

Receiver Reflectance and Optical Return Loss Tolerance (in support of comments #10 and #11)

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P802.3ds Interim

IEEE P802.3ds 200 Gb/s per Wavelength MMF PHYs Task Force

Reflection from Cable Plant

Multimode links will benefit from reduced back reflection from the cable plant.

The specification for receiver reflectance was changed to -15 dB (max) in the most recent multimode link standard 802.3db.

A receiver reflectance (max) of -20 dB is proposed, and analysis shows an optical return loss tolerance (max) of 17 dB.

Data rate	Receiver reflectance (max)	Optical return loss tolerance (max)
50G and lower	-12 dB	12 dB
100G	-15 dB	14 dB
200G	-20 dB (proposed)	17 dB (proposed)

Model

Link model in [murty_3db_01_111121](#)



Optical return loss tolerance

Receiver reflectance

Connector reflectance (into waveguide)

Connector transmittance (into waveguide)

Number of connectors

T_0

R_D

R

T

N

} Need a model for connector. Note $R + T < 1$

Simplifications:

1. Incoherent addition of reflected intensity
2. No fiber attenuation
3. Multiple reflections from a connector are ignored

Connector Reflectance and Loss

Connector Reflectance

300.8.2

The maximum discrete reflectance shall be less than -20 dB.

Model

Yi Tang and Mark Nowell, [tang_3db_adhoc_01_042822](#)

Gaussian distribution of R with mean -30 dB and standard deviation 4 dB

Connector Loss

300.8.2

The maximum link distance is based on an allocation of 1.5 dB total connection and splice loss. For example, this allocation supports three connections with an average insertion loss per connection of 0.5 dB. Connections with lower loss characteristics may be used provided the requirements of Table 300–10 are met. However, the loss of a single connection shall not exceed 0.75 dB.

Guidance on connector loss

Doug Coleman, [T11-2015-265v0](#)

Grade A:

0.25 max.

≤ 0.20 dB max. for $> 97\%$ of samples Premium Solution – Factory Polish

≤ 0.10 dB mean

Grade B:

0.50 max.

≤ 0.40 dB max. for $> 97\%$ of samples Standard Solution – Factory Polish

≤ 0.20 dB mean

Grade C:

0.75 max.

≤ 0.60 dB max. for $> 97\%$ of samples Standard Solution – Field Polish

≤ 0.30 dB mean

Model

Doug Coleman, [T11-2025-265v0](#)
[tang_3db_adhoc_01_042822](#)

Percent	$1 - (R+T)$
50%	< 0.2 dB
35%	< 0.3 dB
12%	< 0.4 dB
3%	< 0.5 dB

Model



Optical return loss tolerance

Receiver reflectance

Connector reflectance (into waveguide)

Connector transmittance (into waveguide)

Number of connectors

T_0

R_D → -20 dB

R → Gaussian distribution $\mu = -30$ dB, $\sigma = 4$ dB

T → Connector loss model on slide 4

N → 2, 4 and 6

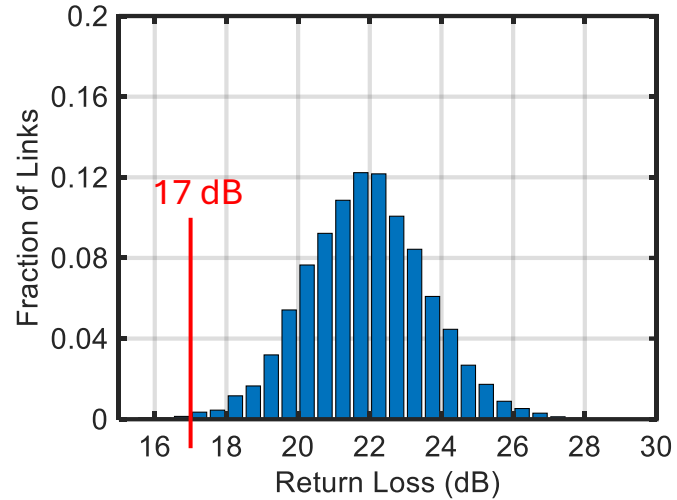
Simplifications:

1. Incoherent addition of reflected intensity
2. No fiber attenuation
3. Multiple reflections from a connector are ignored

