Optical Tolerance Return Loss with APC MDIs and PC Connections: In support of comment 9 on D1.2

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Overview

- Investigate the impact of having APC MDI on link return loss when PC connections are present in the cable plant
- This scenario covers brown-field upgrade to transceivers with APC MDIs
- A hybrid APC-PC cable would be used to connect the transceivers with APC MDIs to the rest of the cable plant with PC connectors

Link return loss impacts two specifications

Table 167-7-Transmit Characteristics

Transmitter eye closure for PAM4 (TECQ), each lane (max)	4.4		dB
Overshoot/undershoot (max)	TBD	TBD	%
Transmitter excursion, each lane (max)	2		dBm
Extinction ratio, each lane (min)	2.5		dB
Transmitter transition time, each lane (max)	17		ps
Average launch power of OFF transmitter, each lane (max)	–30		dBm
$RIN_{12}OMA$ (max)	–131		dB/Hz
Optical return loss tolerance (max)	12		dB
Encircled flux[c]	≥ 86% at 19 µm ≤ 30% at 4.5 µm		—

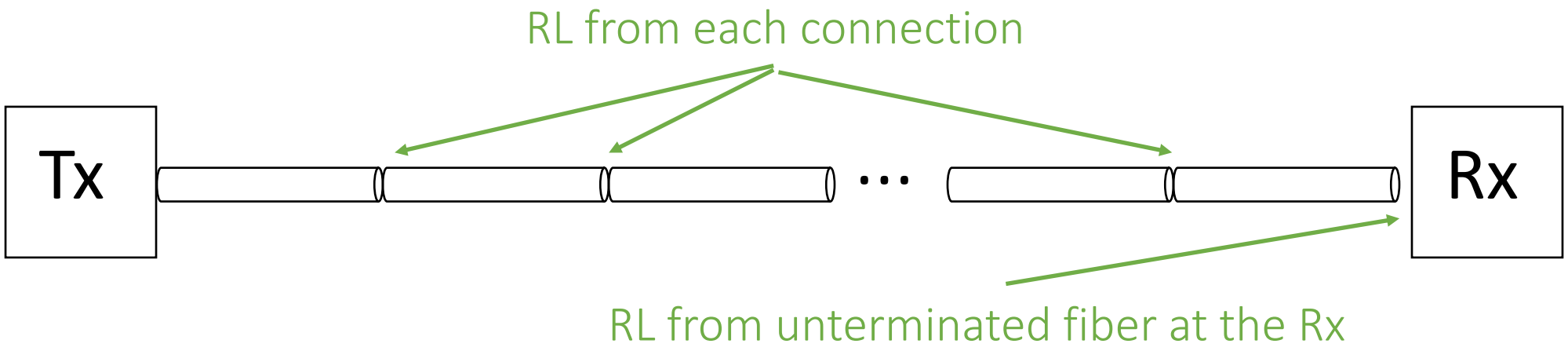
[a]RMS spectral width is the standard deviation of the spectrum.
[b]*Editors' note: The value of TDECQ(max) for SR and VR links is under study, with a value as low as 4.0 dB under consideration.*
[c]If measured into type A1a.2 or type A1a.3, or A1a.4, 50 µm fiber, in accordance with IEC 61280-1-4.

Table 168-8-Receive Characteristics

Average receive power, each lane[c] (min)	–6.3	-6.4	dBm
Receive power, each lane (OMA_{outer}) (max)	3.5		dBm
Receiver reflectance (max)	–12		dB
Stressed receiver sensitivity (OMA_{outer}), each lane[c] (max)	-1.8	-2.0	dBm
Receiver sensitivity (OMA_{outer}), each lane (max) for TECQ ≤ 1.8 dB for 1.8 < TECQ ≤ 4.4 dB	 -4.4 -6.2 + TECQ	 -4.6 -6.4 + TECQ	 dBm dBm
Conditions of stressed receiver sensitivity test:[d]			

