802.3 25 Gb/s Study Group Considerations for 25 Gb/s Cable Assembly Specifications

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Purpose

- Considerations for 25 Gb/s cable assembly specifications consistent with adopted objectives

  - Define a single-lane 25 Gb/s PHY for operation over links consistent with copper twin axial cables, with lengths up to at least 3m

  - Define a single-lane 25 Gb/s PHY for operation over links consistent with copper twin axial cables, with lengths up to at least 5m

- Make progress on cable assembly and channel specifications pending other PMD/PHY decisions

Cable assembly naming

- CA-L = up to at least 5 meter cable assembly
- CA-S = up to at least 3 meter cable assembly
- Cable assembly with QSFP28 plug = QSFP-CA
- Cable assembly with SFP28 plug = SFP-CA
- Cable assembly with breakout = QSFP-x4SFP-CA

	QSFP-CA (QSFP28)	SFP-CA (SFP28)	QSFP-x4SFP-CA - breakout
CA-L	5m	5m	5m
CA-S	3m	3m	3m

- Note that the cable assembly naming used here is explicit in plug types to avoid ambiguity in short hand notation in developing the standard but may not translate directly into optimal notation to be used in the standard.

25 Gb/s Ethernet – Cable assembly – QSFP-CA-L

Use 802.3bj clause 92

92.10 Cable assembly characteristics
92.10.1 Characteristic impedance and reference impedance
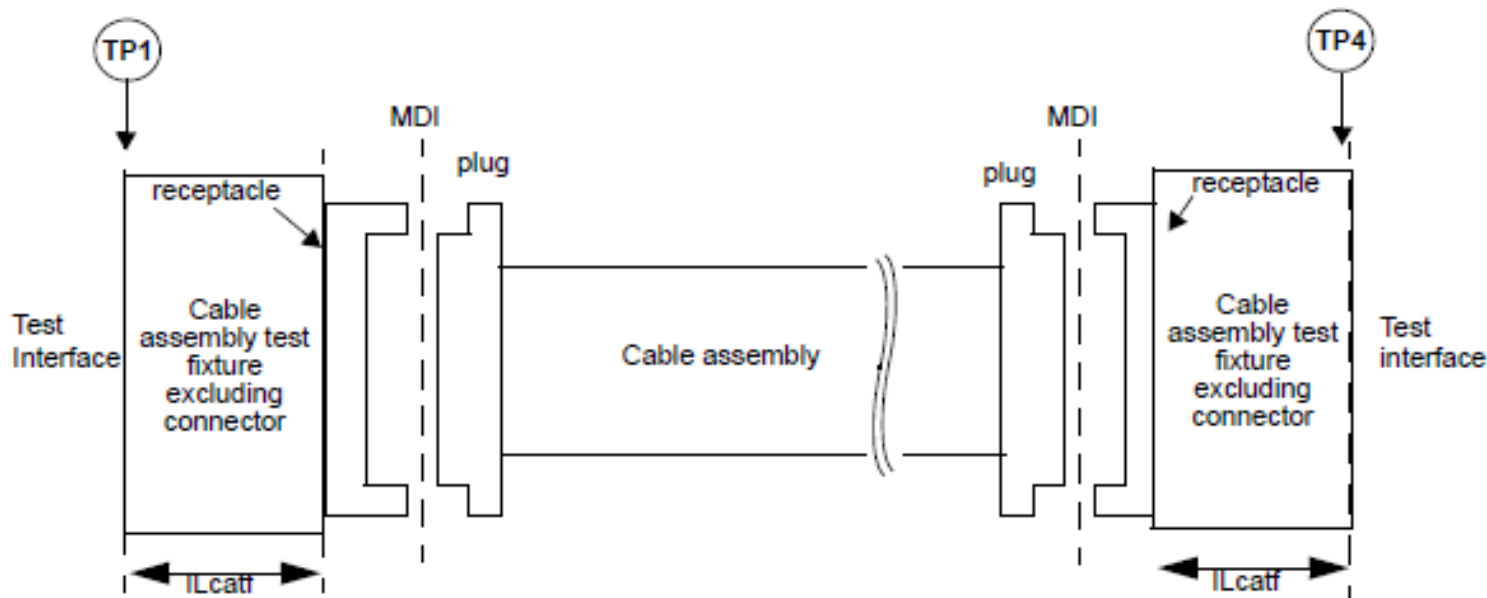92.10.2 Cable assembly insertion loss
92.10.3 Cable assembly differential return loss
92.10.4 Differential to common-mode return loss
92.10.5 Differential to common-mode conversion loss
92.10.6 Common-mode to common-mode return loss
92.10.7 Cable assembly Channel Operating Margin

