



Hardware Specifications



Note

The terms "Unidirectional Path Switched Ring" and "UPSR" may appear in Cisco literature. These terms do not refer to using Cisco ONS 15xxx products in a unidirectional path switched ring configuration. Rather, these terms, as well as "Path Protected Mesh Network" and "PPMN," refer generally to Cisco's path protection feature, which may be used in any topological network configuration. Cisco does not recommend using its path protection feature in any particular topological network configuration.

This appendix provides detailed shelf assembly hardware specifications for the Cisco ONS 15600. It includes the following sections:

- [A.1 Shelf Specifications, page A-1](#)
- [A.2 Card Specifications, page A-5](#)
- [A.3 SFP/XFP Specifications, page A-12](#)

A.1 Shelf Specifications

This section provides bandwidth specifications; slot assignments; lists of cards and topologies; shelf dimensions; Cisco Transport Controller (CTC) specifications; the LAN, TL1, modem, and alarm interface specifications; and timing, database, environmental, and power specifications.

A.1.1 Bandwidth

The ONS 15600 has the following bandwidth specifications:

- Total bandwidth: 320 Gbps
- Optical bandwidth: 40 Gbps per slot

A.1.2 Slot Assignments

The ONS 15600 has the following slot assignments:

- Total card slots: 14
- Optical cards: Slots 1 to 4, 11 to 14
- Timing and Shelf Controller (TSC): Slots 5, 10

- Single Shelf Cross Connect (SSXC): Slots 6/7, 8/9

A.1.3 Cards

The ONS 15600 has the following cards:

- TSC
- SSXC
- ASAP
- OC48/STM16 LR16 1550
- OC48/STM16 SR16 1310
- OC192/STM64 LR4 1550
- OC192/STM64 SR4 1310
- OC192/STM64 4 Port ITU C-Band

A.1.4 Configurations

The ONS 15600 has the following configurations:

- 1+1 automatic protections switching (APS) for point-to-point and linear configurations
- Two-fiber path protection
- Path-protected mesh network (PPMN)
- Two-fiber bidirectional line switched ring (BLSR)
- Four-fiber bidirectional line switched ring (BLSR)
- Unprotected

A.1.5 Dimensions

The ONS 15600 has the following dimensions:

- Height: 83.9 inches (2130 mm)
- Width: 23.6 inches (600 mm)
- Depth: 23.6 inches (600 mm)
- Weight: 500 lb (226.8 kg) (without cards)

A.1.6 Cisco Transport Controller

CTC has the following specifications:

- 10/100BaseT
- TSC access: RJ-45 connector
- Backplane access: RJ-45 connector

A.1.7 External LAN Interface

The external LAN interface has the following specifications:

- 10/100BaseT Ethernet
- Backplane access: RJ-45 connector

A.1.8 TL1 Craft Interface

The craft interface has the following specifications:

- Speed: 9600 bps
- Backplane (CAP/CAP2) access: EIA/TIA-232 DB-9 type connector

A.1.9 Modem Interface

The modem interface has the following specifications:

- Hardware flow control
- Backplane (CAP/CAP2) access: EIA/TIA-232 DB-9 type connector

A.1.10 Alarm Interface

The alarm interface has the following specifications:

- Visual: Critical, Major, Minor, Remote
- Audible: Critical, Major, Minor, Remote
- Alarm contacts: 0.045 mm, -48 VDC, 50 mA
- Backplane (CAP/CAP2) access: Alarm pin fields

A.1.11 BITS Interface

The building integrated timing supply (BITS) interface has the following specifications:

- 2 DS-1 BITS inputs
- 2 derived OC-N outputs

A.1.12 System Timing

The ONS 15600 has the following system timing specifications:

- Holdover stability: Stratum 3E per Telcordia GR-253-CORE
- Free running accuracy: +/- 4.6 ppm
- Reference: External BITS, line, internal

A.1.13 Database Storage

The ONS 15600 has the following database storage specifications:

- Nonvolatile memory: 512 MB, IDE FLASH memory

A.1.14 Environmental Specifications

The ONS 15600 has the following environmental specifications:

- Operating temperature: 23 to 122 degrees Fahrenheit (–5 to +50 degrees Celsius)
- Operating humidity: 5 to 95%, noncondensing

A.1.15 Power Specifications

The ONS 15600 has the following power specifications:

- Input voltage: –48 VDC
- Input current: 80 A per channel (six channels provided)
- Power terminals: Lug

[Table A-1](#) lists the power requirements for each card.

