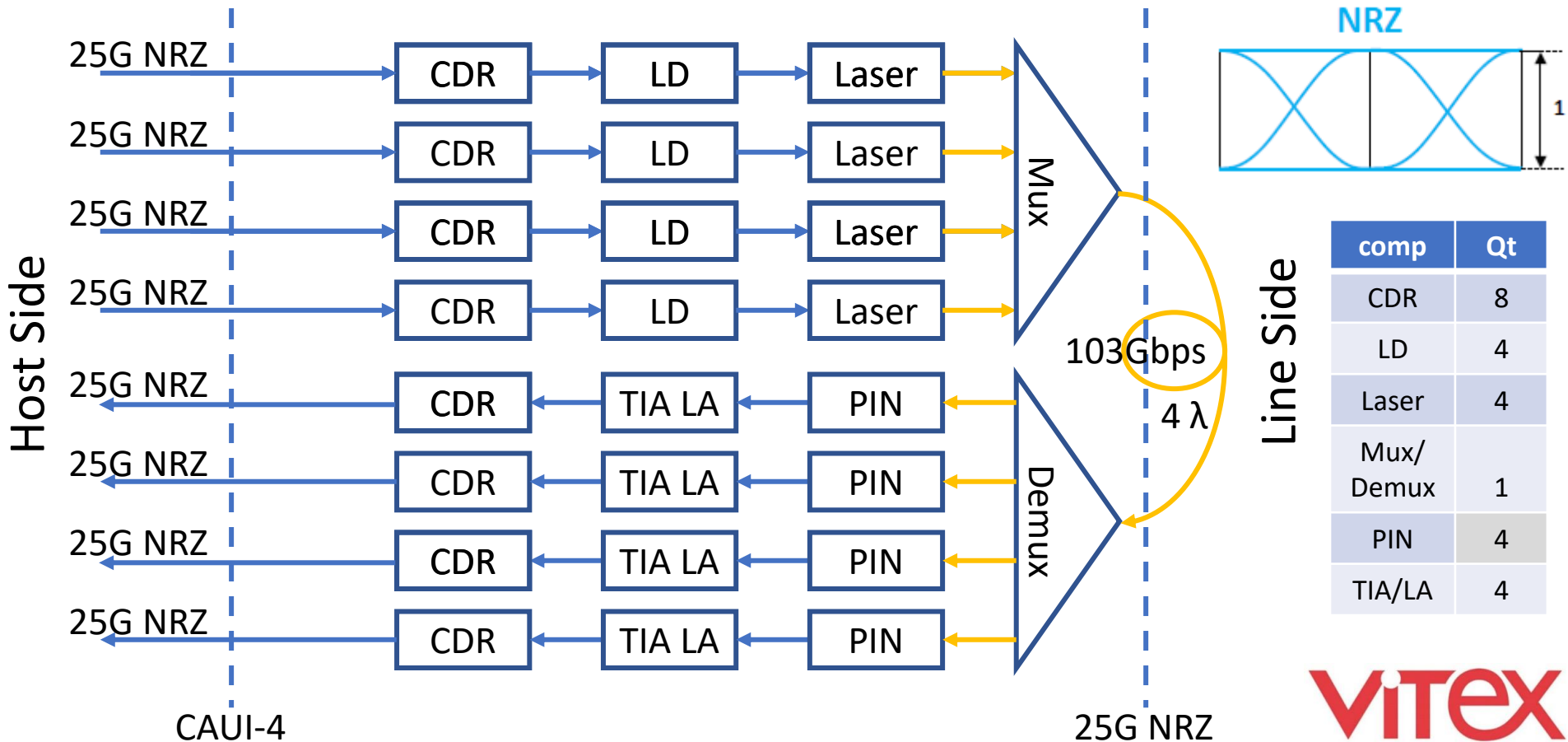
100G Single Lambda Transceivers

1. What is a 100G Single Lambda Transceiver (1- λ Trx)?
2. What are its Performances and Functions ?
3. What are the things to watch for in operating the 1- λ Trx?

