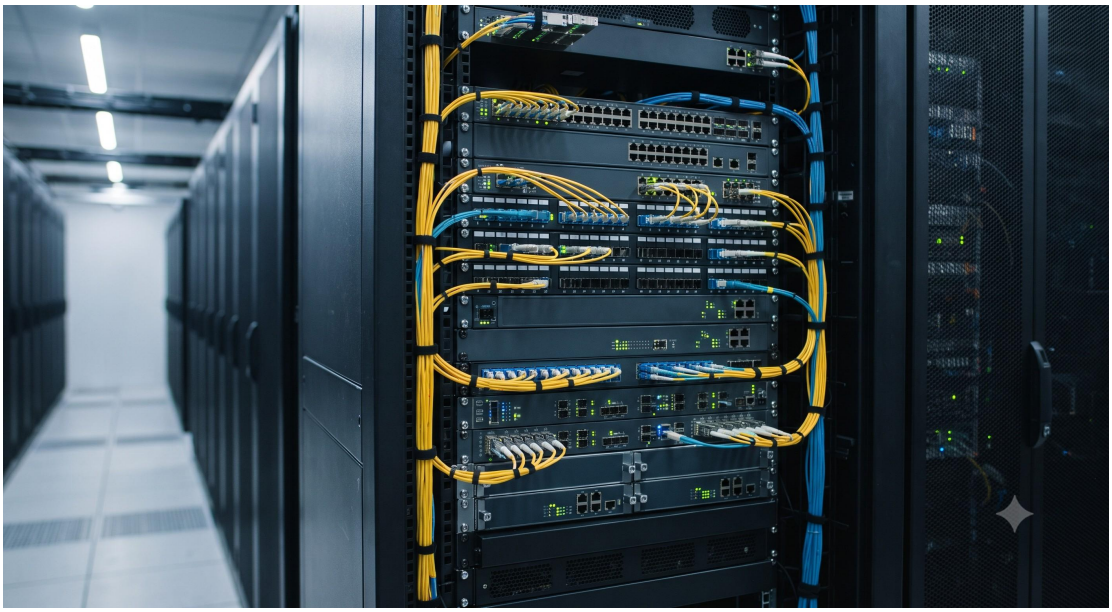
High-Density Fiber Infrastructure Application Note: OEM FTTH Drop Cable Optical Attenuation per Kilometer Standard Values

HIGH-DENSITY FIBER INFRASTRUCTURE APPLICATION NOTE: OEM FTTH DROP CABLE OPTICAL ATTENUATION PER KILOMETER STANDARD VALUES

EXECUTIVE SUMMARY

This document serves as the definitive technical reference for OEM FTTH drop cable optical attenuation characteristics. As fiber-to-the-home deployments scale to meet global broadband demand, precise understanding of attenuation per kilometer values is paramount for link budget calculations, network reliability, and long-term service quality assurance. This application note provides comprehensive attenuation specifications for single-mode and multi-mode drop cable variants, covering industry-standard wavelength windows, environmental impact factors, and quality control benchmarks. Field-proven data supports these values, ensuring network architects and procurement engineers possess the authoritative reference necessary for accurate infrastructure design and material selection.



HARDWARE ARCHITECTURE & SILICON

The optical attenuation performance of FTTH drop cables is intrinsically linked to the physical properties of the glass core and cladding, which are manufactured to exacting OEM specifications. The cables employ high-purity silica glass optimized for minimal Rayleigh scattering and molecular absorption. Key architectural attributes include:

- Core Diameter: 9/125 µm (OS2 single-mode) and 50/125 µm (OM3/OM4 multi-mode) with tight tolerance control (±0.5 µm).
- Cladding Design: Matched-cladding or depressed-cladding profiles to confine light and reduce macrobending losses.
- Coating System: Dual-layer acrylate coating (primary and secondary) with a nominal outer diameter of 245 µm to mitigate micro-bending effects.

- Strength Members: Aramid yarn or glass-reinforced plastic (GRP) to provide tensile strength and protect the fiber from mechanical stress that can induce attenuation.

- Cable Sheath: LSZH (Low Smoke Zero Halogen) or UV-resistant HDPE (High-Density Polyethylene) to ensure environmental durability and maintain optical performance across diverse deployment scenarios, including aerial, duct, and direct-buried installations.

KEY FEATURES & ROUTING LOGIC

OEM FTTH drop cables are engineered to deliver exceptional optical performance with predictable attenuation profiles. The following features and logical operational principles are integral to their design:

- Attenuation Floor at 1310 nm: Standard attenuation of ≤ 0.36 dB/km, typically achieving 0.32–0.34 dB/km under optimum manufacturing conditions. This wavelength is the primary operating window for upstream and downstream communication in GPON/XGS-PON networks.

- Attenuation Floor at 1490 nm: Standard attenuation of ≤ 0.30 dB/km, typically 0.26 – 0.28 dB/km, supporting downstream video and data overlay services.

- Attenuation Floor at 1550 nm: Standard attenuation of ≤ 0.25 dB/km,

typically 0.22 – 0.24 dB/km, critical for long-reach and high-power video distribution.

