Installing Tranceivers and Optical Components on Avaya Virtual Services Platform 9000

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Contents

Chapter 1: Introduction

Purpose

This document provides installation instructions and technical specifications for the following:

- Small form factor pluggable (SFP) transceivers
- SFP plus (SFP+) transceivers
- Quad small form factor pluggable plus (QSFP+) transceivers

For a list of supported transceivers, see the latest product-specific release notes. Information in the release notes takes precedence over information in this document.

Related resources

Documentation

See *Documentation Reference for Avaya Virtual Services Platform 9000,* NN46250-100 for a list of the documentation for this product.

Training

Ongoing product training is available. For more information or to register, you can access the website at http://avaya-learning.com/.

Course code	Course title
4D00010E	Knowledge Access: ACIS - Avaya ERS 8000 and VSP 9000 Implementation
5D00040E	Knowledge Access: ACSS - Avaya VSP 9000 Support

Viewing Avaya Mentor videos

Avaya Mentor videos provide technical content on how to install, configure, and troubleshoot Avaya products.

About this task

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Procedure

- To find videos on the Avaya Support website, go to http://support.avaya.com and perform one of the following actions:
  - In **Search**, type `Avaya Mentor Videos` to see a list of the available videos.
  - In **Search**, type the product name. On the Search Results page, select **Video** in the **Content Type** column on the left.
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  - Enter a key word or key words in the **Search Channel** to search for a specific product or topic.
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Go to the Avaya Support website at http://support.avaya.com for the most up-to-date documentation, product notices, and knowledge articles. You can also search for release notes, downloads, and resolutions to issues. Use the online service request system to create a service request. Chat with live agents to get answers to questions, or request an agent to connect you to a support team if an issue requires additional expertise.

Searching a documentation collection

On the Avaya Support website, you can download the documentation library for a specific product and software release to perform searches across an entire document collection. For example, you can perform a single, simultaneous search across the collection to quickly find all occurrences of a particular feature. Use this procedure to perform an index search of your documentation collection.

Before you begin

- Download the documentation collection zip file to your local computer.
- You must have Adobe Acrobat or Adobe Reader installed on your computer.

Procedure

1. Extract the document collection zip file into a folder.
2. Navigate to the folder that contains the extracted files and open the file named <*product_name_release*>.pdx.
3. In the Search dialog box, select the option **In the index named <*product_name_release*>.pdx**.
4. Enter a search word or phrase.
5. Select any of the following to narrow your search:
   - Whole Words Only
   - Case-Sensitive
   - Include Bookmarks
   - Include Comments
6. Click **Search**.

   The search results show the number of documents and instances found. You can sort the search results by Relevance Ranking, Date Modified, Filename, or Location. The default is Relevance Ranking.

Locating end of sale notices

Use the following procedure to locate the most up-to-date information on end of sale notices and replacement recommendations for transceivers and optical components.

Procedure

1. Go to the Avaya Support website at http://support.avaya.com/.
2. Select **Support by Product** > **Documents**.
3. Enter the product name, and a release.
4. Select Product Lifecycle Notices.
5. Click **Enter**.
6. Select the End of Sale notice to view the information.

Chapter 2: New in this release

The following sections detail what is new in *Installing Transceivers and Optical Components on Avaya Virtual Services Platform 9000,* NN46250-305, for Release 4.1.

Features

See the following sections for information about feature changes.

Release 4.1 adds the following SFP+ and QSFP+ modules and cables.

Bidirectional SFP+ optical transceiver

Release 4.1 adds support for the 10GBASE-BX SFP+ bidirectional transceivers.

Model	Part number
10GBASE-BX SFP+ bidirectional transceivers, 10 kilometer	AA1403169, AA1403170

For more information, see

- 10GBASE-BX SFP+ specifications on page 47.
- Job aid on page 32.

End of sale notices

Release 4.1 adds information on how to locate the most up-to-date information on end of sale notices and replacement recommendations for transceivers and optical components. For more information, see Locating end of sale notices on page 8.

QSFP+ optical transceiver

Release 4.1 adds the following two QSFP+ optical transceivers.

Model	Part number
40GBase-LM4 QSFP+	AA1404002-E6
40GBASE-ER4 QSFP+	AA1404003-E6

Information has been updated on the 40GBASE-ER4 QSFP+ since the initial release of this document.

For more information, see

- 40GBASE-LM4 QSFP+ specifications on page 58.
- 40GBASE-ER4 QSFP+ specifications on page 59.

QSFP+ Direct Attach Cable (DAC)

The QSFP+ to QSFP+ 40 gigabit Direct Attach Cable (DAC) assembly directly connects two QSFP+ ports. The new 10 meter cable is added in this release.

Model	Part number
QSFP+ to QSFP+ 40G, 10 meter active DAC	AA1404028-E6

For more information, see QSFP+ to QSFP+ 40-gigabit direct attach cable specifications on page 63.

QSFP+ breakout cable specifications

The QSFP+ to four SFP+ 10 Gigabit Ethernet (GbE) breakout cable (BOC) assembly directly connects one QSFP+ port to four SFP+ ports. The new 1, 3, 5, 10 meter cables are added in this release.

Note:

Avaya Virtual Services Platform 9000 does not support the 40 Gigabit Ethernet ends of the QSFP+ breakout cables because the platform does not support channelization on the VSP 9012QQ-2 module. Avaya Virtual Services Platform 9000 supports only the four SFP+ 10 Gigabit Ethernet ends of the following QSFP+ breakout cables: AA1404033-E6, AA1404035-E6, AA1404036-E6, and AA1404041-E6.

Model	Part number
QSFP+ to 4 SFP+ breakout cable, 1 meter (Passive)	AA1404033-E6
QSFP+ to 4 SFP+ breakout cable, 3 meter (Passive)	AA1404035-E6
QSFP+ to 4 SFP+ breakout cable, 5 meter (Passive)	AA1404036-E6
Fiber QSFP+ to 4 SFP+ breakout cable, 10 meter (Active)	AA1404041-E6

For more information, see:

- Job aid on page 51.
- QSFP+ breakout cable specifications on page 62.

Supported SFP+ 10-Gigabit DACs

The following SFP+ 10-Gigabit DACs were added in Release 4.1.

Cable type	Part number	Description
10GBASE-CX SFP+ 2-pair twinaxial copper cable that plugs into the SFP+ socket and connects two 10-gigabit ports	AA1403019–E6	SFP+ DAC 3 meter

Table continues…

Cable type	Part number	Description
10GBASE-CX SFP+ 2-pair twinaxial copper cable that plugs into the SFP+ socket and connects two 10-gigabit ports	AA1403020–E6	SFP+ DAC 5 meter
10GBASE-CX SFP+ 2-pair twinaxial copper cable that plugs into the SFP+ socket and connects two 10-gigabit ports.	AA1403022–E6	SFP+ DAC 7 meter
10GBASE-CX SFP+ 2-pair twinaxial copper cable that plugs into the SFP+ socket and connects two 10-gigabit ports.	AA1403021–E6	SFP+ DAC 15 meter

For more information, see 10GBASE-CX specifications on page 44.

Other changes

There are no other changes in this release.

Chapter 3: Safety and equipment care

This chapter contains important safety and regulatory information. Read this section before you install Small Form Factor Pluggable (SFP) and Small Form Factor Pluggable Plus (SFP+).

Fiber optic equipment care

Use the information in this section to properly maintain and care for fiber optic equipment.

Transceivers are static sensitive.

Dust contamination can reduce the performance of optical parts in transceivers. When you store a transceiver, or after you disconnect it from a fiber optic cable, always keep a dust cover over the optical bore.

Dispose of this product according to all national laws and regulations.

To prevent equipment damage, observe the following electrostatic discharge (ESD) precautions when you handle or install the components:

- Ground yourself and the equipment to an earth or building ground. Use a grounded workbench mat (or foam that dissipates static charge) and a grounding wrist strap. The wrist strap must touch the skin and you must ground it through a one megaohm resistor.
- Do not touch anyone who is not grounded
- Leave all components in their ESD-safe packaging until installation, and use only a static-shielding bag for all storage, transport, and handling.

