Application Liability

for extended channel topologies

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IEEE 802.3 FO Connector Loss ad hoc

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The Situation

- 3N815 WD for ISO/IEC 24764: Information technology - Generic cabling for Data Centre premises, Annex C
  - Table C.1 attempts to advise users on the trade-off between connection + splice loss and length, allowing up to 6.1 dB of loss for laser applications
  - Table C.2 tabulates maximum allowed loss for up to 10 connections and 10 splices in a link, assuming all are simultaneously at worst case
    - This approach effectively allows high-loss components to be masked by average components
    - Ex: 8 x 0.75 dB = 6.0 dB = 7 x 0.5 dB + 1 x 2.5 dB

8 at maximum allow 7 average to mask 1 high

Note: ISO ad hoc agreed to delete Table C.2

Table C.1

Table C. 1 – Maximum channel attenuation allocated to connecting hardware

		Channel length m								
		25	50	75	100	250	500	750	1000	2000
Application	OF cable Category and design	Total connecting hardware attenuation [1] dB								
10BASE-FL/FB	OM1 62,5/125	12,40	12,30	12,20	12,15	11,60	10,75	9,85	9,00	5,50
	OM2 50/125	6,70	6,60	6,50	6,45	5,90	5,05	4,15	3,30	-
	OM3	6,70	6,60	6,50	6,45	5,90	5,05	4,15	3,30	-
100BASE-FX	OM1 62,5/125	10,95	10,90	10,85	10,85	10,60	10,25	9,85	9,50	8,00
	OM2 50/125	5,95	5,90	5,85	5,85	5,60	5,25	4,85	4,50	3,0
	OM3	5,95	5,90	5,85	5,85	5,60	5,25	4,85	4,50	3,0
1000BASE-SX	OM1 62,5/125	6,05	5,90	5,65	5,40	2,70	-	-	-	-
	OM2 50/125	5,90	5,80	5,70	5,60	4,70	2,45	-	-	-
	OM3	6,05	5,95	5,90	5,80	5,20	4,00	2,45	-	-
1000BASE-LX	OM1 62,5/125	5,80	5,75	5,70	5,65	5,10	3,55	1,05	-	-
	OM2 50/125	5,30	5,25	5,20	5,10	4,40	2,15	-	-	-
	OM3	5,30	5,25	5,20	5,10	4,40	2,15	-	-	-
10GBASE-SR/SW	OM1 62,5/125	4,50	-	-	-	-	-	-	-	-
	OM2 50/125	5,85	5,00	3,50	0,90	-	-	-	-	-
	OM3	6,10	6,00	5,80	5,60	3,50	-	-	-	-
10GBASE-LX4	OM1 62,5/125	5,90	5,85	5,70	5,55	3,45	-	-	-	-
	OM2 50/125	5,90	5,85	5,70	5,55	3,45	-	-	-	-
	OM3	5,90	5,85	5,70	5,55	3,45	-	-	-	-

[1] The figures are rounded down to two decimal places.