- Macrobending Sensitivity: Enhanced bend-insensitive fibers (ITU-T G.657.A1/A2) ensure attenuation increase of ≤ 0.1 dB per 10 turns at 10 mm radius for 1550 nm, facilitating deployment in tight spaces such as MDUs (Multi-Dwelling Units).

- Routing Logic: Attenuation values are additive over cable segments; network planners must sum individual span attenuations and include splice/connector losses (typically 0.1–0.3 dB per connector) to calculate total optical path loss.

COMPLIANCE & STANDARDS

All OEM FTTH drop cables strictly adhere to international telecommunication and optical fiber standards to guarantee interoperability and performance. The compliance framework encompasses:

- ITU-T G.652.D: Standard single-mode fiber for terrestrial transmission networks (attenuation and dispersion parameters).

- ITU-T G.657.A1/A2: Bend-insensitive single-mode fiber optimized for access networks and FTTH deployments (reduced macrobending sensitivity).

- ISO/IEC 11801: Generic cabling for customer premises, specifying optical fiber performance categories.

- TIA/EIA-568: Commercial building telecommunications cabling standard, detailing fiber attenuation limits for structured cabling.

- IEC 60793-2: Optical fiber specifications – part 2: Product specifications covering dimensional, mechanical, and transmission characteristics.

- Telcordia GR-20-CORE: Generic requirements for optical fiber and cable, addressing reliability, testing, and environmental performance.

- CE and RoHS Compliant: Ensuring environmental and safety compliance for European market deployment.

TECHNICAL SPECIFICATIONS

OPTICAL ATTENUATION VALUES (per kilometer at 23°C ± 2°C)

- Attenuation (1310 nm): ≤ 0.36 dB/km (Typ. 0.33 dB/km)
- Attenuation (1383 nm): ≤ 0.38 dB/km (water peak compliant)
- Attenuation (1490 nm): ≤ 0.30 dB/km (Typ. 0.27 dB/km)
- Attenuation (1550 nm): ≤ 0.25 dB/km (Typ. 0.23 dB/km)
- Attenuation (1625 nm): ≤ 0.28 dB/km (Typ. 0.26 dB/km)

ENVIRONMENTAL & MECHANICAL FACTORS INFLUENCING ATTENUATION

- Temperature Dependence: Attenuation variation ≤ 0.01 dB/km over -40°C to

+85°C (IEC 60793-1-52).

- Humidity Effects: Attenuation stability within ±0.02 dB/km after 30 days at 85°C / 85% RH (damp heat test).

- Tensile Load Impact: Attenuation increase ≤ 0.05 dB/km under 100 N tensile load for 1 hour.

- Bend Radius: Minimum dynamic bend radius of 20 mm for G.657.A2 fibers without material degradation, increasing attenuation by ≤ 0.1 dB per turn at 10 mm radius.

- Water Penetration: Cable construction prevents water ingress and associated hydrogen-induced attenuation increase.

Parameter	**Specification**
Form Factor	FTTH Drop Cable - 2mm to 5mm Outer Diameter
Wavelength Range	1260 nm – 1625 nm (O, E, S, C, L bands)
Attenuation (1310 nm)	≤ 0.36 dB/km (Typ. 0.33 dB/km)
Attenuation (1490 nm)	≤ 0.30 dB/km (Typ. 0.27 dB/km)
Attenuation (1550 nm)	≤ 0.25 dB/km (Typ. 0.23 dB/km)
Fiber Type	ITU-T G.652.D and G.657.A1/A2 compliant
Tensile Strength	≥ 200 N (short term) / ≥ 80 N (long

	term)
Operating Temperature	-40°C to +85°C
Bend Radius (Dynamic)	≥ 20 mm (G.657.A2)
Cable Jacket	LSZH or UV-Resistant HDPE
Connector Options	SC/APC, SC/UPC, LC/UPC (customer specified)



ORDERING SKU INFORMATION

OEM drop cables are offered in a variety of configurations to support diverse installation requirements. The standard ordering matrix includes:

- SKU: OEM-FTTH-DC-001: 9/125 OS2 single-mode, 2 fibers, LSZH, 1 km spool (Indoor/Outdoor)

- SKU: OEM-FTTH-DC-002: 9/125 OS2 single-mode, 4 fibers, HDPE, 2 km spool (Outdoor/Aerial)

- SKU: OEM-FTTH-DC-003: 50/125 OM4 multi-mode, 2 fibers, LSZH, 500 m spool (Indoor High-Speed Data)

- SKU: OEM-FTTH-DC-004: 9/125 OS2 single-mode, 12 fibers, central loose tube, HDPE, 3 km spool (High-Density Distribution)

- SKU: OEM-FTTH-DC-005: 9/125 OS2 single-mode, 1 fiber, flat drop, LSZH, 1 km spool (Direct Burial / MDU)

Custom termination options (SC/APC, SC/UPC, LC/UPC connectors) and length-specific spooling are available upon request with minimum order quantities (MOQ) as defined in the pricing schedule. Please consult with regional sales representatives for delivery lead times and technical support services.