  Clear the area of synthetic materials such as polyester, plastic, vinyl, or styrofoam because these materials carry static electricity that damages the equipment.

Fiber optic cable care

Although reinforcing material and plastic insulation protects the glass fiber in fiber optic cable, it is subject to damage.

Use the following precautions to avoid damaging the glass fiber:

- Do not kink, knot, or vigorously flex the cable.

- Do not bend the cable to less than a 40 mm radius.
- Do not stand on fiber optic cable; keep the cable off the floor.
- Do not pull fiber optic cable harder than you do a cable containing copper wire of comparable size.
- Do not allow a static load of more than a few pounds on a section of the cable.
- Place protective caps on fiber optic connectors that are not in use.
- Store unused fiber optic patch cables in a cabinet, on a cable rack, or flat on a shelf.

Frequent overstressing of fiber optic cable causes progressive degeneration that leads to failure.

If you suspect damage to a fiber optic cable, either due to mishandling or an abnormally high error rate observed in one direction, reverse the cable pairs. If the high error rate appears in the other direction, replace the cable.

Warning:

Risk of equipment damage

Do not crush fiber optic cable. If fiber optic cable is in the same tray or duct with large, heavy electrical cables, the weight of the electrical cable can damage the fiber optic cable.

Fiber optic connector care

Before you connect fiber optic connectors to transmission equipment, test equipment, patch panels, or other connectors, ensure fiber optic connectors are clean. The performance of an optical fiber connector depends on how clean the connector and coupling are at the time of connection.

A damaged or dirty connector can damage a connector with which it pairs. A connector must be clean before you insert it into a transmitter or receiver.

Never clean an optical connector while it carries light. Optical power can cause ignition of the cleaning material when it contacts the end of the optical connector and can destroy the connector. Typical cleaning materials, for example, tissues saturated with alcohol, combust almost instantaneously after you expose them to optical power levels of +15 dBm or higher.

Visually inspect the connector to determine cleanliness and to determine if it needs replacing. You must replace a connector that has a scratch across the core, or a scratch that appears to end in the core.

The proper connector cleaning method depends on the connector contaminants:

- Judge cleanliness by visual inspection with a fiber microscope. First inspect the connector, and then clean as required.

  Danger:

  Risk of eye injury

When you inspect a connector, ensure that light sources are off. The light source in fiber optic cables can damage your eyes.

- If you suspect only the possibility of dust particles, for example, if you leave a connector uncapped in a clean environment, use high-quality canned air or a reel cleaner, for example, a Cletop, to clean the connector. A reel cleaner is a good choice to ensure that no dust contaminates the connector.
- If the connector is visibly dirty or you suspect contamination by chemicals (for example, matching gel), use high-quality alcohol and canned air to clean the connector. This method is the most thorough cleaning method. In some cases, a reel cleaner can suffice.

The more surface manipulation you apply to the connector, the more likely you are to damage the connector.

When you insert a connector ferrule into a connector or adapter, ensure that the ferrule tip does not touch the outside of the mating connector or adapter. This action can produce scratches and dirt deposits on the connector.

To help prevent connectors from collecting dust, cover them when not in use. To avoid the transfer of oil or other contaminants from your fingers to the end face of the ferrule, handle connectors with care. Do not touch the connector end face.

Cleaning single connectors

Clean connectors so that the optical signal is minimally attenuated by the connector.

Perform this procedure if you suspect more than dust contamination.

Before you begin

- You need a lens-grade, lint-free tissue, for example, Kimwipes.
- You need an optical-grade isopropyl alcohol (IPA) (98% or more pure).
- You need a high-quality canned compressed air with extension tube.

  Compressed air must be free of dust, water, and oil, or filmy deposits or scratches on the surface of the connector can result.
- You need a fiber optic microscope to inspect connectors.

Danger:

Risk of eye injury

When you inspect a connector, ensure that light sources are off. The light source used in fiber optic cables can damage your eyes.

To avoid getting debris in your eyes, wear safety glasses when you work with the canned air duster.

To avoid eye irritation on contact, wear safety glasses when you work with isopropyl alcohol.

Procedure

1. Remove dust or debris by applying canned air to the cylindrical and end-face surfaces of the connector.
2. Gently wipe the cylindrical and end-face surfaces with a tissue dampened with optical-grade isopropyl alcohol.
3. Gently wipe the cylindrical and end-face surfaces with a dry tissue.

   Important:

   Do not let the IPA evaporate; wipe it dry immediately. Alcohols can leave a residue that is difficult to remove.
4. Dry the connector surfaces by applying canned air.
5. Inspect the connector to ensure it is clean and undamaged.

   To prevent contamination, do not touch the connector surfaces after cleaning; and cover connectors with dust caps if they are not in use.

Cleaning duplex connectors

Clean connectors so that the optical signal is minimally attenuated by the connector.

Perform this procedure when you suspect more than dust contamination.

Before you begin

- You need a lens-grade, lint-free tissue, for example, Kimwipes.
- You need an optical-grade isopropyl alcohol (IPA) (98% or more pure).
- You need a high-quality canned compressed air with extension tube.

  Compressed air must be free of dust, water, and oil, or filmy deposits or scratches on the surface of the connector can result.
- You need a fiber optic microscope to inspect connectors.

About this task

Danger:

Risk of eye injury

When you inspect a connector, ensure that light sources are off. The light source in fiber optic cables can damage your eyes.

To avoid getting debris in your eyes, wear safety glasses when you work with the canned air duster.

To avoid eye irritation on contact, wear safety glasses when you work with isopropyl alcohol.

Procedure

1. Remove or retract the shroud.

On removable shroud connectors, hold the shroud on the top and bottom at the letter designation, apply medium pressure, and then pull it free from the connector body. Do not discard the shroud.

OR

On retractable shroud connectors, hold the shroud in the retracted position.

2. Remove dust or debris by applying canned air to the cylindrical and end-face surfaces of the connector.
3. Gently wipe the cylindrical and end-face surfaces of both ferrules using a tissue saturated with optical-grade isopropyl alcohol.
4. Gently wipe the cylindrical and end-face surfaces with a dry tissue.

   Important:

   Do not let the IPA evaporate; wipe it dry immediately. Alcohols can leave a residue that is difficult to remove.
5. Blow dry the connector surfaces with canned air.
6. Inspect the connector to ensure it is clean and undamaged.
7. Using care to not touch the clean ferrules, gently push the shroud back onto the connector until it seats and locks in place.

Cleaning receptacles

Clean connector receptacles or ports so that the optical signal is minimally attenuated by the connection.

Before you begin

- You need an optical-grade isopropyl alcohol (IPA) (98% or more pure).
- You need cleaning swabs (also called cleaning sticks or wands).
- You need a high-quality canned compressed air with extension tube.

  Compressed air must be free of dust, water, and oil, or filmy deposits or scratches on the surface of the connector can result.

Warning:

Risk of equipment damage

To avoid contamination, only clean optical ports if you see evidence of contamination or reduced performance exists, or during their initial installation.

To prevent oil contamination of connectors, use only high-quality canned compressed air.

Do not allow the air extension tube to touch the bottom of the optical port.

Procedure

1. Remove dust or debris by blowing canned air into the optical port of the device using the canned air extension tube.
2. Clean the optical port by inserting a wand moistened with alcohol into the receptacle and rotating it.

   Use each cleaning wand to clean only one optical port.
3. Dry the optical port by inserting a dry wand into the receptacle and rotating it.

   Important:

   Do not let the IPA evaporate; wipe it dry immediately. Alcohols can leave a residue that is difficult to remove.
4. Remove lint by blowing compressed air into the optical port.
5. Reconnect the optical connector and check for proper function.

   If you do not reinstall the connector, use a protective cap.

   If problems persist, ensure that the connector or receptacle is free from damage.

Chapter 4: SFP

This chapter provides installation procedures and specifications for small form factor pluggable (SFP) transceivers.

