Summary of Technical Feasibility Demonstrated for 100m OM4 MMF Links

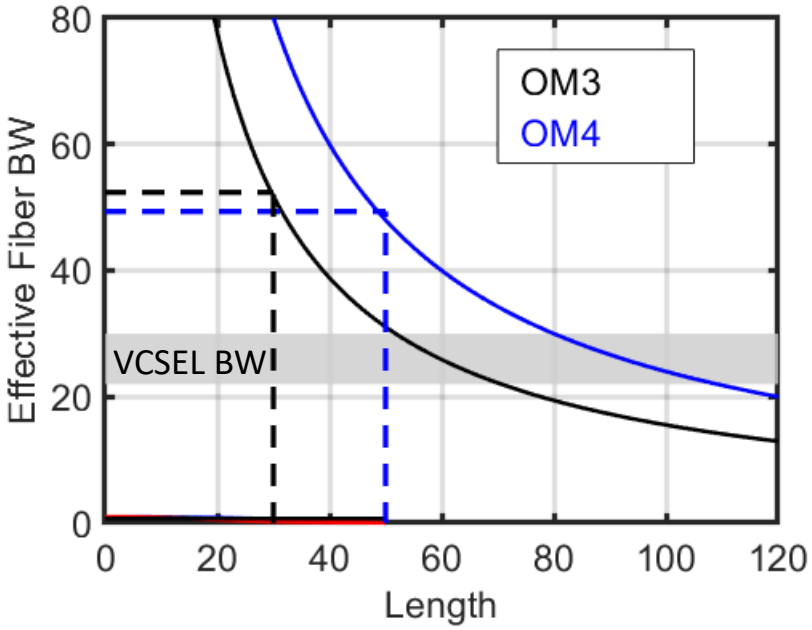
Ramana Murty, Broadcom
Vipul Bhatt, II-VI

November 10, 2020

IEEE P802.3db 100 Gb/s, 200 Gb/s, and 400 Gb/s Short Reach Fiber Task Force
Ad Hoc Teleconference

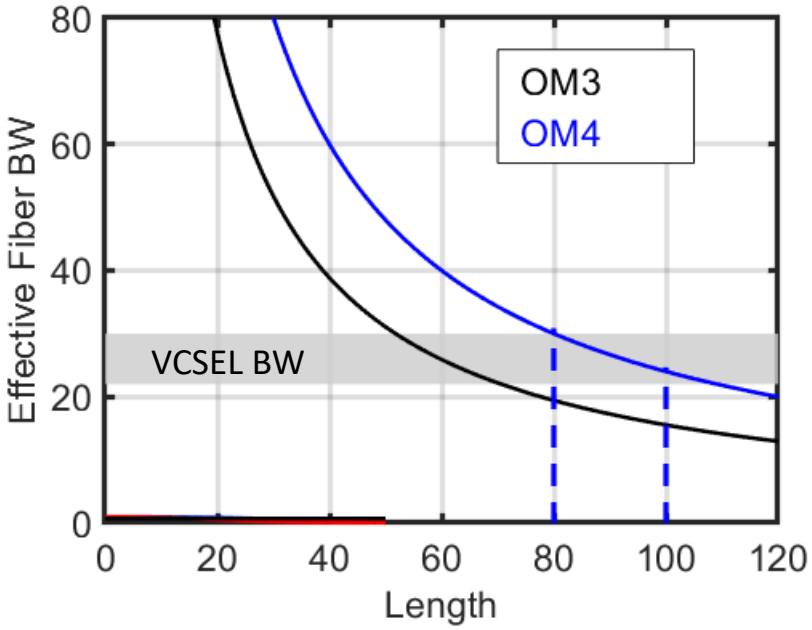
There is a VCSEL-limited & a Fiber-limited Regime for 100G per λ over MMF

30m OM3 / 50m OM4: “VCSEL-limited”



Fiber adds a small penalty.

80 – 100m OM4: “Fiber-limited”



Fiber adds a significant penalty.

1. Expressions for modal bandwidth from kolesar_3cm_01_1118.pdf.
2. Chromatic dispersion parameters U0 = 1328 nm and S0 = 0.093477 ps/(nm^2·km) for OM3 and OM4, abbott_3db_adhoc_01_080620.pdf.
3. Reference king_3cm_adhoc_01_062818.pdf.