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25 Gb/s Ethernet – Cable assembly – QSFP-CA-S

Use 802.3bj clause 92 with revisions to 92.10.2 and 92.10.5 to account for length dependent impairments

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92.10.1 Characteristic impedance and reference impedance
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     –Limit specified as Conversion _loss(f)-IL(f)
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25 Gb/s Ethernet – Cable assembly – SFP-CA-L

Use 802.3bj clause 92 and implement COM with appropriate crosstalk paths

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92.10.1 Characteristic impedance and reference impedance
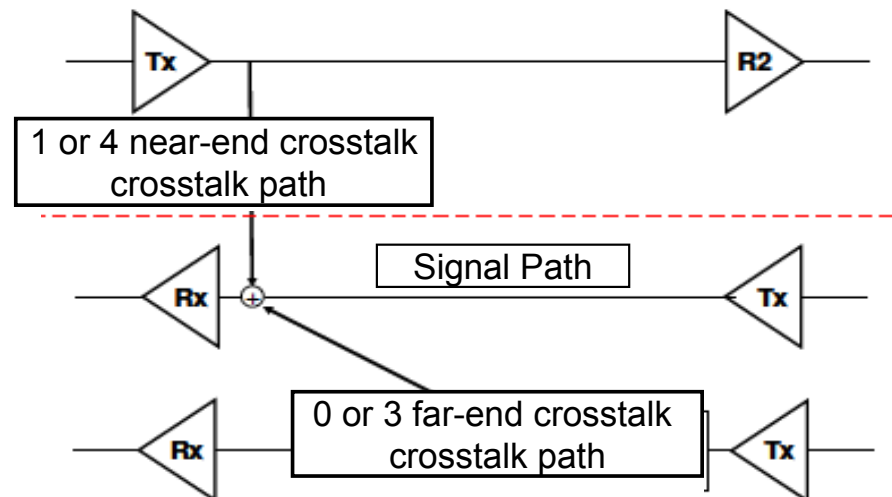92.10.2 Cable assembly insertion loss
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25 Gb/s Ethernet – Cable assembly – SFP-CA-S

Use 802.3bj clause 92 with revisions to 92.10.2 and 92.10.5 to account for length dependent impairments and implement COM with crosstalk paths

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92.10.1 Characteristic impedance and reference impedance
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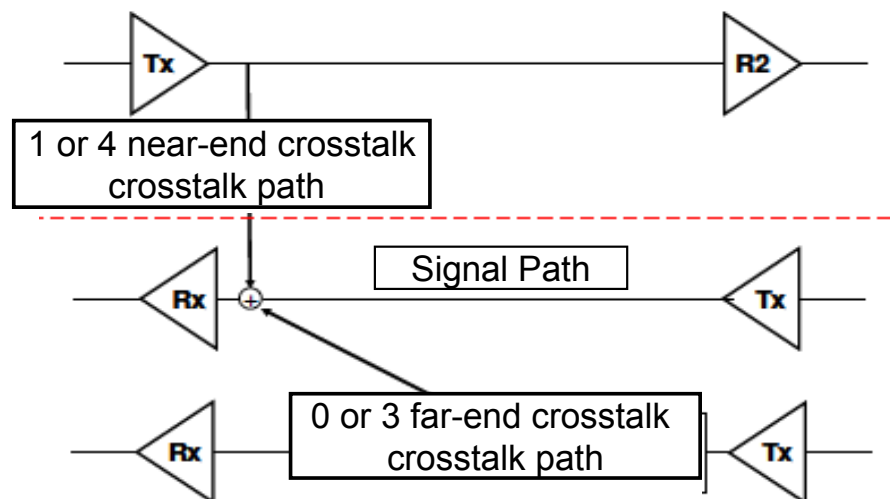92.10.3 Cable assembly differential return loss
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25 Gb/s Ethernet – Cable assembly – QSFP-x4SFP-CA-L