Table A-1 Power Requirements for Individual Cards

Card Type	Card Name	Watts
Control Cards	TSC	58
	SSXC	165
Optical Cards	OC48/STM16 LR16 1550	170
	OC48/STM16 SR16 1310	180
	OC192/STM64 LR4 1550	180
	OC192/STM64 SR4 1310	165
	OC192/STM64 4 Port ITU C-Band	180
Multifunction Cards	ASAP	170

[Table A-2](#) lists the power requirements for an individual fan in the fan-tray assembly.

Table A-2 Power Requirements for Individual Fans

Condition	Watts	Amps	BTU/Hr.
Min. at 48 V (ambient temperature less than 25 degrees Celsius (77 degrees Fahrenheit))	12	0.25	41
Max at 48 V (ambient temperature greater than 25 degrees Celsius (77 degrees Fahrenheit))	46	0.95	157

A.2 Card Specifications

This section provides specifications for the following cards:

- TSC
- SSXC
- OC48/STM16 LR/LH 16 Port 1550
- OC48/STM16 SR/SH 16 Port 1310
- OC192/STM64 LR/LH 4 Port 1550
- OC192/STM64 SR/SH 4 Port 1310
- ASAP
- Filler

A.2.1 TSC Card Specifications

Table A-3 shows the TSC card specifications.

Table A-3 TSC Card Specifications

Specification Type	Description
CTC software	Interface: 10/100BaseT LAN Backplane (CAP/CAP2) access: RJ-45
TL1 craft interface	Speed: 10/100BaseT LAN Front panel access: RJ-45 type connector Backplane access: RJ-45 and EIA/TIA-232 DB-9 type connector
Synchronization	Stratum 3E, per Telcordia GR-1244 Free running access: accuracy 4.6 ppm Holdover stability: 3.7×10^{-7} ppm/day including temperature (< 255 slips in first 24 hours) Reference: External BITS, line, internal
Operating temperature	23 to 122 degrees Fahrenheit (–5 to +50 degrees Celsius)
Operating humidity	5 to 95%, noncondensing
Dimensions	Height: 16.50 in. (419 mm) Width: 1.10 in. (28 mm) Depth: 18.31 in. (465 mm) Card weight: 4.0 lb (1.81 kg)
Compliance	When installed in a node, ONS 15600 cards comply with these safety standards: UL 60950, CSA C22.2 No. 950, EN 60950, IEC 60950

A.2.2 SSXC Specifications

Table A-4 shows the SSXC card specifications.

Table A-4 SSXC Card Specifications

Specification Type	Description
Cross-connect	Connection setup time: 7 microseconds Latency: 0.5 microseconds
Operating temperature	23 to 122 degrees Fahrenheit (-5 to +50 degrees Celsius)
Operating humidity	5 to 95%, noncondensing
Dimensions	Height: 16.50 in. (419 mm) Width: 2.36 in. (60 mm) Depth: 18.31 in. (465 mm) Card weight: 5.0 lb (2.27 kg)
Compliance	When installed in a node, ONS 15600 cards comply with these safety standards: UL 60950, CSA C22.2 No. 950, EN 60950, IEC 60950

A.2.3 OC48/STM16 LR/LH 16 Port 1550 Specifications

Table A-5 shows the OC48/STM16 LR/LH 16 Port 1550 card specifications.

Table A-5 OC48/STM16 LR/LH 16 Port 1550 Card Specifications

Specification Type	Description
Line	Bit rate: 2.49 Gbps Code: Scrambled nonreturn to zero (NRZ) Fiber: 1550 nm single-mode Loopback mode: Facility Connectors: OGI Compliance: SONET Telcordia GR-253
Transmitter	Max. transmitter output power: +3 dBm Min. transmitter output power: -2 dBm Center wavelength: 1500 nm to 1580 nm Nominal wavelength: 1550 nm Transmitter: Distributed feedback (DFB) laser Note The CTC Maintenance > Transceiver tab shows the optical power transmitted (OPT) levels. CTC might show OPT levels at 1 dBm greater or less than the actual card OPT level.