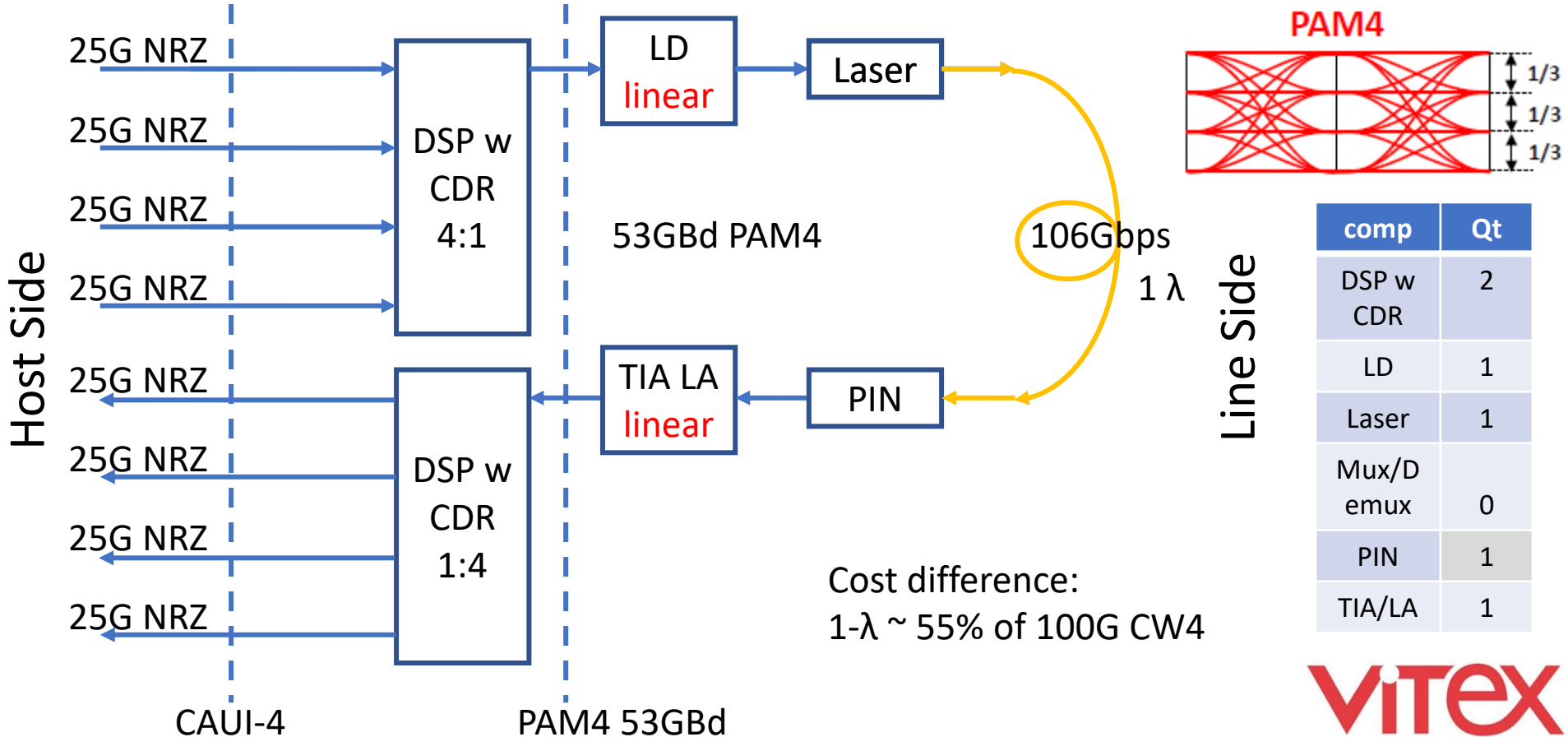
What is a 1- λ Trx?

- 1- λ Trx comes as DR1/FR1/LR1 in a QSFP28 housing and can reach over up to 500m/2km/10km SMF respectively.
- Hot Pluggable 38-pin electrical interface and duplex-LC optical interface.
- Host side signal => 4x25Gbps NRZ.
- Line side signal => 100Gbps PAM4
- Power class = 6 (4.5W) (SFF-8679)
- Tx and Rx Performance spec => 100G-FR Technical Specification Rev 2.0