SFP transceivers

This section describes how to select and install small form factor pluggable (SFP) transceivers.

Important:

- The Virtual Services Platform 9000 operates in forgiving mode for SFP transceivers, which means that the switch will bring up the port operationally when using Non-Avaya SFP transceivers. Avaya does not provide support for operational issues related to these SFPs, but they will operate and the port link will come up. The switch logs the device as an unsupported or unknown device.

Selecting an SFP

Use an SFP transceiver to connect a device motherboard to a fiber optic or unshielded twisted pair network cable. Select the appropriate transceiver to provide the required reach.

Procedure

1. Determine the required reach.

   Depending on the product, SFP transceivers are available for cable distances of up to 100 meters (m), 550 m, 10 kilometers (km), 40 km, 70 km, and 120 km.

2. Determine the required media and connector type.

   You need fiber optic cable for a reach over 100 m.

   Possible media include CAT5, single mode fiber, and multimode fiber. Possible connectors include LC, MT-RJ, and RJ-45.

3. If the media is optical fiber, determine wavelength restrictions or requirements.

   To expand available bandwidth on a common optical fiber, use Coarse Wavelength Division Multiplexing (CWDM) SFP transceivers.

4. Determine if you need digital diagnostic monitoring (DDM). DDM is enabled by default.

   Not all SFP transceivers or products support DDM.

Job aid

The following table describes the reach provided by various SFP transceivers. This table is informational only—not all Avaya products support all the SFP transceivers listed here.

SFP model	Common application
1000BASE-T SFP	Lowest-cost gigabit Ethernet solution. Up to 100 m reach over Category 5 (CAT5) unshielded twisted pair (UTP).
100BASE-FX SFP	Up to 2 km reach over multimode fiber (MMF) pair.
1000BASE-SX DDI SFP	Well-suited for campus local area networks (LAN) and intrabuilding links. • up to 275 m using 62.5 micrometer (µm) MMF optic cable • up to 550 m using 50 µm MMF optic cable
100BASE-LX10 1000BASE-LX DDI SFP	Up to 10 km reach over a single mode fiber (SMF) pair. Up to 550 m reach over a multimode fiber pair.
1000BASE-XD DDI SFP	Up to 40 km reach over a single mode fiber pair.
100BASE-ZX 1000BASE-ZX DDI SFP	Up to 70 km reach over a single mode fiber pair.
1000BASE-BX10 DDI SFP	1310 nm to 1490 nm, up to 10 km reach over single mode fiber. AA1419069–E6 to AA1419070–E6 mating pairs.
	1310 nm to 1490 nm, up to 40 km reach. Bidirectional over one single mode fiber. AA1419076–E6 to AA1419077–E6 mating pairs.
1000BASE-EX DDI SFP	Up to 120 km reach over a single mode fiber pair.

SFP transceivers are hot-swappable input and output enhancement components that permit Gigabit Ethernet ports to link with other Gigabit Ethernet ports over various media types.

The system also supports Coarse Wavelength Division Multiplexer (CWDM) SFP transceivers. CWDM technology consolidates multiple optical channels on a common optical fiber. CWDM uses multiple wavelengths to expand available bandwidth.

CWDM SFP transceivers support high speed data communications for Metropolitan Area Networks (MAN). The system uses a grid of eight CWDM optical wavelengths in both ring and point-to-point configurations. All components are color-coded by wavelength.

Important:

The attainable cable length can vary depending on the quality of the fiber optic cable used.

Use Digital Diagnostic Monitoring (DDM) to monitor SFP laser operating characteristics. DDM is enabled by default. Support for Digital Diagnostic Interfaces (DDI—an interface that supports DDM) involves data collection and alarm and warning monitoring. Static data collection includes SFP vendor information, DDI support information, and DDI alarm and warning threshold values. Dynamic

data collection includes temperature, supply voltage, laser bias current, transmit power, and receive power. DDM works during active laser operation without affecting data traffic.

DDM generates temperature warnings and alarms if the port is administratively enabled. The device only generates other DDM warnings and alarms if the link is up. The device uses an offset of 8 degrees for warning thresholds and an offset of 5 degrees for alarm thresholds to calculate the thresholds used by the monitoring code. For example, if the warning threshold is 73 °C and the alarm threshold is 78 °C for the part, then the monitoring code uses 65 °C as the warning threshold and 73 °C as the alarm threshold. DDM high temperature alarm results in port shutdown for second generation module ports only.

The Virtual Services Platform 9000 only checks warning and alarm status bits during initialization and during requests for dynamic data. If the system asserts or clears an alarm or warning, the system logs a message and generates a trap. The system maps DDM warning and alarm messages into Warning and Fatal message categories for system logging purposes.

The device sends traps if you enable the DDM traps send feature using the **`pluggable-optical-module ddm-traps-send`** command. The device always generates logs no matter if the DDM traps send feature is enabled or disabled. Configure the DDM monitor interval using the **`pluggable-optical-module ddm-monitor-interval <10..40>`** command. The DDM monitor interval is 10–40 seconds. The default is 10 seconds.

The following table describes the Avaya SFP transceiver models that the Virtual Services Platform 9000 supports.

Note:

All SFP models in this table are supported on the 10 Gigabit per second (Gbps) modules and include DDI support, with the following exceptions:

- The 100BASE-FX model is not supported on the 10 Gbps modules.
- The 1000BASE-T model does not support DDI.

Model	Part number	Description
1000BASE-T SFP	AA1419043–E6	gigabit Ethernet, RJ–45 connector 850 nm, gigabit Ethernet, duplex LC connector
1000BASE-SX DDI SFP	AA1419048–E6	850 nm, gigabit Ethernet, duplex LC connector
1000BASE-XD DDI SFP	AA1419050–E6*	1310 nm, gigabit Ethernet, duplex LC connector * This transceiver has reached end-of-sale (EOS). For more information about EOS transceivers, and recommended replacements for your product, see Locating end of sale notices on page 8.
1000BASE-XD DDI SFP	AA1419051–E6*	1550 nm, gigabit Ethernet, duplex LC connector * This transceiver has reached end-of-sale (EOS). For more information about EOS transceivers, and recommended replacements for your product, see Locating end of sale notices on page 8.

Table continues…

Model	Part number	Description
1000BASE-ZX DDI SFP	AA1419052–E6*	1550 nm, gigabit Ethernet, duplex LC connector * This transceiver has reached end-of-sale (EOS). For more information about EOS transceivers, and recommended replacements for your product, see Locating end of sale notices on page 8.
1000BASE-BX10 DDI SFP	AA1419069–E6 (10 km at 1310 nm) and mating pair AA1419070–E6 (10 km at 1490 nm)	1310 nm (tx) and 1490 nm (rx) gigabit Ethernet, single-fiber LC connector
1000BASE-EX DDI SFP	AA1419071–E6** This transceiver has reached end-of-sale (EOS). For more information about EOS transceivers, and recommended replacements for your product, see Locating end of sale notices on page 8.	1550 nm, gigabit Ethernet, duplex LC connector
1000BASE–XD DDI CWDM 40 km SFP	AA1419053–E6 to AA1419060–E6** These transceivers have reached end-of-sale (EOS). For more information about EOS transceivers, and recommended replacements for your product, see Locating end of sale notices on page 8.	gigabit Ethernet, duplex LC connector
1000BASE–ZX DDI CWDM 70 km SFP	AA1419061–E6 to AA1419068–E6** These transceivers have reached end-of-sale (EOS). For more information about EOS transceivers, and recommended replacements for your product, see Locating end of sale notices on page 8.	gigabit Ethernet, duplex LC connector

Table continues…

Model	Part number	Description
	Important: AA1419065–E6 remains available for purchase.	
100BASE-FX SFP	AA1419074–E6	1300 nm, 100 Mbps Ethernet, multimode fiber, duplex LC connector

Installing an SFP

Install an SFP to provide an interface between the device and the network cable.

Before you begin

- Verify that the SFP is the correct model for your network configuration.
- Before you install the optical connector, ensure it is clean.

