2m Passive Copper Cable Feasibility at 112G

Tom Palkert, Alex Haser & Chris Roth
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Objective:

- To provide loss numbers for individual channel components for purposes of evaluating 2m passive copper cable feasibility at 112G
- Three topologies presented:
  - Traditional PCB (feasible with retimers)
  - Symmetric BiPass
  - Asymmetric BiPass (traditional PCB/ BiPass)
- Assumptions: Total ball-to-ball channel budget = 28 dB

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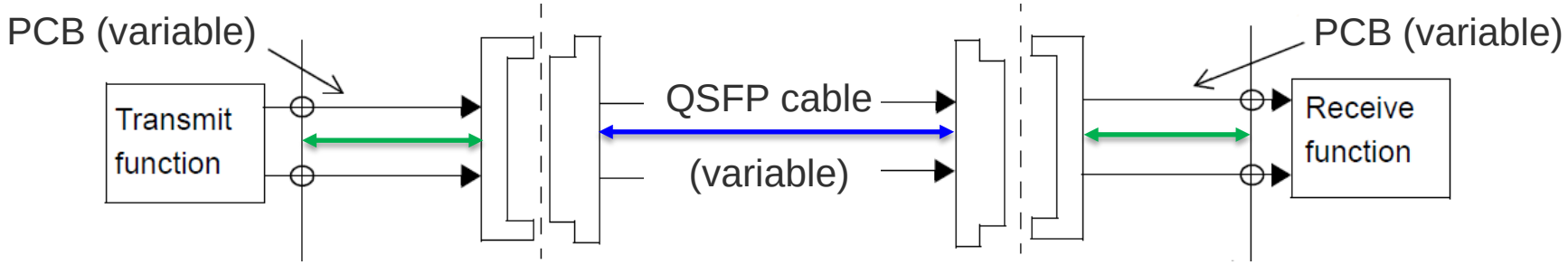
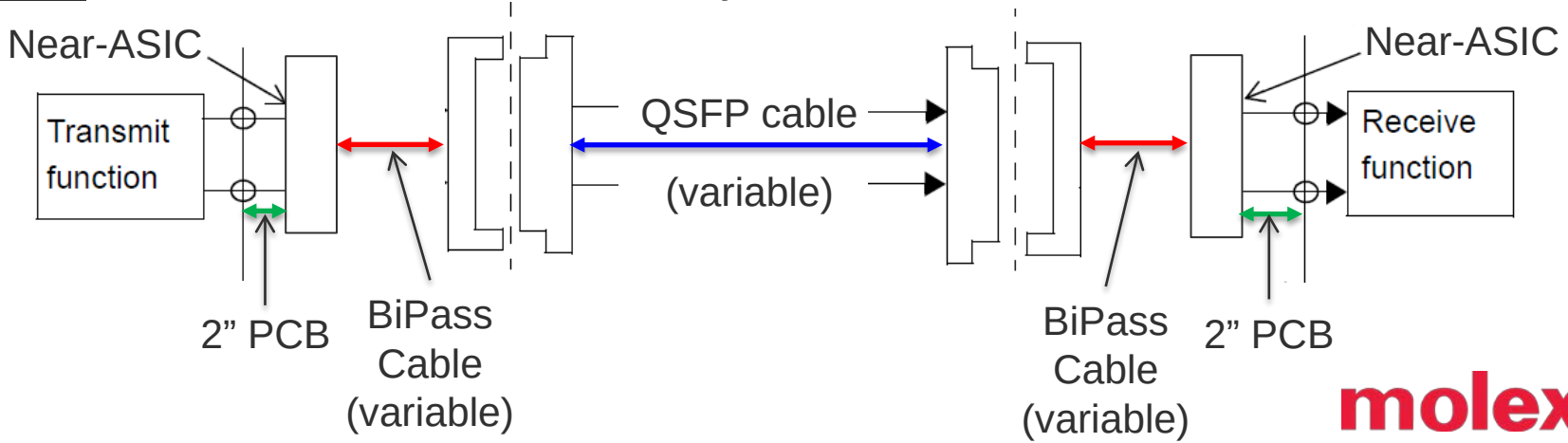
Topologies:

Traditional PCB: PCB assumed symmetric



BiPass: BiPass cable reach assumed symmetric



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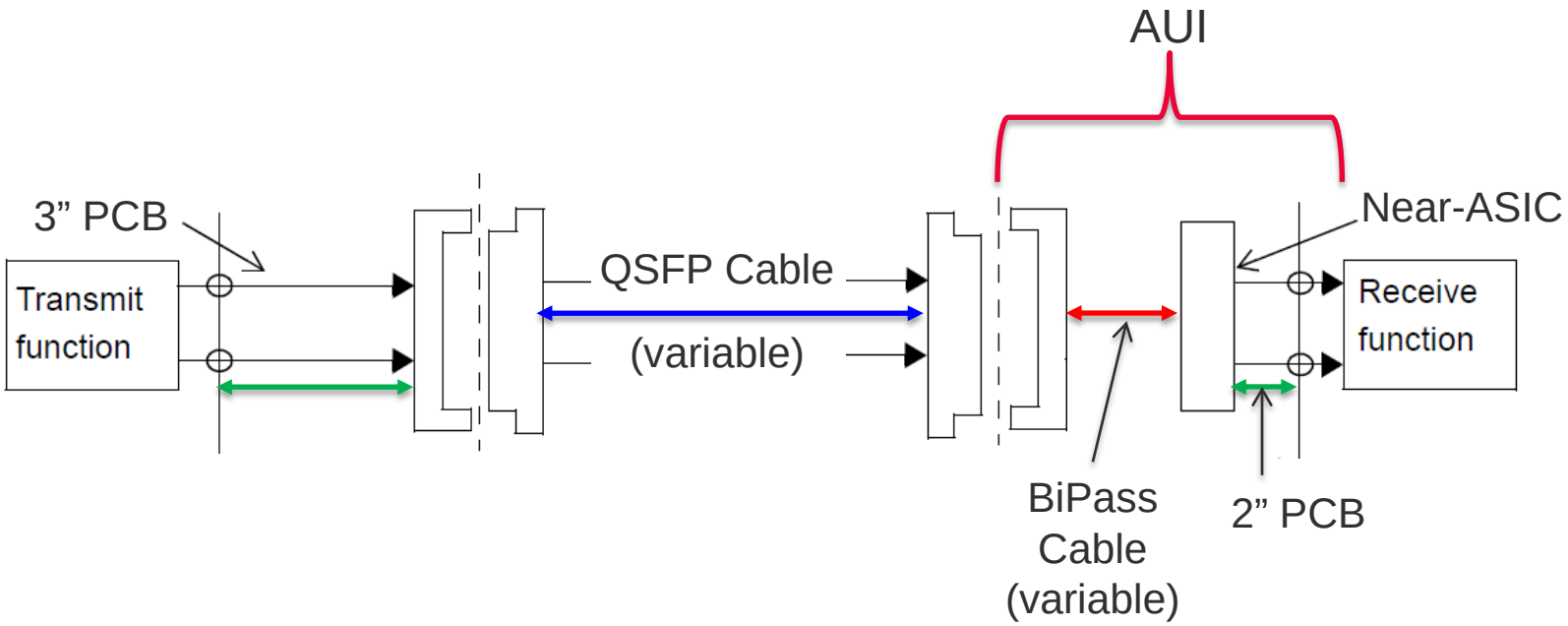
Topologies Continued:

Asymmetric: Traditional PCB one side, BiPass other side



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Estimated Loss Values @ 26.6 GHz

Component	Category	Loss
PCB [dB/in]	Meg 6	1.75
	Tachyon	0.90
BiPass Cable [dB/m]	30 AWG	6.95
	32 AWG	9.80
	34 AWG	12.00
QSFP Cable [dB/m]	26 AWG	5.05
	28 AWG	7.60
Other [dB]	Connectors, paddle cards, wire terminations, etc. (per side)	3.00* 4.00**

NOTE: Loss numbers are nominal; actual numbers will vary based on implementation

*Does not include Near-ASIC connectors; used for traditional PCB implementations
**Includes Near-ASIC connectors; used for BiPass implementations

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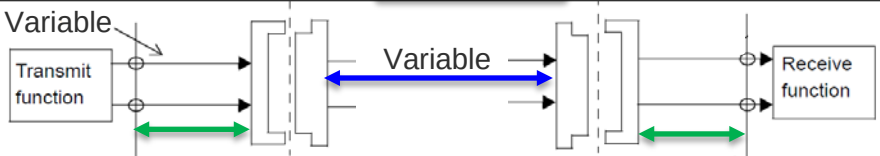
Traditional PCB Channels*:

*PCB lengths assumed symmetric on both sides

OSFP Cable (m)			Meg 6					Tachyon				
			PCB (m)									
			0.051 (2 in)	0.102 (4 in)	0.152 (6 in)	0.203 (8 in)	0.254 (10 in)	0.051 (2 in)	0.102 (4 in)	0.152 (6 in)	0.203 (8 in)	0.254 (10 in)
28 AWG	2.25		30.10	37.10	44.10	51.10	58.10	26.70	30.30	33.90	37.50	41.10
	2.00		28.20	35.20	42.20	49.20	56.20	24.80	28.40	32.00	35.60	39.20
	1.75		26.30	33.30	40.30	47.30	54.30	22.90	26.50	30.10	33.70	37.30
	1.50		24.40	31.40	38.40	45.40	52.40	21.00	24.60	28.20	31.80	35.40
	1.25		22.50	29.50	36.50	43.50	50.50	19.10	22.70	26.30	29.90	33.50
26 AWG	2.25		24.36	31.36	38.36	45.36	52.36	20.96	24.56	28.16	31.76	35.36
	2.00		23.10	30.10	37.10	44.10	51.10	19.70	23.30	26.90	30.50	34.10
	1.75		21.84	28.84	35.84	42.84	49.84	18.44	22.04	25.64	29.24	32.84
	1.50		20.58	27.58	34.58	41.58	48.58	17.18	20.78	24.38	27.98	31.58
	1.25		19.31	26.31	33.31	40.31	47.31	15.91	19.51	23.11	26.71	30.31