Table A-5 OC48/STM16 LR/LH 16 Port 1550 Card Specifications (continued)

Specification Type	Description
Receiver	<p>Max. receiver level: -9 dBm</p> <p>Min. receiver level: -28 dBm</p> <p>Receiver: InGaAs Avalanche Photo Diode (APD) photo detector</p> <p>Link loss budget: 26 dB minimum, with 1 dBm dispersion penalty</p>
Loopback mode	<p>Facility (Line)</p> <p>Note You must use a 19 to 24 dBm fiber attenuator (15 to 20 dBm is recommended) when connecting a fiber loopback to an OC48/STM16 LR/LH 16 Port 1550 card. Never connect a direct fiber loopback.</p>
Operating temperature	23 to 122 degrees Fahrenheit (-5 to +50 degrees Celsius)
Operating humidity	5 to 95%, noncondensing
Dimensions	<p>Height: 16.50 in. (419 mm)</p> <p>Width: 1.50 in. (38 mm)</p> <p>Depth: 18.31 in. (465 mm)</p> <p>Card weight: 5.0 lb (2.27 kg)</p>
Compliance	<p>SONET Telcordia GR-253</p> <p>When installed in a node, ONS 15600 cards comply with these safety standards: UL 60950, CSA C22.2 No. 950, EN 60950, IEC 60950</p> <p>Eye safety compliance: Class 1 (21 CFR 1040.10 and 1040.11) and Class 1 (IEC 60825) laser products</p>

A.2.4 OC48/STM16 SR/SH 16 Port 1310 Specifications

Table A-6 shows the OC48/STM16 SR/SH 16 Port 1310 card specifications.

Table A-6 OC48/STM16 SR/SH 16 Port 1310 Card Specifications

Specification Type	Description
Line	Bit rate: 2.49 Gbps Code: Scrambled NRZ Fiber: 1310 nm single-mode Loopback mode: Facility Connectors: OGI Compliance: SONET Telcordia GR-253
Transmitter	Max. transmitter output power: -3 dBm Min. transmitter output power: -10 dBm Center wavelength: 1266 nm to 1360 nm Nominal wavelength: 1310 nm Transmitter: Fabry Perot laser Note The CTC Maintenance > Transceiver tab shows the OPT levels. CTC might show OPT levels at 1 dBm greater or less than the actual card OPT level.
Receiver	Max. receiver level: -3 dBm Min. receiver level: -18 dBm Receiver: Positive-intrinsic-negative (PIN) diode Link loss budget: 8 dBm min., with 1 dBm dispersion penalty
Loopback mode	Facility (Line) Note You must use a 3-dBm fiber attenuator when connecting a fiber loopback to an OC48/STM16 SR/SH 16 port 1310 card. Never connect a direct fiber loopback.
Operating temperature	23 to 122 degrees Fahrenheit (-5 to +50 degrees Celsius)
Operating humidity	5 to 95%, noncondensing
Dimensions	Height: 16.50 in. (419 mm) Width: 1.50 in. (38 mm) Depth: 18.31 in. (465 mm) Card weight: 5.0 lb (2.27 kg)
Compliance	SONET Telcordia GR-253 When installed in a node, ONS 15600 cards comply with these safety standards: UL 60950, CSA C22.2 No. 950, EN 60950, IEC 60950 Eye safety compliance: Class 1 (21 CFR 1040.10 and 1040.11) and Class 1 (IEC 60825) laser products

A.2.5 OC192/STM64 LR/LH 4 Port 1550 Specifications

Table A-7 shows the OC192/STM64 LR/LH 4 Port 1550 card specifications.