Danger:

Risk of eye injury by laser

Fiber optic equipment can emit laser or infrared light that can injure your eyes. Never look into an optical fiber or connector port. Always assume that fiber optic cables connect to a light source.

Electrostatic alert:

ESD can damage electronic circuits. Do not touch electronic hardware unless you wear a grounding wrist strap or other static-dissipating device.

Warning:

Risk of equipment damage

Only trained personnel can install this product.

About this task

Installing an SFP takes approximately 3 minutes.

Procedure

1. Remove the SFP from its protective packaging.
2. Grasp the SFP transceiver between your thumb and forefinger.
3. Insert the device into the port on the module.

   Depending on the module type, you must insert some SFP transceivers into the port with the bail facing up and some SFP transceivers with the bail facing down.

Warning:

Risk of equipment damage

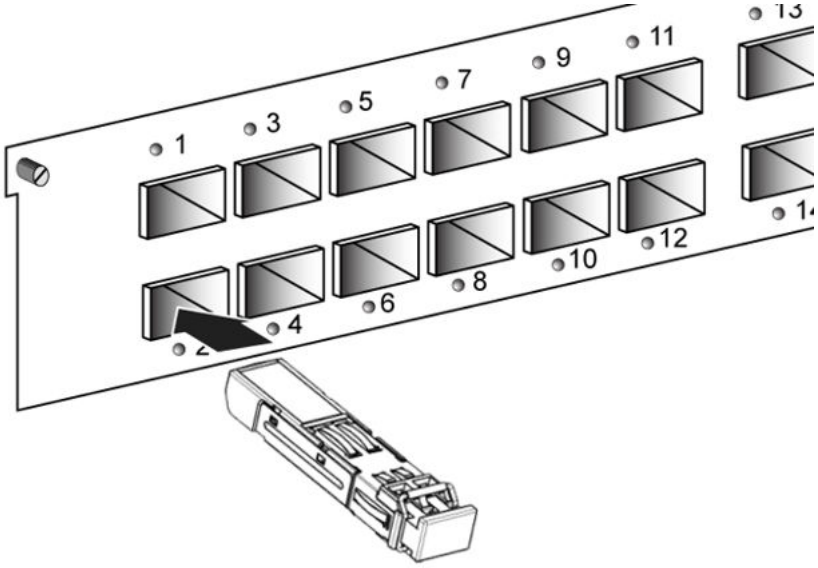
SFP transceivers are keyed to prevent incorrect insertion. If the SFP transceiver resists pressure, do not force it; turn it over, and reinsert it.

Apply a light pressure to the device until it clicks and locks into position.

4. Remove the dust cover from the optical bore, and insert the fiber optic connector.

Example

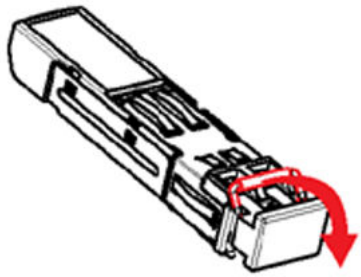
The following figure shows an example installation of a bore plug transceiver with the bail latch facing up. The figure does not represent a specific product.



Job aid

Depending on the transceiver manufacturer, the SFP transceiver can use different types of locking and extractor mechanisms.

The following figure shows the typical mechanism used on SFP transceivers; other locking mechanisms exist although they are not shown here. In the following figure, the SFP transceiver uses the bore plug. Pull the bail to release the device.



Removing an SFP

Remove an SFP to replace it or to commission it elsewhere.

Before you begin

- Wear an antistatic wrist strap.

Danger:

Risk of eye injury by laser

Fiber optic equipment can emit laser or infrared light that can injure your eyes. Never look into an optical fiber or connector port. Always assume that fiber optic cables connect to a light source.

Electrostatic alert:

ESD can damage electronic circuits. Do not touch electronic hardware unless you wear a grounding wrist strap or other static-dissipating device.

Procedure

1. Disconnect the network fiber optic cable from the SFP connector.
2. Depending on your SFP model, there are different locking mechanisms to release the SFP transceiver. The following describes the typical mechanism used on SFP transceivers; other locking and extractor mechanisms exist, although they are not described here.
   - Bail latch: Pull the swing-down latch handle to the fully lowered position and hold the handle to extract the module.
3. Slide the SFP out of the module SFP slot.

   If the SFP does not slide easily from the module slot, use a gentle side-to-side rocking motion while firmly pulling the SFP from the slot.
4. Affix dust covers over the fiber optic bore and connector.
5. Store the SFP in a safe place until needed.

   Important:

   If you discard the SFP transceiver, dispose of it according to all national laws and regulations.

SFP specifications

This section provides technical specifications for the supported small form factor pluggable (SFP) models. Use this information to aid in proper network design.

The specifications in this section meet or exceed those specified in the applicable IEEE standards, where they exist.

In these specifications, unless otherwise noted, receiver sensitivity is the minimum average input optical power for which Avaya guarantees the receiver meets the bit error rate (BER) of 10^{-12}.

Important:

For instances where you install a significant number of long-range SFPs and SFP+s, you must be sure to have sufficient power available to power these optical devices.

Virtual Services Platform 9000 supports only Avaya-qualified transceivers. Other vendor transceivers will not work and Avaya does not support them.

SFP labels

The Avaya label on a typical SFP transceiver contains an Avaya serial number, a bar code, a manufacturer code, an interface type, and a part number.

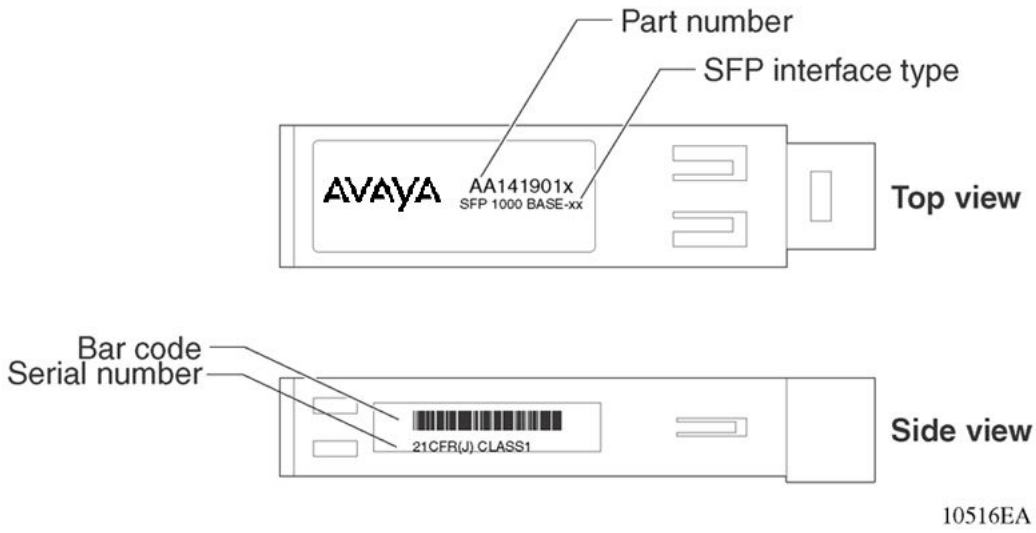


Figure 1: SFP label

General SFP specifications

The following table describes general SFP specifications.

Table 1: General SFP specifications

Parameter	Description
Dimensions (H x W x D)	8.5 x 13.4 x 56.4 millimeters (0.33 x 0.53 x 2.22 inches), unless otherwise stated.
Operating temperature	–5 to 85 ºC for RoHS -E6 models
Storage temperature	–40 to 85 ºC
Maximum supply current	300 mA, unless otherwise stated
Maximum power consumption	1.0 W, unless otherwise stated

Supported SFP transceivers

The following section provides specifications for the supported SFP transceivers.

1000BASE-T SFP specifications

The 1000BASE-T SFP provides gigabit Ethernet connectivity using a single eight-pin RJ-45 connector.