Use 802.3bj clause 92 and implement COM with appropriate crosstalk paths for plug type

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92.10.1 Characteristic impedance and reference impedance
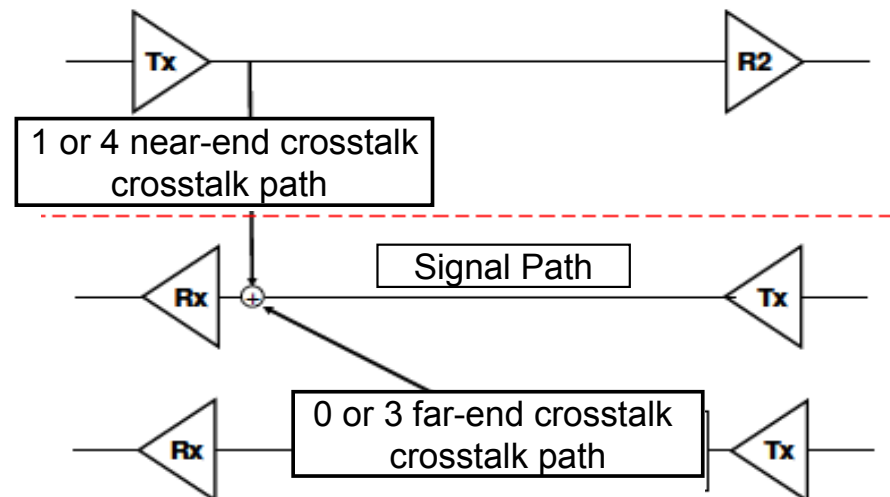92.10.2 Cable assembly insertion loss
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25 Gb/s Ethernet – Cable assembly – QSFP-x4SFP-CA-S

Use 802.3bj clause 92 with revisions to 92.10.2 and 92.10.5 to account for length dependent impairments and implement COM with appropriate crosstalk paths for plug type

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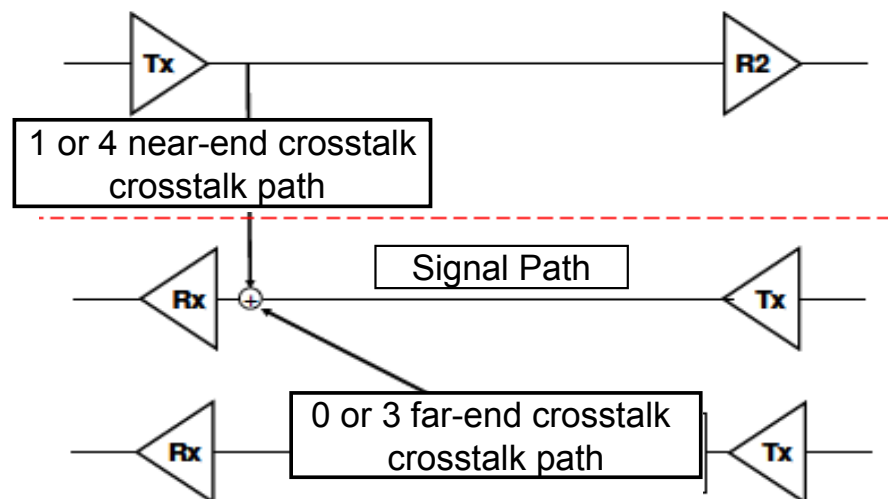92.10.3 Cable assembly differential return loss
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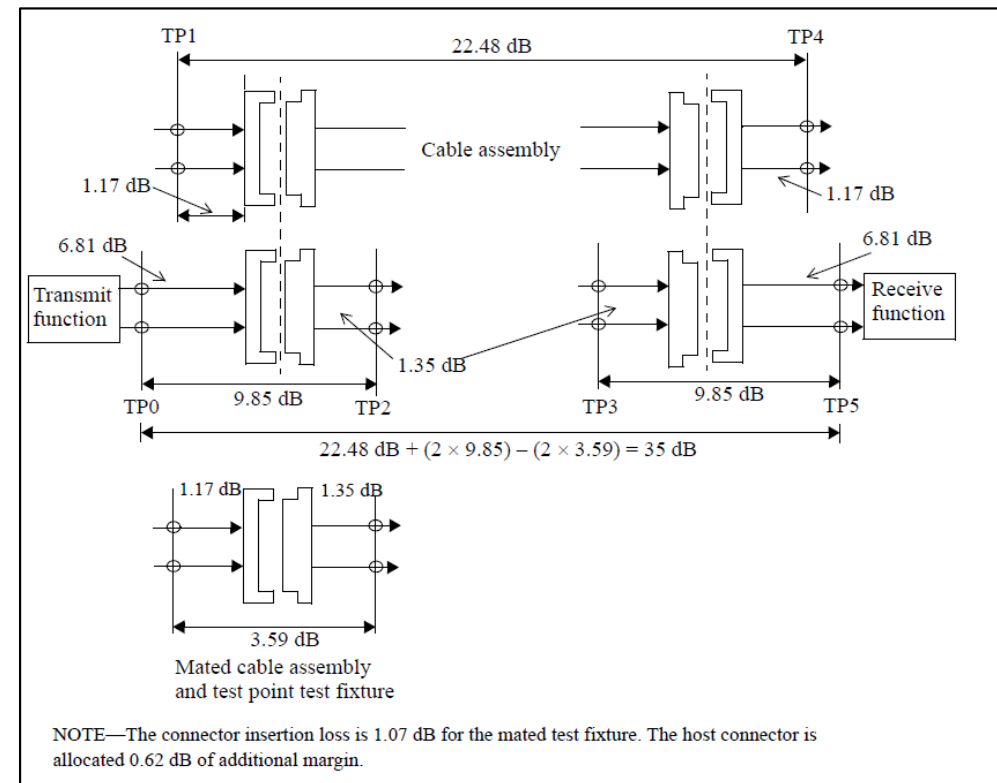92.10.6 Common-mode to common-mode return loss
92.10.7 Cable assembly Channel Operating Margin