TDECQ: Model and Measurements

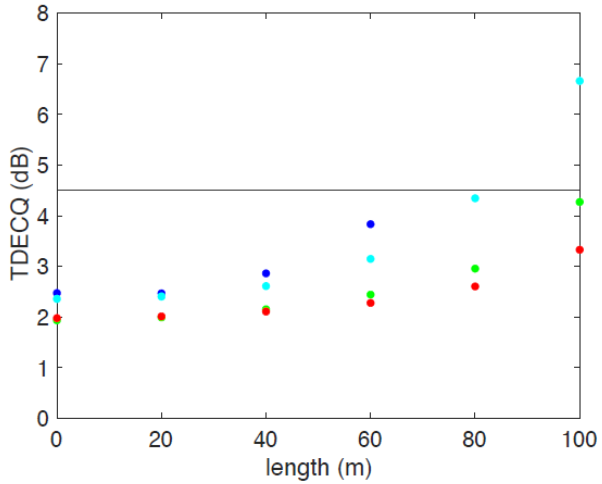
ingham_3db_adhoc_01a_062520.pdf

- 30m OM3 / 50m OM4 adds small penalty.
  Fiber transmission adds little penalty – “VCSEL-limited.”

- 100m OM4 link feasible with 9+ tap Rx FFE.
  Fiber transmission adds significant penalty – “Fiber-limited.”

  While TDECQ is below 4.5 dB with 9 Rx FFE taps, more margin would be needed for manufacturing. Continued VCSEL development should lead to the performance required for high volume production when the Standard is published.

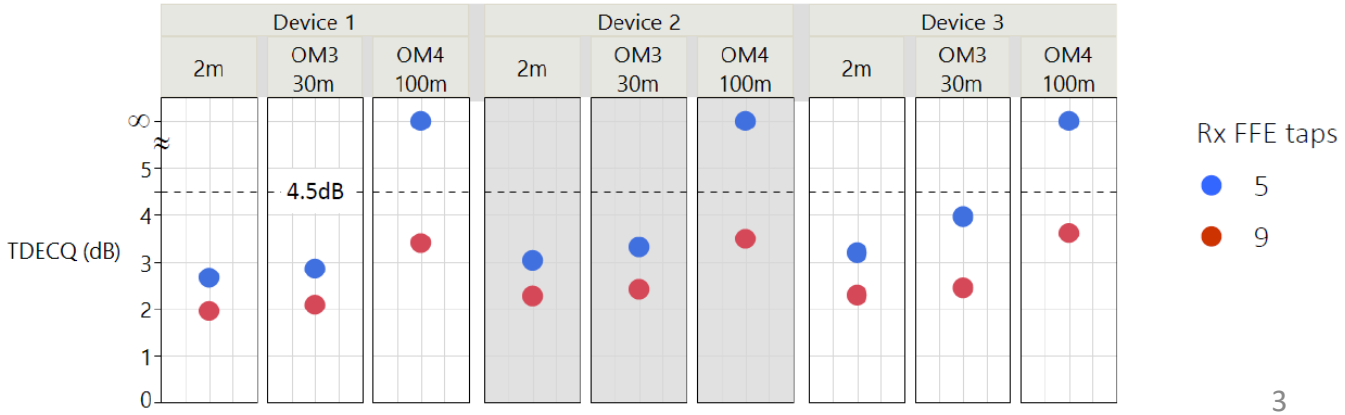
Link model



TDECQ versus OM4 link length for 5-tap Rx FFE (blue), 7-tap Rx FFE (cyan), 9-tap Rx FFE (green) and 23-tap Rx FFE (red)
If TDECQ is not measurable at a particular length, then a data point is not shown

Device	RMS Spectral Width (nm)	
	RT	75°C
1	0.59	
2	0.49	0.42
3	0.37	

Measurements (75°C)