The 1000BASE-T SFP only operates at 1 gigabits per second (Gbps) speed. Operation at 100 or 10 megabits per second (Mbps) speeds are not supported.

The part number for this model is AA1419043-E6.

The maximum current requirement of the SFP is 375 milliamperes (mA) at 5 volts (V).

The following table describes the 1000BASE-T SFP specifications.

Table 2: IEEE 802.3z 1000BASE-T SFP specifications

Parameter	Specifications
Standards	IEEE 802.3z, IEEE 802.3ab
Connectors	RJ-45
Cabling	CAT5E or better UTP
Distance	Up to 100 m

1000BASE-SX DDI SFP specifications

The 1000BASE-SX DDI SFP transceiver has a reach of up to 550 m using 50 µm MMF, and of 275 m using 62.5 µm MMF. This SFP transceiver operates at 850 nm. The part number is AA1419048-E6.

The following table describes standards, connectors, cabling, and distance for the 1000BASE-SX DDI SFP transceivers.

Table 3: 1000BASE-SX SFP DDI (550 m) specifications

Parameter	Specifications
Maximum electrical power consumption	1 watt (W)
Connector	Duplex LC
Cabling	MMF
Data rate	1.0 Gbps
Line rate (8B/10B code)	1.25 Gbps
Link optical power budget	7.5 dB
Transmitter characteristics	
Launch power	–9.5 to –4.0 dBm
Receiver characteristics	
Receiver sensitivity	–17 dBm
Maximum receiver power	0 dBm

1000BASE-LX DDI SFP specifications

This SFP transceiver provides 1000BASE-LX gigabit Ethernet connectivity at 1310 nanometers (nm) using single mode or multimode optical fiber. The part number is AA1419049-E6.

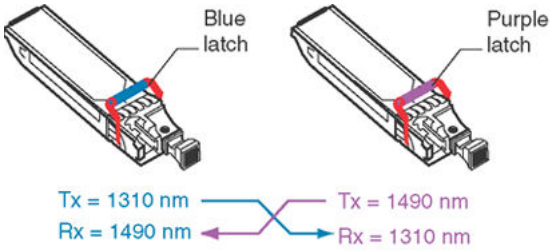
Table 4: 1000BASE-LX DDI SFP specifications

Parameter	Specifications
Maximum electrical power consumption	1.0 watt (W)
Connectors	Duplex LC
Cabling	• 50 micrometer (µm) multimode fiber (MMF) • 62.5 µm multimode fiber • 9 µm single mode fiber (SMF)
Distance	• Up to 550 meters (m) using MMF • Up to 10 kilometers (km) using SMF
Data rate	1.0 Gbps
Line rate (8B/10B code)	1.25 Gbps
Link optical power budget	9.5 dB
Transmitter characteristics	
Launch power	–9.5 to –3.0 dBm
Receiver characteristics	
Receiver sensitivity	–19.0 dBm
Maximum receiver power	–3.0 dBm

1000BASE-BX bidirectional SFP transceivers

The 1000BASE-BX bidirectional DDI SFP transceivers provides gigabit Ethernet connectivity over a single fiber.

In the following figure, the transmit (Tx) and receive (Rx) paths share the same fiber by using two different wavelengths. One model transmits at 1310 nm and receives at 1490 nm, while the mating model transmits at 1490 nm and receives at 1310 nm. You can only connect a mating pair.



The long wavelength optical transceivers used in these models provide variable distance ranges using single mode fiber optic cabling.

You can use 1000BASE-BX SFP transceivers to double the number of your fiber links. For example, if you install 20 fiber pairs with 20 conventional ports connected, you can use 1000BASE-BX SFP transceivers to expand to 40 ports, using the same fiber.

The following table provides the reach and part numbers for each mating pair.

Table 5: 1000BASE-BX SFP transceivers

Reach	1310 nm	1490 nm
10 km	AA1419069-E6	AA1419070-E6

1000BASE-BX10 bidirectional DDI SFP specifications

The 1000BASE-BX10 SFP transceivers (part numbers AA1419069-E6 and AA1419070-E6) can attain a reach of up to 10 km.

The following table describes standards, connectors, cabling, and distances for the 1000BASE-BX10 SFP transceiver.

Table 6: IEEE 802.3ah 1000BASE-BX10 bidirectional SFP specifications

Parameter	Specification
Connectors	Single-fiber LC
Data rate	1.0 Gbps
Line rate (8B/10B code)	1.25 Gbps
Distance	Up to 10 km
Wavelength	1310 nm and 1490 nm

Table continues…

Parameter	Specification
Link optical power budget	11.0 dB
Maximum transmitter and dispersion power penalty	3.3 dB
Transmitter characteristics	
Maximum launch power	–3.0 dBm
Minimum launch power	–9.0 dBm
Receiver characteristics	
Maximum receiver sensitivity	–19.5 dBm
Maximum input power (maximum average receive power)	–3.0 dBm

100BASE-FX SFP specifications

The 100BASE-FX SFP provides 100 Mbps Ethernet Carrier Sense Multiple Access with Collision Detection (CSMA-CD) connectivity using multimode optical fiber. The 100BaseFX uses an LED transmitter. The centre wavelength, spectral width, and optical rise/fall time satisfy the trade-off curves in the FDDI PMD document (ISO/IEC 9314–3:1900). The supported link length is up to 2 km over MMF. The part number for this model is AA1419074–E6.

The following table describes the 100BASE-FX SFP specifications.

Table 7: 100BASE-FX SFP specifications

Parameter	Specifications
Maximum electrical power consumption	0.8 W
Connectors	Duplex LC
Cabling	• 62.5 µm MMF optic cable • 50 µm MMF optic cable
Distance	Up to 2 km using 500 Mhz-km MMF optic cable
Wavelength	1300 nm
Link optical power budget	10 dB
Transmitter characteristics	
Transmitter type	LED
Nominal wavelength	1300 nm
Transmit output power (max)	– 14 dBm
Transmit output power (min)	– 23.5 to – 20 dBm
Spectral width	140 nm (FHWM)
Minimum extinction ratio	10 dB
Receiver characteristics	
Receiver type	PIN photodiode

Table continues…

Parameter	Specifications
Wavelength range	1270 nm to 1380 nm
Nominal wavelength	—
Receiver sensitivity	– 33.5 dBm
Maximum input power	– 14 dBm
Path penalty	—
Maximum receive reflectance	—

Chapter 5: SFP+

This chapter provides installation procedures and specifications for small form factor pluggable plus (SFP+) transceivers.

SFP+ transceivers

This section describes how to select and install small form factor pluggable plus (SFP+) transceivers.

Use an SFP+ transsceiver to connect a device motherboard to fiber optic or direct attached cables, up to 15 meters in length. SFP+ transceivers are similar to SFP transceivers in physical appearance but SFP+ transceivers support 10-gigabit per second (Gbps) connections. SFP+ modules are not compatible with SFP modules.

Important:

- The Virtual Services Platform 9000 operates in strict mode for SFP+ transceivers, which means that the switch will not bring up the port operationally when using non-Avaya SFP+ transceivers.
- The Virtual Services Platform 9000 operates in forgiving mode for SFP+ direct attached cables (DACs), which means that the switch will bring up the port operationally when using non-Avaya direct attached cables. Avaya does not provide support for operational issues related to these DACs, but the DACs will operate and the port link will come up.

All Avaya SFP+ transceivers support Digital Diagnostic Monitoring (DDM).

Selecting an SFP+

Use an SFP+ transceiver to interface a port to a fiber optic cable.

About this task

Select the appropriate transceiver to provide the required reach. Depending on the product, you can obtain SFP+ transceivers for cable distances of up to 15 meters (m), 400 m, 10 kilometers (km), 40 km, and 70 km. Alternatively, you can use a direct attach cable (10GBASE-CX) to connect ports for cable distances of up to 15 meters.

Procedure

1. Determine the required reach.
2. Determine wavelength restrictions or requirements.
3. Use the following job aid to determine the appropriate SFP+ transceiver or cable for your application.