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25 Gb/s Channel loss budget 35 dB

- Supports up to at least 5m cable assembly (CA-L) – 802.3bj Host Loss = 6.81 dB

- Supports up to at least 3m cable assembly (CA-S) – 802.3bj Host Loss + 3.6 dB = 10.41 dB

- RS-FEC

	CA-L (35 dB)	CA-S (35 dB)
	dB (@12.8906 GHz)	dB (@12.8906 GHz)
Host connector allocation	1.69	1.69
Host PCB	6.81	10.41
(TP2/TP3) HCB PCB	1.35	1.35
Total Host IL	9.85	13.45
CATF PCB	1.17	1.17
(TP2/TP3) HCB PCB	1.35	1.35
Host connector allocation	1.07	1.07
Total MTF	3.59	3.59
Bulk cable assumed	18	10.8
CATF PCB IL	1.17	1.17
Host connector allocation	1.07	1.07
Cable Assembly	22.48	15.28

$$22.48 \text{ dB} + (2 \times 9.85) - (2 \times 3.59) = 35 \text{ dB}$$

NOTE—The connector insertion loss is 1.07 dB for the mated test fixture. The host connector is allocated 0.62 dB of additional margin.

- CA-S - 3m cable assembly (bulk cable assumptions need to align with 30 dB budget to enable common 3m cable assembly specifications)
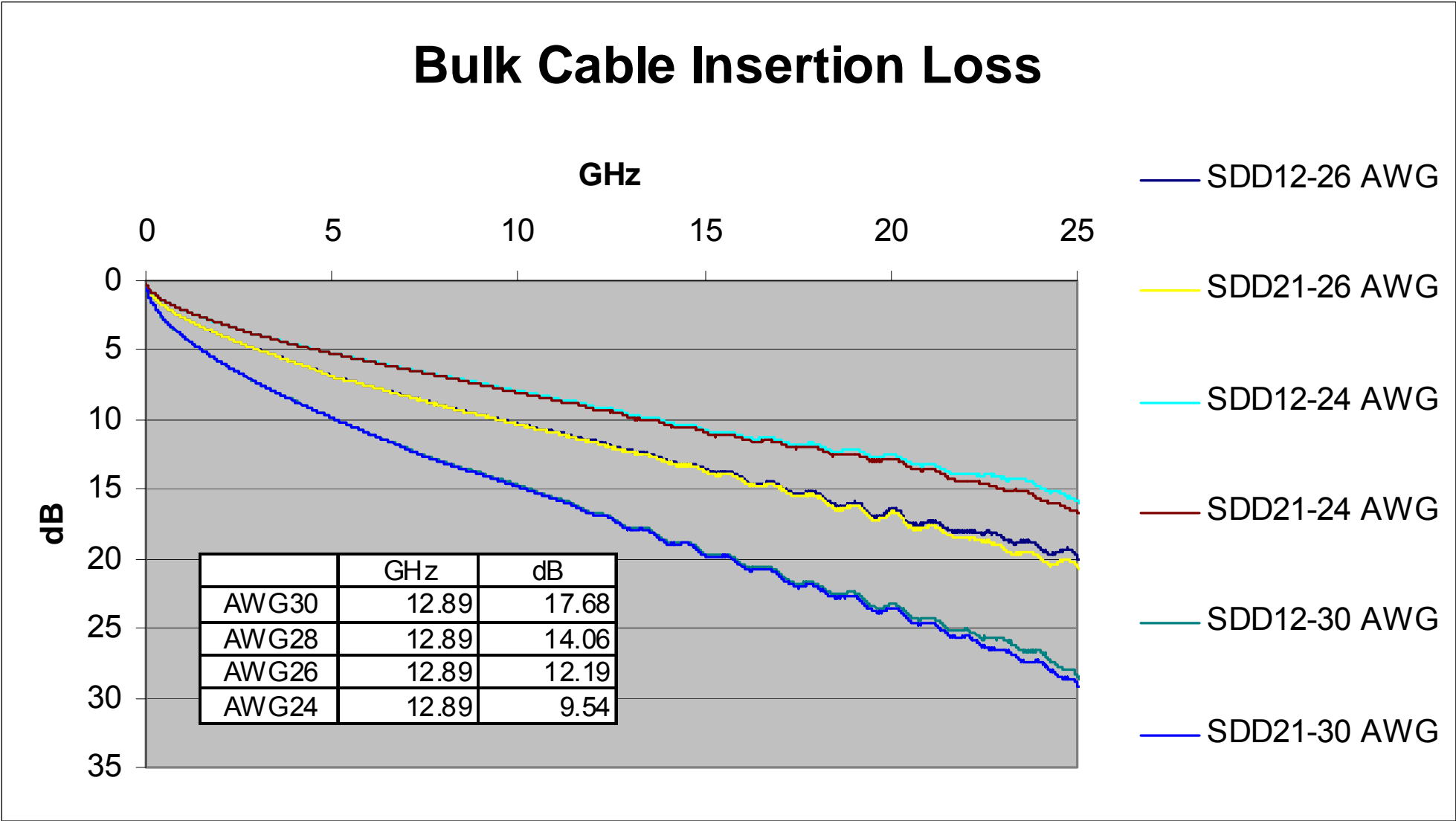
25 Gb/s Channel loss budget 30 dB

- Supports up to at least 3m cable assembly (CA-S) Host Loss = 6.81 dB (TBD) same as 802.3bj