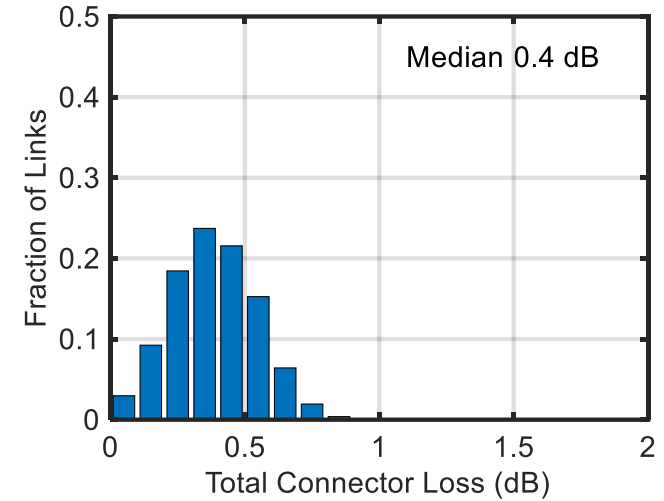
Statistics

10000 Monte Carlo runs each for 2, 4 and 6 connectors

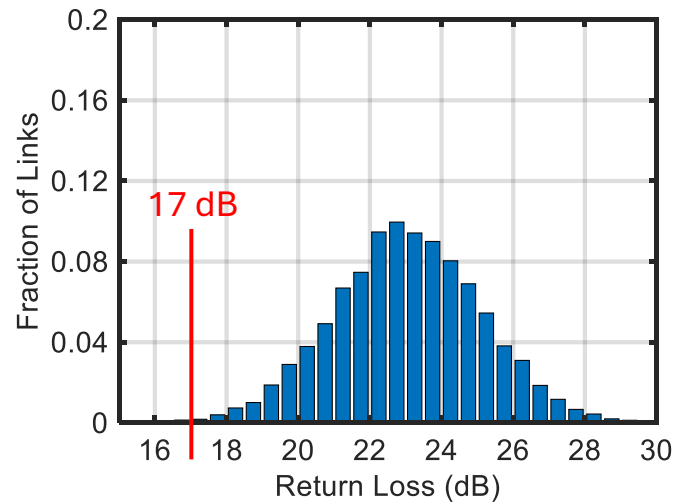
# Connectors	2
Rx Reflectance	-20 dB



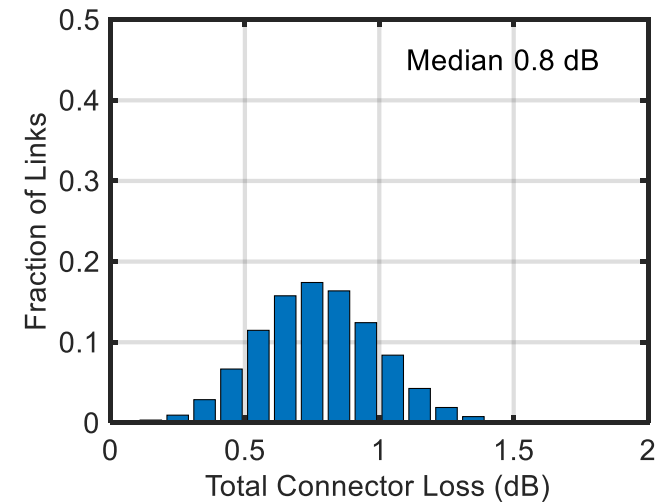
Optical return loss (dB)	Links (%)
> 16	99.9
> 17	99.7
> 18	98.9
> 19	96.1
> 20	87.5



# Connectors	4
Rx Reflectance	-20 dB

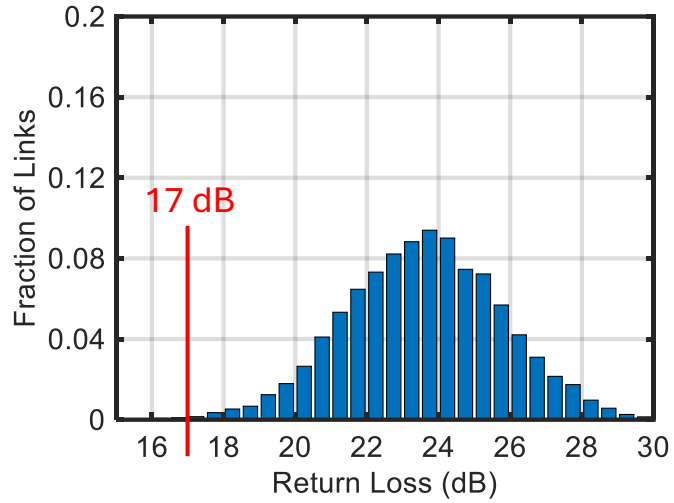


Optical return loss (dB)	Links (%)
> 16	99.9
> 17	99.7
> 18	99.1
> 19	97.3
> 20	92.5

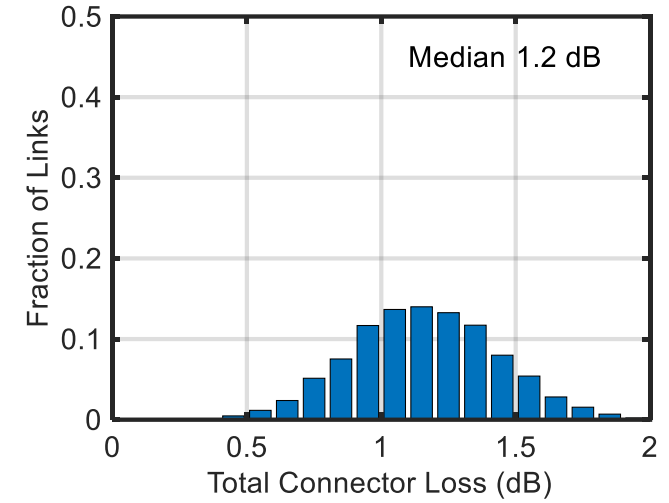


Statistics

# Connectors	6
Rx Reflectance	-20 dB



Optical return loss (dB)	Links (%)
> 16	99.9
> 17	99.7
> 18	99.3
> 19	98.1
> 20	95.1



Similar analysis with Grade A connectors

N	% links with return loss above 17 dB
2	99.3
4	99.1
6	99.1

Summary

Following values are proposed for Clause 300:

Table 300 – 7 Transmit characteristics

Optical return loss tolerance (max)	17 dB
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Table 300 – 8 Receive characteristics

Receiver reflectance (max)	–20 dB
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