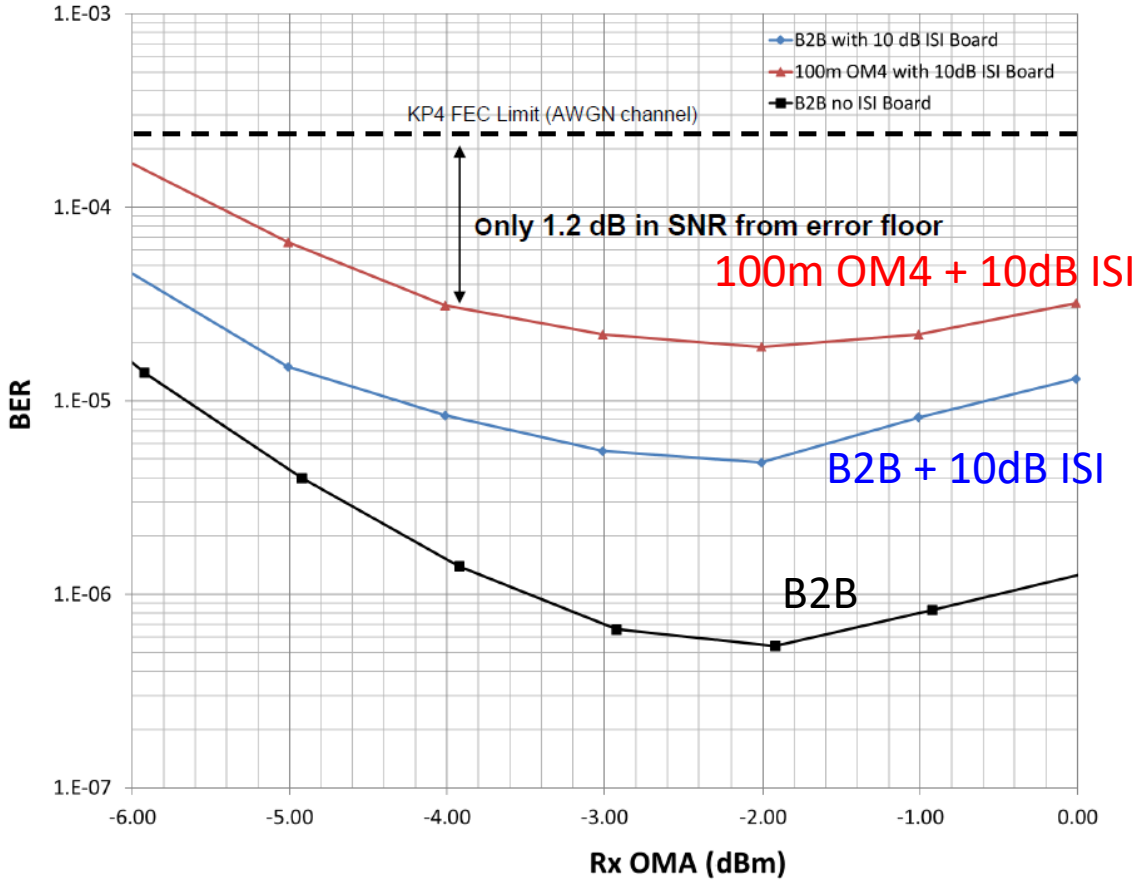
Evidence of Technical Feasibility from BER Measurements

lyubomirsky_3db_01_1020.pdf

Pre-FEC BER below 2.4E-4 (KP4 FEC limit)
for 100m OM4 transmission.

This experiment was designed to mimic the difficulty of using a linear interface, by adding 10 dB of ISI, while transmitting over 100m OM4 fiber with a 100G VCSEL.

However, in so-doing, it also provides an independent, experimental demonstration of Technical Feasibility of 100m over OM4.



Differentiation of the PMDs

Specifications

Reference equalizer BT filter represents the combination of anti-aliasing filter (26.5625 GHz) and the effective fiber bandwidth.

Other potential differences for a low cost PMD1:

- Max RMS spectral width
- Minimum OMA (for max TDECQ)
- MPN penalty

murty_3db_adhoc_01a_100120.pdf

Parameter	PMD1	PMD2	Units	Notes
MMF	OM3	OM4	—	1
Link length	30	100	m	2
Fiber attenuation	0.1	0.3	dB	
Reference equalizer BT filter Uw = 0.6 nm Uw = 0.5 nm	 21.9 22.2	 14.7 15.7	 GHz GHz	3

⇦ For testing transmitter compliance

Relative Cost

Benefit to defining two PMDs is that a wide range of VCSEL cost evolution scenarios can be accounted for.