Maximum attenuation of multimode fiber



Overview

For multimode transmission, modal dispersion—rather than chromatic dispersion or attenuation—usually limits the maximum bit rate and link length.

Key Takeaways

Multimode fiber attenuation typically ranges from 2. 3–3. 5 dB/km at 850 nm and 0.

6–1. 5 dB/km at 1300 nm, depending on fiber type (OM1–OM5) and laser optimization.

Attenuation Overview

Attenuation in multimode fiber (MMF) refers to the loss of optical power per unit length, usually expressed in dB/km. It is a critical factor in determining the maximum transmission distance for a given data rate and wavelength. Lower attenuation allows longer links without signal repeaters or amplifiers.

Typical Attenuation by Fiber TypeOM1 (62. 5 µm core, LED-optimized): 850 nm: ~3. 5 dB/km1300 nm: ~1.

5 dB/kmSuitable for 1G Ethernet up to 275 m and 10G Ethernet up to 33 m. OM2 (50 µm core, LED-optimized): 850 nm: ~3. 0 dB/km1300 nm: ~1.

0 dB/kmSupports 1G Ethernet up to 550 m and 10G Ethernet up to 33 m. OM3 (50 µm core, laser-optimized): 850 nm: ~3. 5 dB/km1300 nm: ~1.

0 dB/kmDesigned for VCSELs, supports 10G Ethernet up to 300 m, 40G up to 100 m, and 100G up to 100 m. OM4 (50 µm core, laser-optimized, higher bandwidth): 850 nm: ~3. 0 dB/km1300 nm: ~1.

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0 dB/kmExtends 10G Ethernet to 400 m, 40G to 150 m, and 100G to 150 m. OM5 (50 µm core, wideband, SWDM-capable): 850–950 nm: similar attenuation to OM4 (~3. 0 dB/km at 850 nm)Supports multi-wavelength short-range multiplexing for 40G, 100G, and 400G applications.

Key Considerations

Wavelength Dependence: Attenuation is lower at 1300 nm than at 850 nm for all MMF types, but most modern data center applications use 850 nm VCSELs, making 850 nm attenuation the primary design factor.

Laser-

Optimized Fibers: OM3, OM4, and OM5 fibers are optimized for VCSELs, providing lower effective attenuation and higher modal bandwidth compared to older LED-optimized OM1 and OM2 fibers. Distance and Data Rate: The allowable link distance is determined by the total channel loss, which includes fiber attenuation, connector loss, and splice loss. Designers must ensure that the sum of these losses does not exceed the transceiver's power budget.

Standards Compliance: MMF attenuation requirements are defined by TIA-492AAAB/AAAC/AAAD and IEC 60793-2-10, ensuring interoperability and predictable performance across vendors.

Summary

For modern enterprise and data center networks, OM3, OM4, and OM5 fibers are preferred due to their lower attenuation and higher bandwidth, supporting high-speed Ethernet over longer distances. Attenuation values are typically 3. 0–3.

5 dB/km at 850 nm and 1. 0–1. 5 dB/km at 1300 nm, and these values are critical for calculating link budgets and ensuring reliable network performance.

Article Content

Calculate the Maximum Attenuation for Optical Fiber Links

PDF file

Multimode Optical Fiber Selection & Specification - Corning

The OM fiber classification is often referenced in both LAN and DC applications. In general, the higher the OM numerical digit, the higher the system performance one can expect from that particular fiber

Fiber-Optic Cable Signal Loss, Attenuation, and Dispersion | Juniper ...

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For multimode transmission, modal dispersion—rather than chromatic dispersion or attenuation—usually limits the maximum bit rate and link length. For single-mode transmission,

OM1 vs OM2 vs OM3 vs OM4 vs OM5 Multimode Fiber Guide

Compare OM1, OM2, OM3, OM4, and OM5 multimode fiber specs, distances, bandwidth, and applications. Essential guide for data center fiber selection.

Guidelines On What Loss To Expect When Testing Fiber Optic Cables

In MM fibers, the OTDR will underestimate the loss considerably - as much as 3 dB in a 10 dB link - but the amount is unpredictable. In long distance SM links, the difference may be less, but there are

Multi-mode optical fiber

Multi-mode optical fiber is a type of optical fiber mostly used for communication over short distances, such as within a building or on a campus. Multi-mode links can be used for data rates up to 800 Gbit/s.

Fiber Optic Cable Types Explained

Our comprehensive guide to types of fiber optic cables. Learn all about the differences between single mode and multimode cables, as well as the various fiber wavelengths and standard core sizes used

Single Mode vs. Multimode Fiber: Core Differences and Selection Guide

The table below lists typical maximum distances for 10/40/100G rates using single-mode and multimode fiber. For longer-distance, higher-speed 400/800G applications, see the complete

Attenuation vs. Wavelength in Multimode Optical Fiber

850 nm wavelength typically exhibits the highest attenuation in multimode fibers. 1300 nm and 1550 nm wavelengths offer lower attenuation, but modal dispersion becomes more of an issue

Multimode Optical Fiber Selection & Specification

Table 5 provides the bandwidth and attenuation parameters for OM-compliant fiber types specified in Tables 3 and 4. For a fuller explanation of bandwidth characterization in MMF, please consult AE

Multimode raman fiber device with mode discrimination

A multimode optical fiber has a core that includes radially dependent dopant materials to provide a desired refractive index profile and a desired Raman gain coefficient profile. A laser diode

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Multimode vs Single Mode Fiber

Learn the differences between multimode (OM1-OM5) and single mode (OS1-OS2) fiber optic cables—speed, distance, applications, and how to choose the right one for data centers and

The Fiber Optic Association

FOTP-115 Spectral Attenuation Measurement of Step-Index Multimode Optical Fibers FOTP-119 - Coating Geometry Measurement of Optical Fiber by Gray-Scale Analysis (withdrawn July, 2000)

Fiber-optic Attenuators – fixed or variable attenuation,

Fiber-optic attenuators adjust optical signal power levels, for example in fiber-optic links. The degree of attenuation may be fixed or variable.

Single Mode Fiber: Types and Applications

Single Mode Fiber Types: OS1 vs OS2 As we all know, multimode fiber is usually divided into OM1, OM2, OM3, OM4 and OM5 fiber types. When it comes to single mode fiber types, it can be

Fiber Testing Standards 2025 Guide for IEC and TIA

Attenuation This is the total signal loss over the fiber length. IEC 61280-4 and TIA-568.3-D set the maximum allowable attenuation for each fiber

Fiber Optic Cable Specifications Guide | PDF | Optical Fiber | Attenuation

For single mode fibers, it lists parameters such as attenuation, dispersion, mode field diameter, and proof test level. It also provides bend loss specifications for bend-insensitive single mode fibers. For

Fiber Optic Cable Types: A Complete Guide

Their laser optimized multimode fiber designs ensure that you get the maximum performance without undue signal attenuation over their length, and

Comprehensive Guide to Data Center Fiber Optic Systems | Technical ...

Master data center fiber optic implementation with detailed technical specifications, installation procedures, and optimization strategies. Explore advanced configurations, testing protocols, and

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