Table A-7 OC192/STM64 LR/LH 4 Port 1550 Card Specifications

Specification Type	Description
Line	Bit rate: 9.96 Gbps Code: Scrambled NRZ Fiber: 1550 nm single mode
Transmitter	Max. transmitter output power: +7 dBm Min. transmitter output power: +4 dBm Center wavelength: 1530 nm to 1565 nm Nominal wavelength: 1550 nm Transmitter: Lithium Niobate (LN) external modulator transmitter
Receiver	Max. receiver level: -9 dBm Min. receiver level: -22 dBm Receiver: APD/TIA Link loss budget: 24 dB min., with no dispersion or 22 dB optical path loss at BER = 1^{-12} including dispersion
Loopback mode	Payload Note You must use a 19 to 24 dB fiber attenuator (15 to 20 is recommended) when connecting a fiber loopback to an OC192/STM64 LR/LH 4 Port 1550 card. Never connect a direct fiber loopback.
Connectors	OGI
Operating temperature	23 to 122 degrees Fahrenheit (-5 to +50 degrees Celsius)
Operating humidity	5 to 95%, noncondensing
Dimensions	Height: 16.50 in. (419 mm) Width: 1.50 in. (38 mm) Depth: 18.31 in. (465 mm) Card weight: 12.0 lb (5.44 kg)
Compliance	SONET Telcordia GR-253 When installed in a node, ONS 15600 cards comply with these safety standards: UL 60950, CSA C22.2 No. 950, EN 60950, IEC 60950 Eye safety compliance: Class 1 (21 CFR 1040.10 and 1040.11) and Class 1 (IEC 60825) laser products

A.2.6 OC192/STM64 SR/SH 4 Port 1310 Specifications

Table A-8 shows the OC192/STM64 SR/SH 4 Port 1310 card specifications.

Table A-8 OC192/STM64 SR/SH 4 Port 1310 Card Specifications

Specification Type	Description
Line	Bit rate: 9.96 Gbps Code: Scrambled NRZ Fiber: 1310 nm single mode
Transmitter	Max. transmitter output power: -1 dBm Min. transmitter output power: -6 dBm Center wavelength: 1290 nm to 1330 nm Nominal wavelength: 1310 nm
Receiver	Max. receiver level: -1 dBm Min. receiver level: -11 dBm Link loss budget: -5 dB min., with no dispersion or 4 dB optical path loss at BER = 1^{-12} including dispersion
Loopback mode	Payload Note You must use a 3-dBm fiber attenuator when connecting a fiber loopback to an OC192/STM64 SR/SH 4 Port 1310 card. Never connect a direct fiber loopback.
Connectors	OGI
Operating temperature	23 to 122 degrees Fahrenheit (-5 to +50 degrees Celsius)
Operating humidity	5 to 95%, noncondensing
Dimensions	Height: 16.50 in. (419 mm) Width: 1.50 in. (38 mm) Depth: 18.31 in. (465 mm) Card weight: 12.0 lb (5.44 kg)
Compliance	SONET Telcordia GR-253 When installed in a node, ONS 15600 cards comply with these safety standards: UL 60950, CSA C22.2 No. 950, EN 60950, IEC 60950 Eye safety compliance: Class 1 (21 CFR 1040.10 and 1040.11) and Class 1 (IEC 60825) laser products

A.2.7 ASAP Specifications

Table A-9 shows the ASAP card specifications.

Table A-9 ASAP Card Specifications

Specification Type	Description
Carrier Card (CC)	Contains slots for four pluggable ASAP I/O cards, which can be used to provide a variety of optical line interfaces. The CC provides 4 electrical STS-48 or Gigabit Ethernet signals to each ASAP I/O card (for 16 total) and 16 redundant electrical STS-48 matrix interfaces to the backplane. For SONET interfaces, the CC card provides pointer processing and overhead extraction/insertion.
4PIO Pluggable I/O card	The ASAP 4PIO module is a four-port multirate optical interface card. It has four slots for Small Form-factor Pluggable (SFP) optics. The four ports can be provisioned on a per-port basis as OC-3, OC-12, OC-48, or Gigabit Ethernet interfaces.
1PIO Pluggable I/O card	The ASAP 1PIO module is a single-port single-rate optical interface card. It has one slot for XFP optics. The port can be provisioned for one OC-192 interface.
Payloads	Nonconcatenated and/or concatenated payloads at STS-1, STS-3c, STS-6C, STS-9C, STS-12c, STS-24c, STS-48c, and STS-192c are supported. For Gigabit Ethernet interfaces, Layer 1 Ethernet transport is also implemented.
SFP support	ONS-SE-Z1: Supports OC-3 SR-1, OC-12 SR-1, OC-48 IR-1 or GE LX ONS-SI-155-L2: Supports OC-3 LR-2 ONS-SI-622-L2: Supports OC-12 LR-2 ONS-SE-2G-L2: Supports OC-48 LR-2 ONS-SI-2G-S1: Supports OC-48, LR-2
XFP support	ONS-XC-10G-S1: Supports OC-192 SR-1 ONS-XC-10G-L2: Supports OC-192 LR-2
Connectors	Up to 16 SFP connectors (4 per 4PIO module) or 4 XFP connectors (1 per 1PIO module), at front edge of card
Power	130 W to 180 W (maximum)
Operating temperature	23 to 131 degrees Fahrenheit (-5 to +55 degrees Celsius)
Operating humidity	5 to 95%, noncondensing
Dimensions	Height: 16.50 in. (419 mm) Width: 1.50 in. (38 mm) Depth: 18.31 in. (465 mm) Card weight: approximately 6 lb (13.22 kg)
Compliance	SONET Telcordia GR-253 When installed in a system, ONS 15600 cards comply with these safety standards: UL 60950, CSA C22.2 No. 950, EN 60950, IEC 60950 Eye safety compliance: Class 1 (21 CFR 1040.10 and 1040.11) and Class 1 (IEC 60825) laser products