Job aid

SFP+ transceivers are hot-swappable input and output enhancement components that allow 10-Gigabit Ethernet ports to link with other 10-Gigabit Ethernet ports.

All Avaya SFP+ transceivers use LC connectors to provide precision keying and low interface losses.

Model	Part number	Description	Minimum software version
10GBASE-LR/LW SFP+	AA1403011–E6	10 km, 1310 nm SMF	3.0
10GBASE-LR/LW high temperature (–5 °C to +85 °C) SFP+	AA1403011–E6HT	10 km SMF	4.0
10GBASE-ER/EW SFP+	AA1403013–E6	40 km, 1550 nm SMF	3.0
10GBASE-SR/SW SFP+	AA1403015–E6	400 m, 850 nm MMF	3.0
10GBASE-SR/SW high temperature (0 °C to +85 °C) SFP+	AA1403015–E6HT	850 nm MMF	4.0
10GBASE-ZR/ZW SFP+	AA1403016–E6	70 km, 1550 nm SMF	3.4
10GBASE-LRM SFP+	AA1403017–E6	220 m, 1260 to 1355 nm; 1310 nm nominal MMF	3.0
10GBASE CWDM DDI SFP+ (40 km)	AA1403153–E6 to AA1403160–E6	40 km, 1471 to 1611 nm	3.4
10GBASE CWDM DDI SFP+ (70 km)	AA1403161–E6 to AA1403168–E6	70 km, 1471 to 1611 nm	3.4
10GBASE-BX10 SFP+	AA1403169–E6 and AA1403170–E6	10 km	4.1

Installing an SFP+

Install an SFP+ transceiver to provide a 10-gigabit Ethernet interface between the device and other network devices.

Before you begin

Important:

Do not install an SFP+ transceiver in an SFP slot. The two transceivers look the same but function differently. Ensure the slot is an SFP+ slot.

- Verify that the SFP+ transceiver is the correct model for your network configuration.
- Before you install the optical connector, ensure it is clean.

Danger:

Risk of eye injury by laser

Fiber optic equipment can emit laser or infrared light that can injure your eyes. Never look into an optical fiber or connector port. Always assume that fiber optic cables connect to a light source.

Electrostatic alert:

ESD can damage electronic circuits. Do not touch electronic hardware unless you wear a grounding wrist strap or other static-dissipating device.

Warning:

Risk of equipment damage

Only trained personnel can install this product.

About this task

Installing an SFP+ transceiver takes approximately 3 minutes.

Procedure

1. Remove the SFP+ transceiver from its protective packaging.
2. Grasp the SFP+ transceiver between your thumb and forefinger.
3. Insert the device into the port on the module.

   Depending on the module type, you must insert some SFP+ transceivers into the port with the bail facing up and some SFP+ transceivers with the bail facing down.

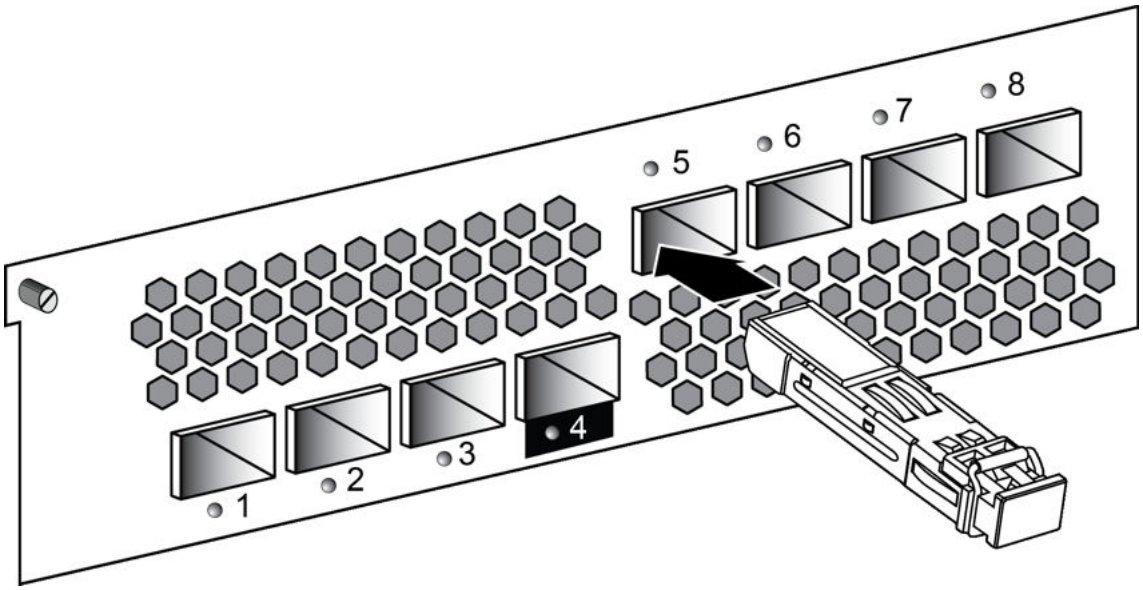
   Warning:

   Risk of equipment damage

   SFP+ transceivers are keyed to prevent incorrect insertion. If the SFP+ transceiver resists pressure, do not force it; turn it over, and reinsert it.

   Apply a light pressure to the SFP+ transceiver until the device clicks and locks into position in the module.
4. Remove the dust cover from the SFP+ optical bores, and insert the fiber optic cable.

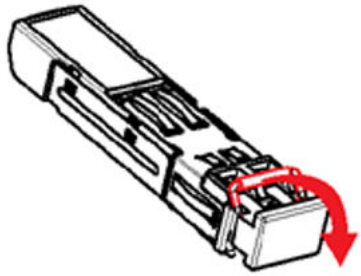
Example



Job aid

Depending on the transceiver manufacturer, the SFP+ transceiver uses bail-latch type of locking and extractor mechanism.

The following figure shows typical mechanism used on SFP+ transceivers; other locking and extractor mechanisms exist. SFP+ transceivers are similar to SFP transceivers in physical appearance. In the following figure, the SFP+ transceiver still contains the bore plug. Pull the bail to release the device.



Removing an SFP+

Remove an SFP+ transceiver to replace it or to commission it elsewhere.

Before you begin

- Wear an antistatic wrist strap.

Danger:

Risk of eye injury by laser

Fiber optic equipment can emit laser or infrared light that can injure your eyes. Never look into an optical fiber or connector port. Always assume that fiber optic cables connect to a light source.

Electrostatic alert:

ESD can damage electronic circuits. Do not touch electronic hardware unless you wear a grounding wrist strap or other static-dissipating device.

Procedure

1. Disconnect the network fiber optic cable from the SFP+ connector.
2. Pull the swing-down latch handle to the fully lowered position, and hold the handle to extract the module.
3. Slide the SFP+ transceiver out of the module SFP+ slot.

   If the SFP+ does not slide easily from the module slot, use a gentle side-to-side rocking motion while firmly pulling the SFP+ transceiver from the slot.
4. Affix dust covers over the fiber optic bore and connector.
5. Store the SFP+ transceiver in a safe place until needed.

   Important:

   If you discard the SFP+ transceiver, dispose of it according to all national laws and regulations.

SFP+ specifications

This section provides technical specifications for the supported 10 gigabit SFP+ models. Use these specifications to aid in network design.

The specifications in this section support the IEEE 802.3-2012 standard. For more information, see the IEEE 802.3 document. All Avaya SFP+ transceivers meet or exceed these standards.

Important:

- The Virtual Services Platform 9000 operates in strict mode for SFP+ transceivers, which means that the switch will not bring up the port operationally when using non-Avaya SFP+ transceivers.
- The Virtual Services Platform 9000 operates in forgiving mode for SFP+ direct attached cables (DACs), which means that the switch will bring up the port operationally when using non-Avaya direct attached cables. Avaya does not provide support for operational issues related to these DACs, but the DACs will operate and the port link will come up.

All Avaya SFP+ transceivers support Digital Diagnostic Monitoring (DDM).

