

# Scaling 100G SR4

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# Presentation Outline & Conclusion

Outline: Link model for 100 SR4 examined for consequences of changing BER and signal rate

Conclusion: With the modest assumptions:

- retimer jitter generation and tolerance scale (constant UI) with signal rate
- Rx sensitivity scales inversely with signal rate for fixed Rx BW and input noise,

A 100G SR4 transceiver can support the higher signal rate and BER associated with RS(544,514) FEC.

## Link Model References

[http://www.ieee802.org/3/bm/public/may13/petrilla\\_04\\_0513\\_optx.pdf](http://www.ieee802.org/3/bm/public/may13/petrilla_04_0513_optx.pdf)

<http://www.ieee802.org/3/bm/public/may13/ExampleMMF%20LinkModel%20%20130503.xlsx>

# Fiber Optic Links Interfaces

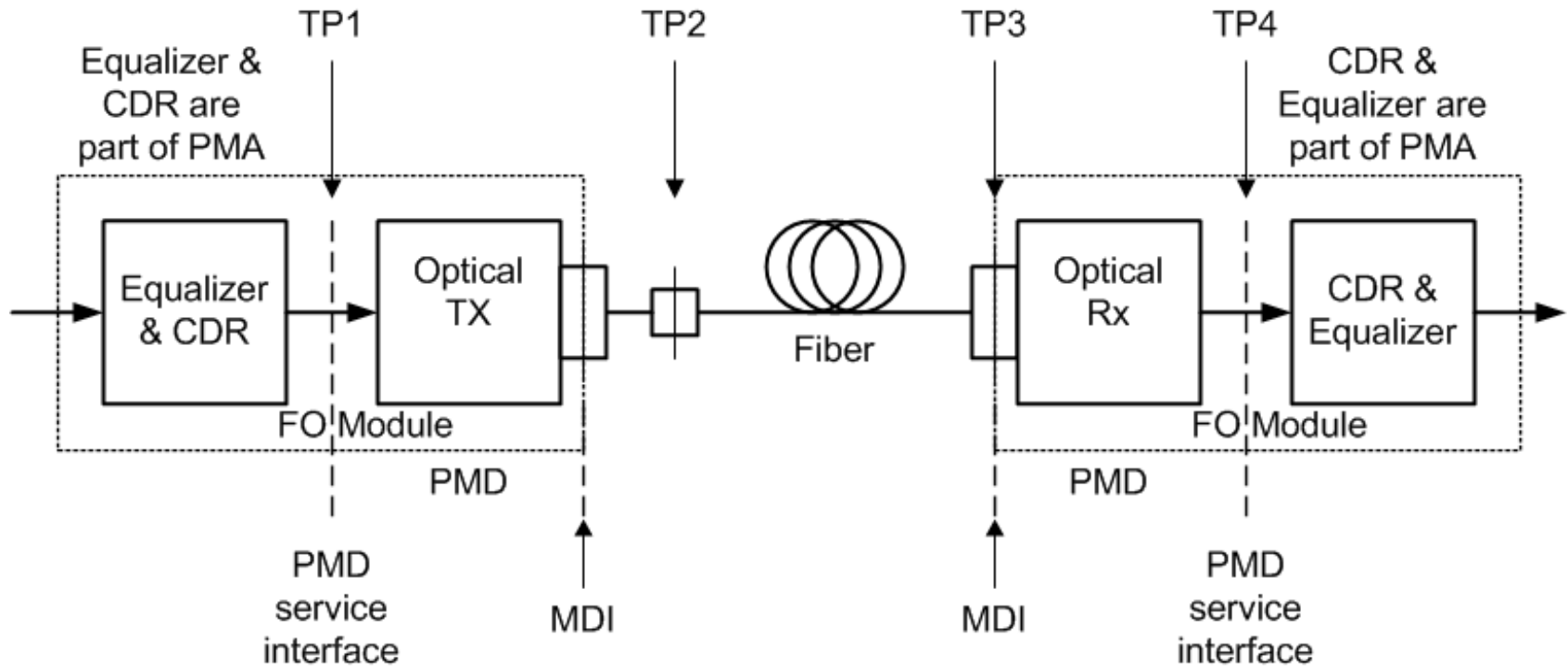


Figure 1

- For cases, as shown above in Figure 1, where retimers are embedded in the optical module, the PMD service interface is not exposed. TP1 and TP4 remain as points on the PMD service interface and, consequently, not exposed.
- The high speed signal inputs and outputs of these optical modules are expected to be defined by CDAUI-16.