A.2.8 Filler Card Specifications

Table A-10 shows the Filler card specifications.

Table A-10 Filler Card Specifications

Specification Type	Description
Dimensions	Height: 16.50 in. (419 mm) Width: 1.50 in. (38 mm) Depth: 18.31 in. (465 mm) Card weight: 2.5 lb (1.134 kg)

A.3 SFP/XFP Specifications

Table A-11 and Table A-12 list the specifications for Cisco ONS 15600 SFPs and XFPs .

Table A-11 SFP Specifications (4PIO Only)

SFP Product ID	Interface	Transmitter Output Power Min/Max (dBm)	Receiver Input Power Min/Max (dBm)
ONS-SI-622-L2	OC-12, STM-4	-3.0 to 2.0	-28 to -8
ONS-SI-155-L2	OC-3, STM-1	-5.0 to 0.0	-34 to -10
ONS-SE-2G-L2	OC-48, STM-16	-2.0 to 3.0	-28 to -9
ONS-SE-Z1	OC-3/12/48, STM-1/4/16	-5.0 to 0	-23 to -3 (155.52/622.08 Mbps) -19 to -3 (1250 Mbps) -18 to 0 (2488.32 Mbps)
ONS-SI-2G-S1	OC-48, STM-16	-2.0 to 3.0	-9

Table A-12 XFP Specifications (1PIO Only)

SFP Product ID	Interface	Transmitter Output Power Min/Max (dBm)	Receiver Input Power Min/Max (dBm)
ONS-XC-10G-S1	OC-192, STM-64	-6.0 to -1.0	-11.0 to -1.0
ONS-XC-10G-L2	OC-192, STM-64	0.0 to 4.0	-24.0 to -7.0

The OC-48/STM16 also supports 32-channel SFPs for DWDM applications; 32-channel SFPs can be plugged into the four-port ASAP card 4PIO module.

Some of the parameters common across all 32 DWDM SFPs include:

- Receiver wavelength: 1260 to 1620 nm
- Minimum overload: -9 dBm
- Maximum reflectance of receiver, measured at Rs: -27 dB
- Maximum receiver power, damage threshold: +5 dBm

- Transmitter output power min/max (dBm): 0 to +4 dBm

Table A-13 lists the available DWDM SFPs.