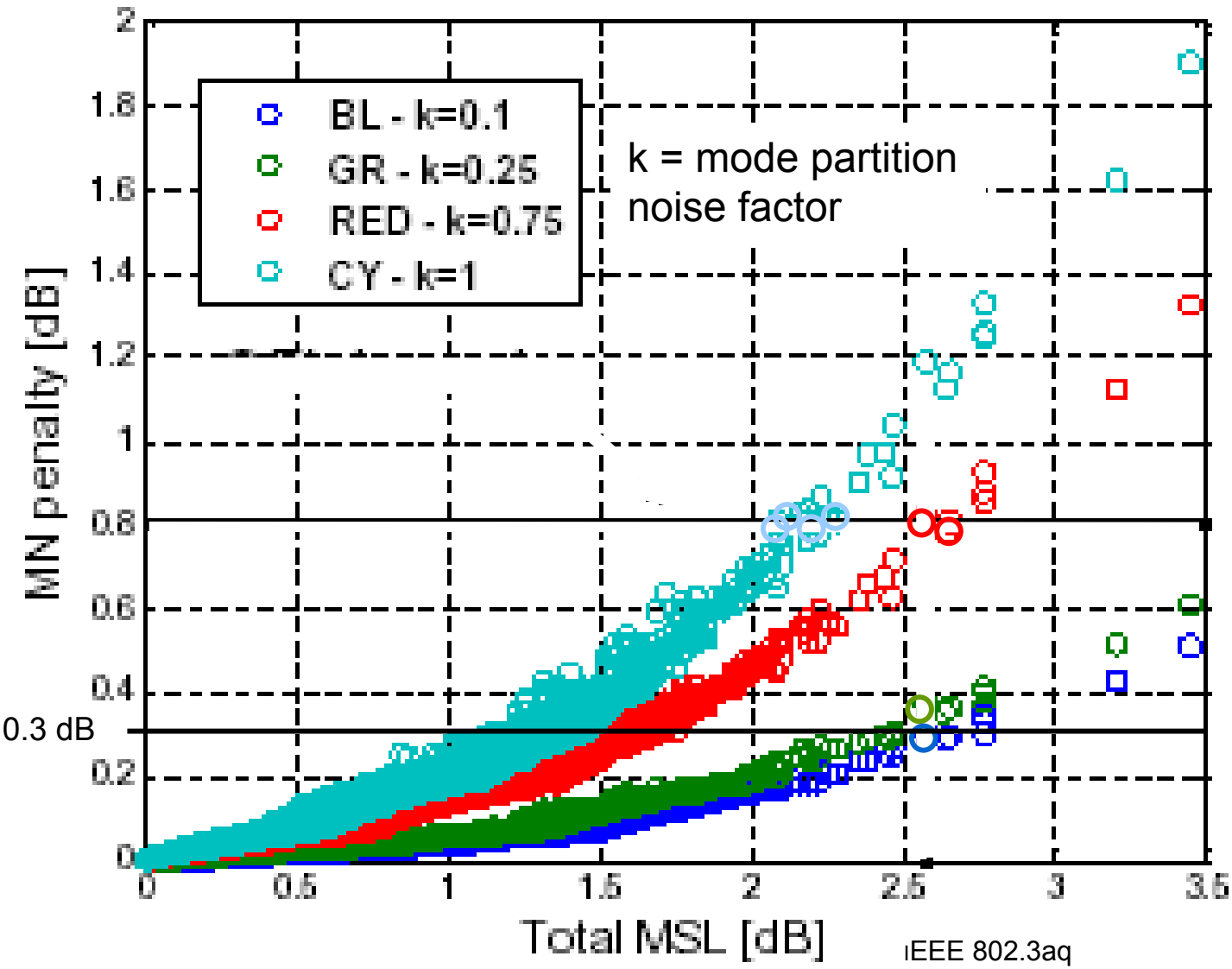
The Situation (continued)

- IEEE 802.3 allocates 1.5 dB for MM connection + splice loss
  - Link modeling of Modal Noise penalty assumes adherence
  - Modal Noise depends on amount of mode selective loss as shown in the next slide
  - The loss of connections and splices is mode selective
  - The model used multiple concatenated connections, not a lumped single MSL
  - Modal Noise allocation also impacts Cross-Product penalty, Pcross, in link model

Modal Noise vs Total Connection Loss

50µm, 1300nm

Increasing slope indicates accelerating noise, and dependence on k factor indicates a potential BER floor



10GBASE-LX4
MN allocation = 0.3 dB

Observations & Recommendation
made to ISO, March 2007

- Advising users to exceed the loss allocation without a commensurate MN allocation increase incurs liability that the link will fail to deliver its specified BER
  - The correct MN adjustment depends on the launch condition, operating wavelength, spectral width, k factor, core size, and connection topology of the channel
  - Table C.1 does not account for this modal noise impact
  - Table C.2 compounds the issue by allowing high-loss components that adversely affect MN by concentrating mode selective loss

- Remove liability by replacing the existing tables with a tabulation of the applications' stated values for
  - Maximum channel distance
  - Maximum total attenuation