- no RS-FEC

	CA-S (30 dB)
	dB (@12.8906 GHz)
Host connector allocation	1.69
Host PCB	6.81
(TP2/TP3) HCB PCB	1.35
Total Host IL	9.85
CATF PCB	1.17
(TP2/TP3) HCB PCB	1.35
Host connector allocation	1.07
Total MTF	3.59
Bulk cable assumed	13
CATF PCB IL	1.17
Host connector allocation	1.07
Cable Assembly	17.48
Channel	30

- CA-S - 3m cable assembly (bulk cable assumptions need to align with 35 dB budget to enable common 3m cable assembly specifications)

Cable insertion loss

Bulk Cable Insertion Loss

	GHz	dB
AWG30	12.89	17.68
AWG28	12.89	14.06
AWG26	12.89	12.19
AWG24	12.89	9.54

Legend:
- SDD12-26 AWG
- SDD21-26 AWG
- SDD12-24 AWG
- SDD21-24 AWG
- SDD12-30 AWG
- SDD21-30 AWG

Source: LEONI Special Cables

Summary

- Considerations for 25 Gb/s cable assembly specifications consistent with adopted objectives

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  - Define a single-lane 25 Gb/s PHY for operation over links consistent with copper twin axial cables, with lengths up to at least 5m

- Cable assembly insertion loss AWG dependent i.e., for a given length insertion loss will be different for each AWG.