This contribution focuses on optical return loss tolerance

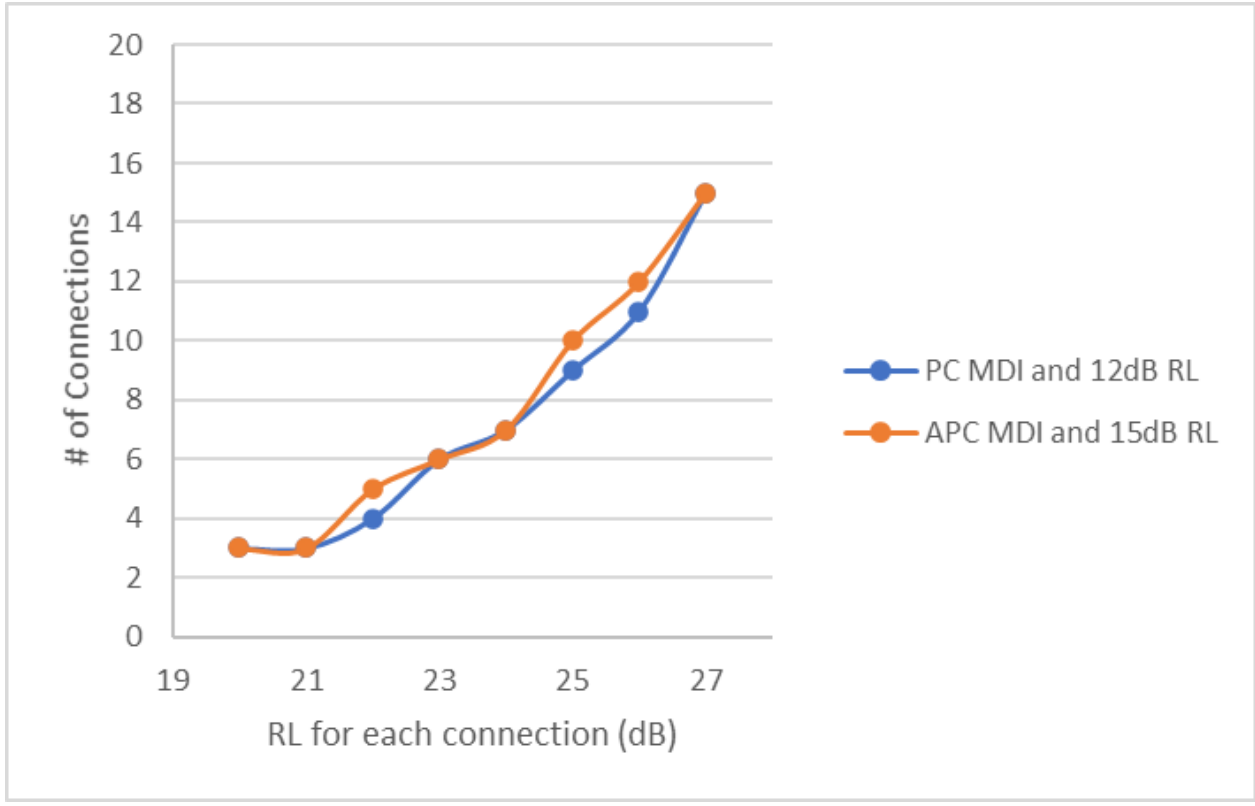
Model the cumulative RL in a link with PC connectors



- Simple model with two sources of RL
  - From each fiber connection
  - From unterminated fiber in front of receiver photodiode
- Unterminated fiber RL = 14.7 dB (PC) and 35 dB(APC)
- Assume no air gaps in connections
- Connection RL 20 dB (IEC Grade B) to 27 dB
- Sum all sources of RL to determine the total RL

With APC MDI we can change “Optical return loss tolerance (max)” from 12 dB to 15 dB

- 12 dB RL - PC MDI (Blue)
  - 3 x 20dB RL
  - 15 x 27dB RL
- 15 dB RL – APC MDI (Orange)
  - 3 x 20 dB RL
  - 15 x 27dB RL
- No negative impact on installed PC cable plant



PC connectors must be clean and well polished, a single air gap can degrade RL to the point where bit errors are introduced!