SFP+ labels

The typical Avaya SFP+ transceiver has a label on the top and bottom or side of the transceiver. The following figures show example labels. Avaya does use alternate labels, depending on the size of the device and space available for label information. Some devices do not have a CLEI code or label.

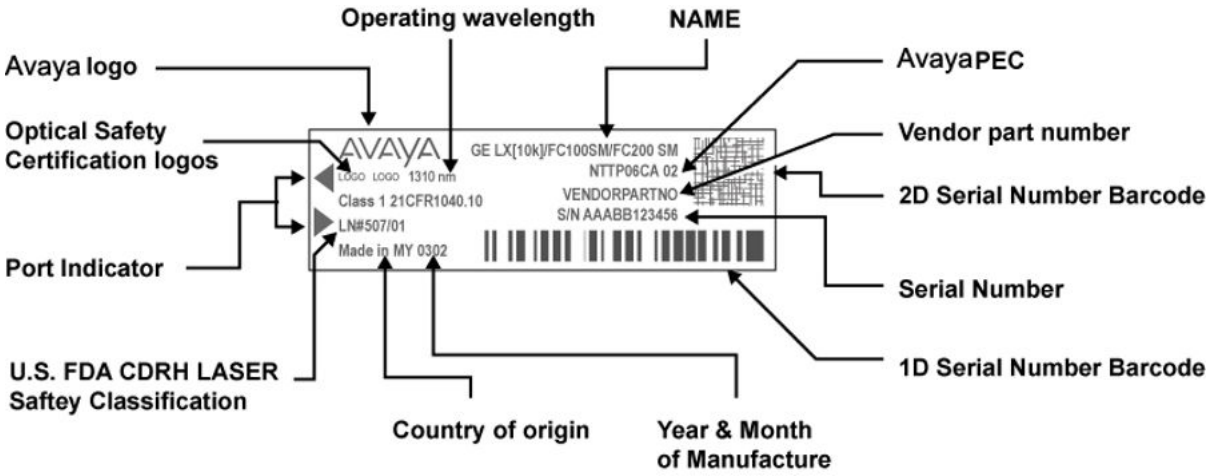


Figure 2: SFP+ top label

Figure 3: SFP+ bottom label

General SFP+ specifications

The following table describes general SFP+ specifications.

Table 8: General SFP+ specifications

Parameter	Specifications
Dimensions (H x W x D)	8.5 x 13.4 x 56.4 millimeters (0.33 x 0.53 x 2.22 inches), unless otherwise stated.
Connectors	LC ultra physical contact (UPC)
Storage temperature	–40 to 85 ºC
Operating temperature	0 to 70 ºC for RoHS -E6 models up to 85 ºC for high temperature models

Supported SFP+ transceivers

The following section provides specifications for the supported SFP+ transceivers.

10GBASE-LR/LW SFP+ specifications

The 10GBASE-LR/LW SFP+ transceiver provides 10 GbE or OC-192 service at a nominal wavelength of 1310 nm. This SFP+ transceiver can attain link lengths of up to 10 km.

For more information about the 10GBASE-LR/LW SFP+ transceiver, including test and measurement information, see the IEEE 802.3ae standard.

The following table lists the transmitter and receiver specifications for the 10GBASE-LR/LW SFP+ transceiver. The part number of this SFP+ transceiver is AA1403011-E6.

Table 9: IEEE 802.3ae 10GBASE-LR/LW SFP+ transceiver specifications

Parameter	Specifications
Center wavelength range	1260 to 1355 nm; 1310 nm nominal
Distance	Up to 10 km
Link optical power budget	9.4 dB
Maximum transmitter and dispersion penalty	3.2 dB at 10 km
Transmitter characteristics	
Line rate (nominal	10GBASE-LR 10.3125 Gbps ±100 ppm (10 GbE)
Average launch power	–8.2 to 0.5 dBm
Minimum launch power in OMA minus transmission and dispersion penalty (TDP)	–6.2 dBm
Minimum optical modulation amplitude	–5.2 dBm
Minimum extinction ratio	3.5 dB
Maximum optical return loss tolerance	–12 dB
Maximum transmitter reflectance	–12 dB
Receiver characteristics	
Line rate (nominal)	10GBASE-LR 10.3125 Gbps ± 100 ppm (10 GbE)
Average receive power for BER 10^{-12}	–14.4 dBm to 0.5 dBm
Receiver damage threshold	1.5 dBm
Maximum receiver sensitivity in OMA	–12.6 dBm
Maximum receiver reflectance	–12 dB
Stressed receiver sensitivity in OMA	–10.3 dBm

Examples of an OFF transmitter are as follows: no power supplied to the PDM, laser shutdown for safety conditions, activation of a PMD_global_transmit_disable or other optional transmitter shutdown condition.

10GBASE-LR/LW SFP+ high temperature (-5 °C to +85 °C) specifications

The 10GBASE-LR/LW SFP+ high temperature transceiver (–5 °C to +85 °C) provides 10 GbE or OC-192 service at a nominal wavelength of 1310 nm. This SFP+ transceiver can attain link lengths of up to 10 km.

For more information about the 10GBASE-LR/LW SFP+ (–5 °C to +85 °C), including test and measurement information, see the IEEE 802.3ae standard.

The following table lists the transmitter and receiver specifications for the 10GBASE-LR/LW SFP + transceiver (–5 °C to +85 °C) . The part number of this SFP+ transceiver is AA1403011-E6HT.

Table 10: IEEE 802.3ae 10GBASE-LR/LW SFP+ (-5 °C to +85 °C) transceiver specifications

Parameter	Specifications
Center wavelength range	1260 to 1355 nm; 1310 nm nominal
Distance	Up to 10 km
Link optical power budget	9.4 dB
Maximum transmitter and dispersion penalty	3.2 dB at 10 km
Operating case temperature range	–5 °C to +85 °C
Transmitter characteristics	
Line rate (nominal)	10GBASE-LR 10.3125 Gbps ±100 ppm (10 GbE)
Average launch power	–8.2 to 0.5 dBm
Minimum launch power in OMA minus transmission and dispersion penalty (TDP)	–6.2 dBm
Minimum optical modulation amplitude	–5.2 dBm
Minimum extinction ratio	3.5 dB
Maximum optical return loss tolerance	–12 dB
Maximum transmitter reflectance	–12 dB
Receiver characteristics	
Line rate (nominal)	10GBASE-LR 10.3125 Gbps ± 100 ppm (10 GbE)
Average receive power for BER 10^{-12}	–14.4 dBm to 0.5 dBm
Maximum average receive power for damage	1.5 dBm
Maximum receiver sensitivity in OMA	–12.6 dBm
Maximum receiver reflectance	–12 dB
Stressed receiver sensitivity in OMA	–10.3 dBm

Examples of an OFF transmitter are as follows: no power supplied to the PDM, laser shutdown for safety conditions, activation of a PMD_global_transmit_disable or other optional transmitter shutdown condition.

10GBASE-ER/EW SFP+ specifications

The 10GBASE-ER/EW SFP+ transceiver provides a reach of up to 40 km at a wavelength of 1550 nm.

For more information about the 10GBASE-ER/EW SFP+ transceiver, including test and measurement information, see the IEEE 802.3ae standard.

The following table lists the transmitter and receiver specifications for the 10GBASE-ER/EW SFP+ transceiver. The part number of this SFP+ transceiver is AA1403013-E6.