Key:
< 25 dB
25 – 28 dB
>28 dB

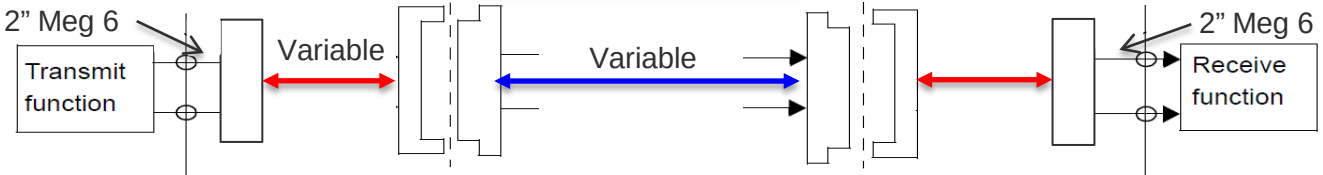


BiPass Channels w/ Meg 6*:

*BiPass reach assumed symmetric on both sides

OSFP Cable (m)			30 AWG					32 AWG					34 AWG				
			0.10	0.15	0.20	0.25	0.30	0.10	0.15	0.20	0.25	0.30	0.10	0.15	0.20	0.25	0.30
			BiPass Cable (m)														
	28 AWG	2.25	33.49	34.19	34.88	35.58	36.27	34.06	35.04	36.02	37.00	37.98	34.50	35.70	36.90	38.10	39.30
		2.00	31.59	32.29	32.98	33.68	34.37	32.16	33.14	34.12	35.10	36.08	32.60	33.80	35.00	36.20	37.40
		1.75	29.69	30.39	31.08	31.78	32.47	30.26	31.24	32.22	33.20	34.18	30.70	31.90	33.10	34.30	35.50
		1.50	27.79	28.49	29.18	29.88	30.57	28.36	29.34	30.32	31.30	32.28	28.80	30.00	31.20	32.40	33.60
		1.25	25.89	26.59	27.28	27.98	28.67	26.46	27.44	28.42	29.40	30.38	26.90	28.10	29.30	30.50	31.70
	26 AWG	2.25	27.75	28.45	29.14	29.84	30.53	28.32	29.30	30.28	31.26	32.24	28.76	29.96	31.16	32.36	33.56
		2.00	26.49	27.19	27.88	28.58	29.27	27.06	28.04	29.02	30.00	30.98	27.50	28.70	29.90	31.10	32.30
		1.75	25.23	25.92	26.62	27.31	28.01	25.80	26.78	27.76	28.74	29.72	26.24	27.44	28.64	29.84	31.04
		1.50	23.97	24.66	25.36	26.05	26.75	24.54	25.52	26.50	27.48	28.46	24.98	26.18	27.38	28.58	29.78
		1.25	22.70	23.40	24.09	24.79	25.48	23.27	24.25	25.23	26.21	27.19	23.71	24.91	26.11	27.31	28.51

Key:
< 25 dB
25 – 28 dB
>28 dB

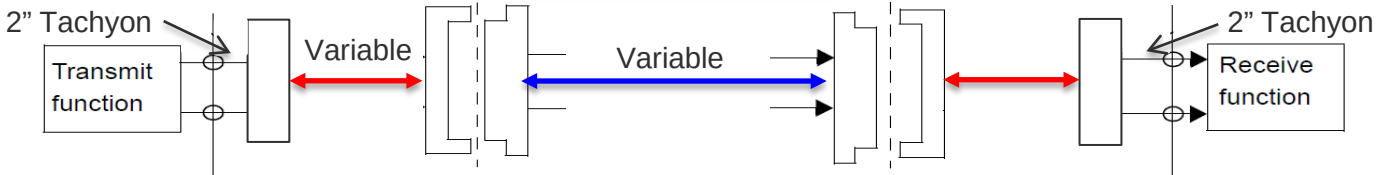


BiPass Channels w/ Tachyon*:

*BiPass reach assumed symmetric on both sides

OSFP Cable (m)			30 AWG					32 AWG					34 AWG				
			0.10	0.15	0.20	0.25	0.30	0.10	0.15	0.20	0.25	0.30	0.10	0.15	0.20	0.25	0.30
			BiPass Cable (m)														
	28 AWG	2.25	30.09	30.79	31.48	32.18	32.87	30.66	31.64	32.62	33.60	34.58	31.10	32.30	33.50	34.70	35.90
		2.00	28.19	28.89	29.58	30.28	30.97	28.76	29.74	30.72	31.70	32.68	29.20	30.40	31.60	32.80	34.00
		1.75	26.29	26.99	27.68	28.38	29.07	26.86	27.84	28.82	29.80	30.78	27.30	28.50	29.70	30.90	32.10
		1.50	24.39	25.09	25.78	26.48	27.17	24.96	25.94	26.92	27.90	28.88	25.40	26.60	27.80	29.00	30.20
		1.25	22.49	23.19	23.88	24.58	25.27	23.06	24.04	25.02	26.00	26.98	23.50	24.70	25.90	27.10	28.30
	26 AWG	2.25	24.35	25.05	25.74	26.44	27.13	24.92	25.90	26.88	27.86	28.84	25.36	26.56	27.76	28.96	30.16
		2.00	23.09	23.79	24.48	25.18	25.87	23.66	24.64	25.62	26.60	27.58	24.10	25.30	26.50	27.70	28.90
		1.75	21.83	22.52	23.22	23.91	24.61	22.40	23.38	24.36	25.34	26.32	22.84	24.04	25.24	26.44	27.64
		1.50	20.57	21.26	21.96	22.65	23.35	21.14	22.12	23.10	24.08	25.06	21.58	22.78	23.98	25.18	26.38
		1.25	19.30	20.00	20.69	21.39	22.08	19.87	20.85	21.83	22.81	23.79	20.31	21.51	22.71	23.91	25.11

Key:
< 25 dB
25 – 28 dB
>28 dB



Asymmetric Channels*:

*Assumes 3” Tachyon on the traditional side & 2” Tachyon on the BiPass side

OSFP Cable (m)		BiPass Cable (m)														
			30 AWG					32 AWG					34 AWG				
			0.10	0.15	0.20	0.25	0.30	0.10	0.15	0.20	0.25	0.30	0.10	0.15	0.20	0.25	0.30
28 AWG		2.25	29.30	29.64	29.99	30.34	30.69	29.58	30.07	30.56	31.05	31.54	29.80	30.40	31.00	31.60	32.20
		2.00	27.40	27.74	28.09	28.44	28.79	27.68	28.17	28.66	29.15	29.64	27.90	28.50	29.10	29.70	30.30
		1.75	25.50	25.84	26.19	26.54	26.89	25.78	26.27	26.76	27.25	27.74	26.00	26.60	27.20	27.80	28.40
		1.50	23.60	23.94	24.29	24.64	24.99	23.88	24.37	24.86	25.35	25.84	24.10	24.70	25.30	25.90	26.50
		1.25	21.70	22.04	22.39	22.74	23.09	21.98	22.47	22.96	23.45	23.94	22.20	22.80	23.40	24.00	24.60
26 AWG		2.25	23.56	23.91	24.25	24.60	24.95	23.84	24.33	24.82	25.31	25.80	24.06	24.66	25.26	25.86	26.46
		2.00	22.30	22.64	22.99	23.34	23.69	22.58	23.07	23.56	24.05	24.54	22.80	23.40	24.00	24.60	25.20
		1.75	21.03	21.38	21.73	22.08	22.42	21.32	21.81	22.30	22.79	23.28	21.54	22.14	22.74	23.34	23.94
		1.50	19.77	20.12	20.47	20.81	21.16	20.06	20.55	21.04	21.53	22.02	20.28	20.88	21.48	22.08	22.68
		1.25	18.51	18.86	19.20	19.55	19.90	18.79	19.28	19.77	20.26	20.75	19.01	19.61	20.21	20.81	21.41

Key:
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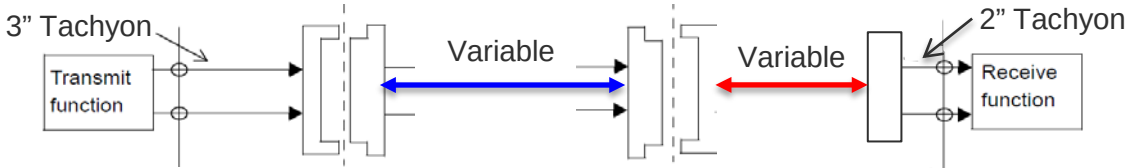

Conclusions:

- Loss numbers for individual channel components presented demonstrate feasibility for 2m passive copper cables in multiple system layouts at 112G with a total 28 dB budget (ball-to-ball):
  - Traditional PCB (feasible with retimers)
  - Symmetric BiPass channels
  - Asymmetric BiPass channels

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