Table A-13 ASAP Card 4PI0 DWDM SFP Specifications

SFP Product ID	Interface	Wavelength ¹
ONS-SC-2G-30.3	OC-48/STM16	1530.3 nm
ONS-SC-2G-31.1	OC-48/STM16	1531.1 nm
ONS-SC-2G-31.9	OC-48/STM16	1531.9 nm
ONS-SC-2G-32.6	OC-48/STM16	1532.6 nm
ONS-SC-2G-34.2	OC-48/STM16	1534.2 nm
ONS-SC-2G-35.0	OC-48/STM16	1535.0 nm
ONS-SC-2G-35.8	OC-48/STM16	1535.8 nm
ONS-SC-2G-36.6	OC-48/STM16	1536.6 nm
ONS-SC-2G-38.1	OC-48/STM16	1538.1 nm
ONS-SC-2G-38.9	OC-48/STM16	1538.9 nm
ONS-SC-2G-39.7	OC-48/STM16	1539.7 nm
ONS-SC-2G-40.5	OC-48/STM16	1540.5 nm
ONS-SC-2G-42.1	OC-48/STM16	1542.1 nm
ONS-SC-2G-42.9	OC-48/STM16	1542.9 nm
ONS-SC-2G-43.7	OC-48/STM16	1543.7 nm
ONS-SC-2G-44.5	OC-48/STM16	1544.5 nm
ONS-SC-2G-46.1	OC-48/STM16	1546.1 nm
ONS-SC-2G-46.9	OC-48/STM16	1546.9 nm
ONS-SC-2G-47.7	OC-48/STM16	1547.7 nm
ONS-SC-2G-48.5	OC-48/STM16	1548.5 nm
ONS-SC-2G-50.1	OC-48/STM16	1550.1 nm
ONS-SC-2G-50.9	OC-48/STM16	1550.9 nm
ONS-SC-2G-51.7	OC-48/STM16	1551.7 nm
ONS-SC-2G-52.5	OC-48/STM16	1552.5 nm
ONS-SC-2G-54.1	OC-48/STM16	1554.1 nm
ONS-SC-2G-54.9	OC-48/STM16	1554.9 nm
ONS-SC-2G-55.7	OC-48/STM16	1555.7 nm
ONS-SC-2G-56.5	OC-48/STM16	1556.5 nm
ONS-SC-2G-58.1	OC-48/STM16	1558.1 nm
ONS-SC-2G-58.9	OC-48/STM16	1558.9 nm
ONS-SC-2G-59.7	OC-48/STM16	1559.7 nm
ONS-SC-2G-60.6	OC-48/STM16	1560.6 nm

1. Typical loss on a 1310-nm wavelength SMF is 0.6 dB/km.

Table A-14 describes the power and noise limited performances parameters for the OC-SC-2G series SFPs.

Table A-14 Power and Noise Limited Performances

Parameter	Power Limited Performances		Noise Limited Performances	
Input power range	-9 to -28 dBm	At BER = 10^{-12} with SONET framed PRBS23 622 Mbps – 2.0 Gbps at OSNR ¹ of 20 dB, 0.1 nm bandwidth 2.0Gbps – 2.7Gbps at OSNR of 21dB, 0.1 nm bandwidth	-9 to -22 dBm	At BER = 10^{-12} with SONET framed PRBS23 At OSNR of 16 dB at 0.1 nm bandwidth.
Dispersion tolerance	-800 to 3600 dBm	622 Mbps – 2.0 Gbps Power penalty = 3 dB OSNR = 20 dB at 0.1 nm bandwidth (Noise penalty = 0 dB)	-800 to 3600 dBm	622 Mbps – 2.0 Gbps Noise penalty = 2 dB OSNR = 18 dB at 0.1 nm bandwidth (Power penalty = 0 dB)
	-800 to 2400 dBm	2.0 Gbps – 2.7 Gbps Power penalty = 3 dB OSNR = 21 dB at 0.1 nm bandwidth (Noise penalty = 0 dB)	-800 to 2400 dBm	2.0 Gbps – 2.7 Gbps Noise penalty = 3 dB OSNR = 19 dB at 0.1 nm bandwidth (Power penalty = 0 dB)

1. OSNR = optical signal-to-noise ratio

Table A-15 provides cabling specifications for the single-mode fiber (SMF) SFPs/XFPs. The ports of the listed SFPs/XFPs have LC-type connectors and the minimum cable distance for all SFPs/XFPs listed is 6.5 feet (2 m). Maximum cable distance for all SFPs/XFPs listed is 328 ft (100 m).

Table A-15 Single-Mode Fiber SFP/XFP Port Cabling Specifications

SFP Product ID	Wavelength ¹	Fiber Type	Cable Distance
ONS-SI-622-L2 Long Reach	1550 nm	9 micron SMF	80 km (49.71 mi.)
ONS-SE-2G-L2	1550 nm	9 micron SMF	80 km (49.71 mi.)
ONS-SE-Z1	1310 nm	9 micron SMF	15 km (9.3 mi.)
ONS-SI-155-L2	1550 nm	9 micron SMF	80 km (49.71 mi.)
ONS-XC-10G-S1	1310 nm	9 micron SMF	2 km (1.2 miles)
ONS-XC-10G-L2	1550 nm	9 micron SMF	80 km (49.71 miles)
ONS-SI-2G-S1	1310 nm	9 micron SMF	80 km (49.71 mi.)

1. Typical loss on a 1310-nm wavelength SMF is 0.6 dB/km.