A typical 100G QSFP28-CWDM4 Trx

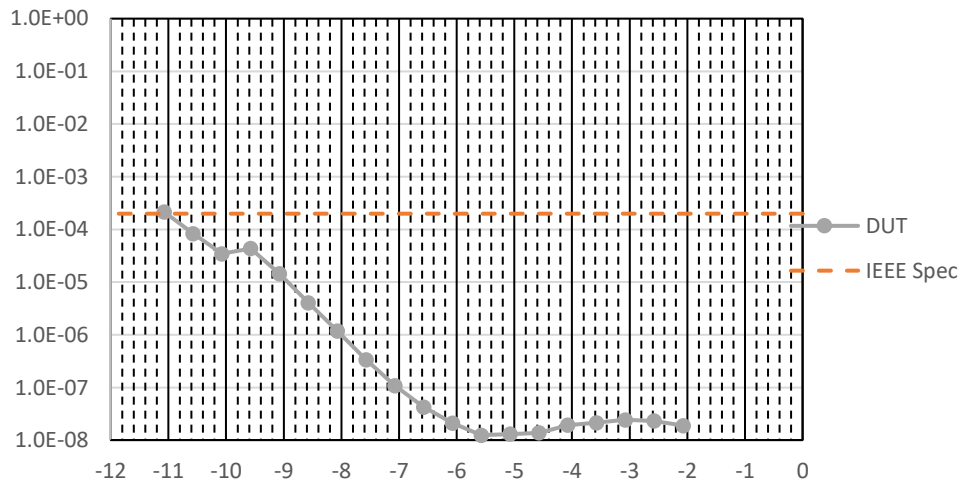


An 1- λ Trx



1-λ Trx Functions & Performances

100G DR1 OMA-BER Curve
OutER = 5.2dB with PRBS31Q



PAM4 is not error-free due to the lower S/N of $20\log(1/3) \Rightarrow -9.5\text{dB}$

It should be noticed that the IEEE spec for BER is $\leq 2e-4$, and after the utilization of KP4-FEC in the DSP, the BER $\leq 1e-15$.

Major spec changes:

Tx: TDP -> TDECQ (3.5dB max)

RLM (0-1) PAM4 vertical linearity

Rx: Sensitivity -> Sensitivity Mask

- PRBS31Q BER Performance, Pre-FEC

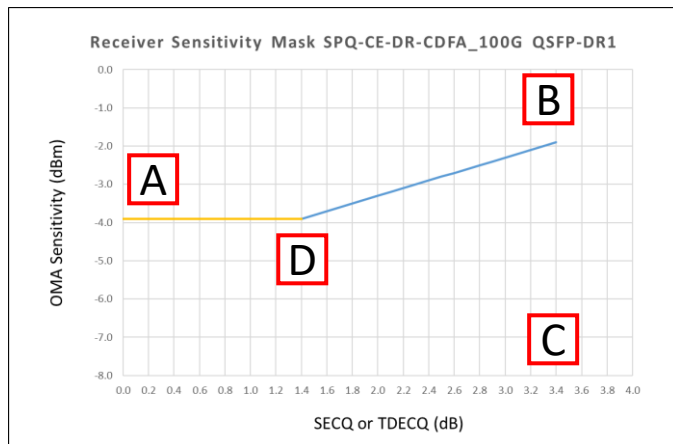
A typical DS of 1-λ DR1 Trx

Table 3 – Transmitter Optical Specifications

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Wavelength	λ_c	1304.5	1311	1317.5	nm	
Side mode suppression ratio	SMSR	30	-	-	dB	
Average Optical Launch Power	P_{OUT}	-2.9	-	4	dBm	
Average Launch Power Tx_Off	P_{OUT_OFF}	-	-	-15	dBm	
Extinction Ratio	ER	3.5	-	-	dB	
Outer Optical Modulation Amplitude	OMA_{outer}	-0.8	-	4.2	dBm	
Launch Power in OMA_{outer} minus TDECQ for ER ≥ 5 dB	$OMA_{outer} - TDECQ$	-2.2	-	-	dBm	
Launch Power in OMA_{outer} minus TDECQ for ER < 5 dB	$OMA_{outer} - TDECQ$	-1.9	-	-	dBm	
Transmitter and dispersion eye closure	TDECQ	-	-	3.4	dB	
TDECQ-10log ₁₀ (C _{eq})		-	-	3.4	dB	
Transmitter transition time	T_{Tx}	-	-	17	ps	
RIN _{15.5} OMA	RIN	-	-	-136	dB/Hz	
Optical return loss tolerance	ORLT	-	-	15.5	dB	
Transmitter reflectance	TR	-	-	-26	dB	

Table 4 – Receiver Optical Specifications

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Wavelength	λ_c	1304.5	1311	1317.5	nm	
Damage Threshold		5	-	-	dBm	
Average receive power		-5.9	-	4	dBm	
Receive power (OMA_{outer})	RP	-	-	4.2	dBm	
Receiver reflectance	RR	-	-	-26	dB	
Receiver sensitivity (OMA_{outer})	RS	max(-3.9, SECQ-5.3)			dBm	
Stressed receiver sensitivity	SRS	-	-	-1.9	dBm	
Stressed Receiver Sensitivity Test Conditions:						
Stressed eye closure for PAM4 (SECQ)	SECQ	-	-	3.4	dB	
SECQ-10log ₁₀ (C _{eq})	-	-	-	3.4	dB	