# 100G SR4 – 400G SR16 Link Model Comparison: Channel Attributes

Parameter	Unit	100G SR4	400G SR16	
Signal rate	GBd	25.78125	26.5625	[1]
Q (BER)		3.8905 (5.0E-5)	3.5401 (2.0E-4)	[2]
Reach	m	100	100	
Fiber Attenuation	dB/km	3.5	3.5	At 850 nm center wavelength
Dispersion min Uo	nm	1316	1316	
Dispersion So	ps/nm <sup>2</sup> km	0.10275	0.10275	
Fiber modal bandwidth at 840 nm CWL	MHz·km	4400	4400	
Reflection Noise Factor		0	0	
Pisi Central	dB	3.16	3.42	Model output
Signal power budget	dB	8.20	8.48	Model output
Connector & splice loss allocation	dB	1.50	1.50	
Fiber Insertion loss	dB	0.36	0.36	Model output
Link power penalties (includes Peye)	dB	6.34	6.63	Model output
Modal Noise Penalty	dB	0.129	0.116	Scaled with Q <sup>2</sup>
Link Margin	dB	0	-0.01	Model output
Additional insertion loss allowed	dB	0	0	Model output

[1] Higher signal rate for RS(544, 514) FEC;  $544/514 * 257/256 * 25G = 26.5625G$ , see gustlin\_3bs\_02a\_0315

[2] 100G SR4 uses RS(528, 514) FEC that corrects 5E-5 BER (random errors) to 1E-12 BER, 100% errors allocated to the optical segment. 400G SR16 uses RS(544, 514) FEC that corrects 3.2E-4 BER (random errors) to 1E-13 BER, 62.5% errors allocated to the optical segment.

# 100G SR4 – 400G SR16 Link Model Comparison: Tx Attributes

Parameter	Unit	100G SR4	400G SR16	
Signal rate	GBd	25.78125	26.5625	
Q (BER)		3.8905 (5.0E-5)	3.5401 (2.0E-4)	
Center Wavelength, min	nm	840	840	
Spectral Width, max	nm	0.60	0.60	
OMA, min	dBm	-3.0	-3.0	
Extinction ratio, min	dB	3.0	3.0	
Tx output transition times, 20% -80%, max	ps	21	21	
RIN <sub>12</sub> OMA, max	dB/Hz	-128	-128	
RIN coefficient		0.7	0.7	
MPN coefficient		0.3	0.3	
Tx reflectance, max	dB	-12	-12	
Tx optical return loss tolerance, max	dB	12	12	
Tx & dispersion eye closure (TDEC), max	dB	4.3	4.5	TDEC(M1=M2=0)=4.21 dB

TDEC increases for 400G SR16 due to the shorter bit times leading to larger Pisi penalties, only partly compensated by the higher BER.

# 100G SR4 – 400G SR16 Link Model Comparison: Rx Attributes

Parameter	Unit	100G SR4	400G SR16	
Signal rate	GBd	25.78125	26.5625	
Q (BER)		3.8905 (5.0E-5)	3.5401 (2.0E-4)	
Center Wavelength, min	nm	840	840	
Rx sensitivity (OMA), max	dBm	-11.2	-11.48	Scales with Log(Q), Log(Signal Rate) & Log(Rx BW)
Rx Bandwidth, min	MHz	18,047	18,047	
RMS base line wander coefficient		0.025	0.025	
Rx reflectance, max	dB	-12	-12	
Rx stressed sensitivity	db	-5.16	-5.16	
Rx stressed eye closure (SEC), max	dB	4.3	4.5	Tracks change in TDEC

# 100G SR4 – 400G SR16 Link Model Comparison: Jitter Attributes

Parameter	Unit	100G SR4	400G SR16	
Signal rate	GBd	25.78125	26.5625	
Q (BER)		3.8905 (5.0E-5)	3.5401 (2.0E-4)	
TP1 RJrms tolerance, min	UI	0.0079	0.0079	Scales with signal rate; constant UI
TP1 DJ tolerance, min	UI	0.11	0.11	Scales with signal rate; constant UI
TP3 DCD tolerance, min	UI	0.05	0.05	Scales with signal rate; constant UI
TP3 DJ tolerance, min	UI	0.247	0.251	Tx & Rx DJ allocations fixed in ps
Cum DJ at TP4	UI	0.328	0.335	Tx & Rx DJ allocations fixed in ps
TP4 TJ at BER, max	UI	0.780	0.780	Forced model output