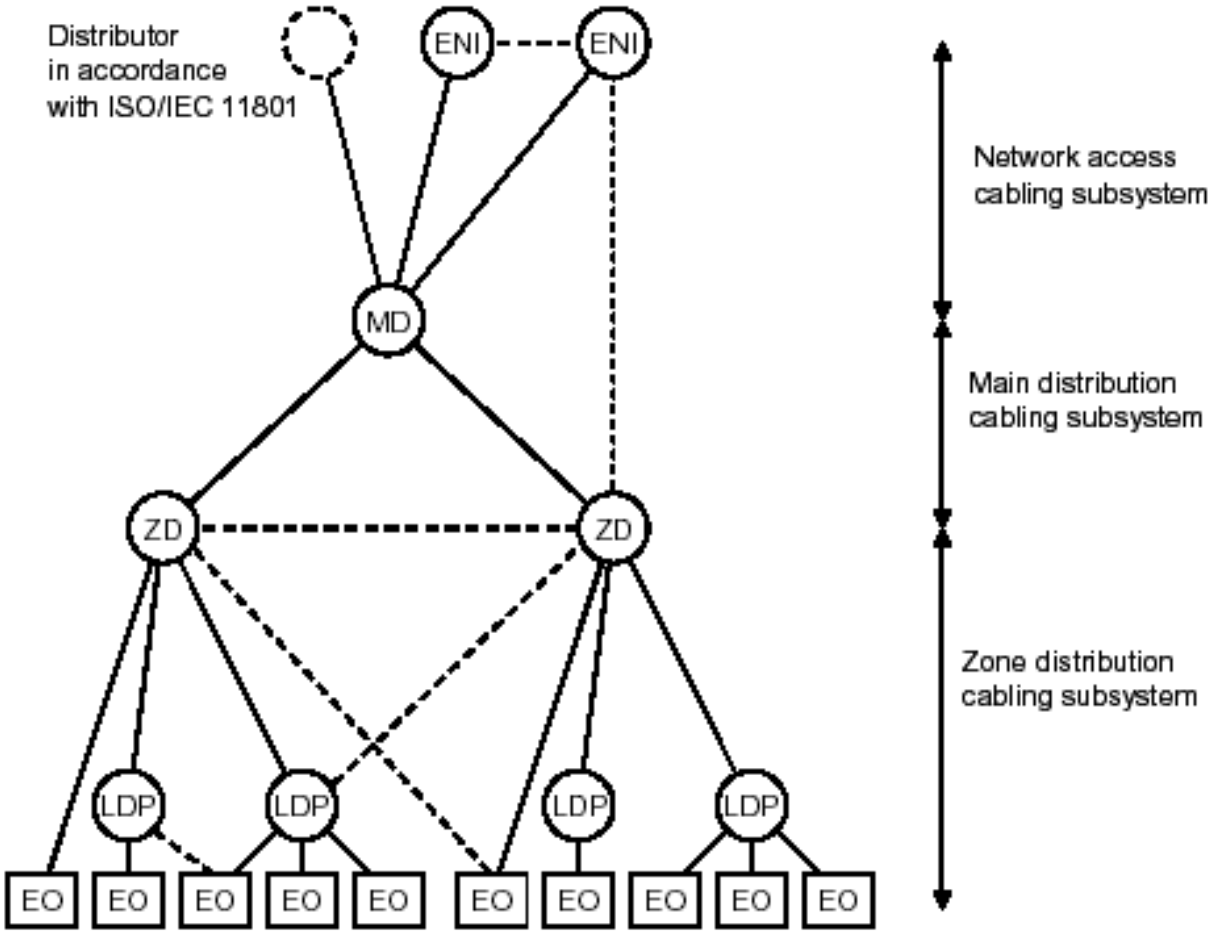
ISO Reaction

- Agreed to remove Table C.2
- Declined to remove Table C.1 or replace with suggested content
- Decided to ask IEEE for guidance via liaison letter, doc 3n822, received by IEEE 802.3 this week

Other Relevant Facts

- ISO activity in early stage, preparing for first ballot
- CENELEC TC215 EN 50173-5 data center standard is approved and awaits ratification by CENELEC BT, contains same tables
- The cabling industry is installing complex topologies today due to pre-terminated array cabling
  - 4 connections minimum for point-to-point channels
  - 8 connections common for central x-connects

Data Center Cabling Architecture
drives complex topologies



Most paths illustrated require at least 4 connections, not counting the use of array–terminated cabling that doubles that number.

------- optional cables

NOTE Network access cabling is also used to connect ENI to ZD.

Figure 3 - Hierarchical structure of generic cabling

Insights

- IEEE's previous response to ISO on this subject were not well received
- Another IEEE response that provides no technical guidance may cause propagation of unwise practices
- Advice to ISO will likely also impact CENELEC content similarly (revision)
- TIA also interested in same subject, but previously declined to publish similar table