To Generate the Sensitivity Mask

- A. max Sensitivity = -3.9dBm
- B. min Sensitivity = SECQ - 5.3dBm = 3.4dB - 5.3dBm = -1.9dBm
- C. max SECQ/TDECQ = 3.4dB
- D. intercept at 3.4dB - 2dB = 1.4dB

1-λ Trx Controls

Mode #	Description	Host Kp4-FEC	Line Kp4-FEC	Host test Pattern	Line test Pattern
00	Mission	Disabled	Enabled		
01	Mission	Enabled	Enabled		
02	Mission	Enabled	Disabled		
03	Mission	Disabled	Disabled		
04	Test Pattern			PRBS31Q	PRBS31Q
05	Test Pattern			SSPRQ	SSPRQ

Traffic

PRBS

Under normal traffic operation (Mission Mode), DSP debug mode provides user the ability to trouble shoot which is included in page 13h and 14h of QSFP-DD-CMIS 4.0.

1- λ Trx Controls

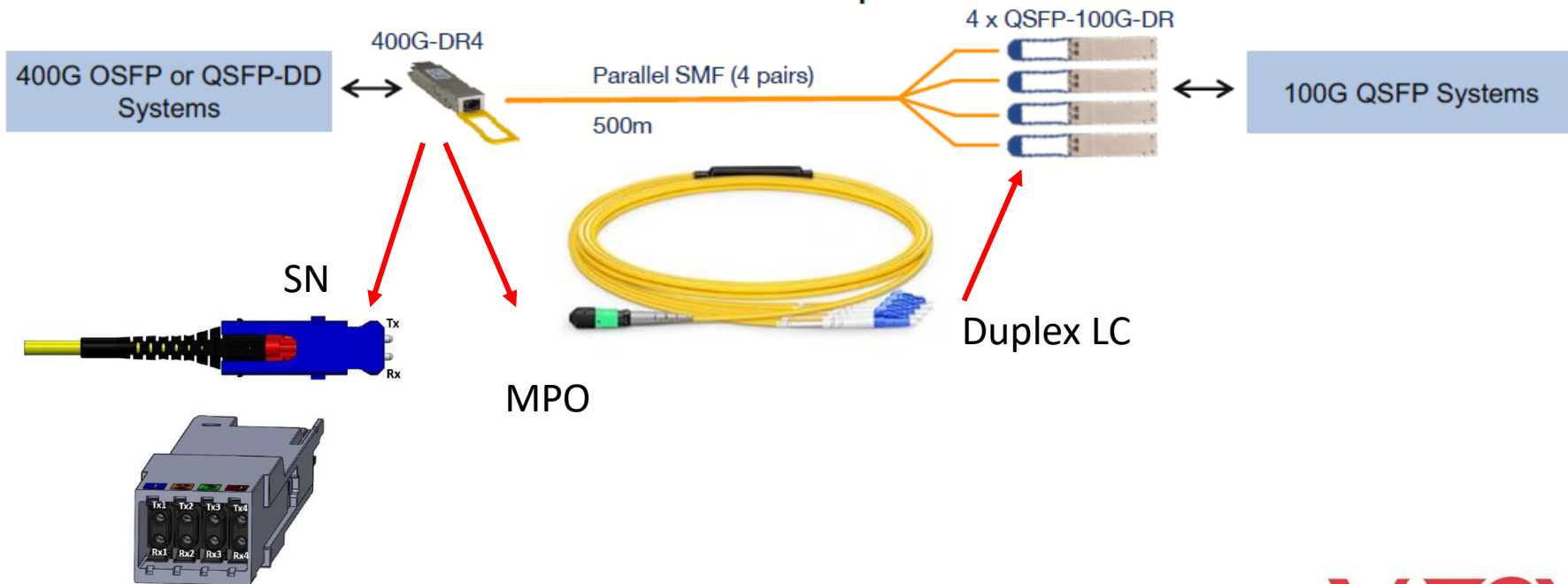
The most frequent mistake in operating the 1- λ transceivers is to have FEC on the host side.

In the extended ID field A0(00).192, which is defined in SFF-8024, identifies the Extended Specification Compliance Code for the transceiver:

- A0(0).0xC0=25h 100GBASE-DR1, CAUI-4 (no FEC)
- A0(0).0xC0=26h 100GBASE-FR1, CAUI-4 (no FEC)
- A0(0).0xC0=27h 100GBASE-LR1, CAUI-4 (no FEC)

From 400G QSFPDD to 1-λ Trx using SN connectors

400G to 100G QSFP28 Breakout Options



Questions?

Thank You!

Contact us

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