Table 11: IEEE 802.3ae 10GBASE-ER/EW SFP+ transceiver specifications

Parameter	Specifications
Line rate (nominal)	10GBASE-ER/EW 10.3125 Gb/s ±100 ppm (10 GbE)
Center wavelength range	1530 to 1565 nm; nominal 1550 nm
Distance	Up to 40 km
Link optical power budget	15 dB
Transmitter and dispersion power penalty	3.0 dB at 40 km
Transmitter characteristics	
Launch power	–4.7 to 4.0 dBm
Minimum side mode suppression ratio	30 dB
Minimum launch power in OMA minus transmission and dispersion penalty (TDP)	–2.1 dBm
Minimum optical modulation amplitude	–1.7 dBm
Maximum average launch power of OFF transmitter	–30 dBm
Minimum extinction ratio	3.0 dB
Maximum $RIN_{12}OMA$	–128 dB/Hz
Maximum optical return loss tolerance	–21 dB
Receiver characteristics	
Average receive power for BER 10^{-12}	– 15.8 dBm to –1.0 dBm
Maximum receive power for damage	4.0 dBm
Maximum receiver sensitivity in OMA	–14.1 dBm
Maximum receiver reflectance	–26 dB
Stressed receiver sensitivity in OMA	–11.3 dBm
Receive electrical 3 dB upper cutoff frequency (maximum)	12.3 GHz

The following list shows examples of an OFF transmitter:

- No power supplied to the PDM.
- Laser shutdown for safety conditions.
- Activation of **`PMD_global_transmit_disable`** or other optional transmitter shutdown condition.

10GBASE-SR/SW SFP+ specifications

The 10GBASE-SR/SW SFP+ transceivers provides 10 GbE service at 850 nm.

For more information about the 10GBASE-SR/SW SFP+ transceiver, including test and measurement information, see the IEEE 802.3ae standard.

Caution:

Risk of equipment damage

To prevent damage to the optical receiver, ensure that at least 1 dB of attenuation exists between the transmit and receive ports.

The following table lists the specifications for the 10GBASE-SR/SW SFP+ transceivers. The part number of this SFP+ transceiver is AA1403015-E6.

Table 12: IEEE 802.3ae 10GBASE-SR/SW SFP+ transceiver specifications

Parameter	Specifications
Data rate	10 gigabits per second (Gbps)
Line rate (64B/66B code)	10.3125 Gbps ± 100 parts per million (ppm)
Center wavelength range	840 to 860 nanometers (nm), nominal 850 nm
Distance	Using 62.5 µm MMF optic cable: • 160 MHz-km fiber: 2 to 26 m • 200 MHz-km fiber: 2 to 33 m Using 50 µm MMF optic cable: • 400 MHz-km fiber: 2 to 66 m • 500 MHz-km fiber: 2 to 82 m • 2000 MHz-km fiber: 2 to 300 m • 4700 MHz-km fiber (OM4): 2 to 400 m
Link optical power budget	7.3 dB
Maximum transmitter and dispersion penalty	3.9 dB at 300 m
Transmitter characteristics	
Root-mean-square spectral width	0.05 to 0.40 nm
Launch power	–7.3 to –1.0 dBm
Minimum extinction ratio	3.0 dB
Maximum optical return loss tolerance	–12 dB
Receiver characteristics	
Average receive power for BER 10^{-12}	–9.9 to –1.0 dBm
Receiver damage threshold	0 dBm
Maximum receiver sensitivity in OMA	–11.1 dBm

Table continues…

Parameter	Specifications
Maximum receiver reflectance	–12 dB
Stressed receiver sensitivity in OMA	–7.5 dBm

10GBASE-SR/SW SFP+ high temperature (0 °C to +85 °C) specifications

The 10GBASE-SR/SW SFP+ high temperature transceiver (0 °C to +85 °C) provides 10 GbE service at 850 nm.

The following table lists the specifications for the 10GBASE-SR/SW SFP+ transceiver (0 °C to +85 °C). The part number of this SFP+ transceiver is AA1403015-E6HT.

For more information about the 10GBASE-SR/SW SFP+ transceiver (0 °C to +85 °C), including test and measurement information, see the IEEE 802.3ae standard.

Warning:

Risk of equipment damage

To prevent damage to the optical receiver, ensure that at least 1 dB of attenuation exists between the transmit and receive ports.

Table 13: IEEE 802.3ae 10GBase–SR/SW SFP+ (0 °C to +85 °C) transceiver specifications

Parameter	Specifications
Data rate	10 Gbps
Line rate (64B/66B code)	10.3125 gigabits per second (Gbps) ± 100 parts per million (ppm)
Center wavelength range	840 to 860 nanometers (nm), nominal 850 nm
Distance	Using 62.5 µm MMF optic cable: • 160 MHz-km fiber: 2 to 26 m • 200 MHz-km fiber: 2 to 33 m Using 50 µm MMF optic cable: • 400 MHz-km fiber: 2 to 66 m • 500 MHz-km fiber: 2 to 82 m • 2000 MHz-km fiber (OM3): 2 to 300 m • 4700 MHz-km fiber (OM4): 2 to 400 m
Link optical power budget	7.3 dB
Maximum transmitter and dispersion penalty	3.9 dB at 300 m
Operating case temperature range	0 °C to +85 °C
Transmitter characteristics	
Root-mean-square spectral width	0.05 to 0.40 nm
Launch power	–7.3 to –1.0 dBm

Table continues…

Parameter	Specifications
Minimum extinction ratio	3.0 dB
Maximum optical return loss tolerance	–12 dB
Receiver characteristics	
Average receive power for BER 10^{-12}	–9.9 to –1.0 dBm
Receiver damage threshold	0dBm
Maximum receiver sensitivity in OMA	–11.1 dBm
Maximum receiver reflectance	–12 dB
Stressed receiver sensitivity in OMA	–7.5 dBm

10GBASE-ZR/ZW SFP+ specifications

The following table lists the transmit and receive specifications for the 10GBASE-ZR/ZW SFP+ transceiver. The part number of this SFP+ transceiver is AA1403016-E6.

Warning:

Risk of BER increase

For proper SFP+ transceiver operation, ensure that at least 11 dB of attenuation is present between the transmit and receive ports.

The reach for this SFP+ transceiver is up to 70 km* at a wavelength of 1550 nm.

Table 14: 10GBASE-ZR/ZW SFP+ specifications

Parameter	Specifications
Line rate (nominal)	10GBASE-ZR 10.3125 Gbps ±100 ppm (10 GbE)
Distance	Up to 70 km *
Link optical power budget	24 dB
Dispersion power penalty	3.0 dB at 70 km (G.652 fiber)
Minimum attenuation between transmit and receive ports	11 dB
Transmitter characteristics	
Center wavelength range	1530 to 1565 nm, nominal 1550 nm
Average launch power	0 to 4.0 dBm
Optical modulation amplitude (minimum)	–1.7 dBm
Extinction ratio (ER) (minimum)	8.2 dB
Maximum transmitter reflectance	–12 dB
Receiver characteristics	
Wavelength range	1280 to 1575 nm. Sensitivity specified for 1530 to 1565 nm.

Table continues…

Parameter	Specifications
Maximum receiver sensitivity (average power)	–24 dBm
Maximum receiver (average) power, BER 10^{-12}	–7.0 dBm
Receiver damage threshold (average power)	+5.0 dBm
Receiver reflectance (maximum)	–27 dB

* Achievable link distance is primarily dependent on cable plant insertion loss. 70 km is not possible in some situations.

10GBASE-LRM SFP+ specifications

The 10GBASE-LRM SFP+ transceiver provides 10 GbE service at a wavelength of 1310 nm. This SFP+ transceiver can attain a reach of up to 220 m on 62.5 µm multimode fiber.

The following table lists the transmitter and receiver specifications for the 10GBASE-LRM SFP+ transceiver. These parameters meet the IEEE 802.3aq-2006 standard. The part number of this SFP + transceiver is AA1403017-E6.

In this table, the OMA, average launch power, and peak power specifications apply at TP2, after accounting for patch cord loss.

Table 15: IEEE 802.3aq 10GBASE-LRM SFP+ transceiver specifications

Parameter	Specifications
Data rate	10 Gbps
Line rate (64B/66B code)	10.3125 Gbps ± 100 ppm
Center wavelength range	1260 to 1355 nm; 1310 nm nominal
Distance	Up to 220 m
Link optical power budget	1.7 to 1.9 dB
Maximum transmitter waveform and dispersion penalty (TWDP)	4.7 dB
Transmitter characteristics	
Average launch power	–6.5 to 0.5 dBm
Peak launch power	3 dBm
Root-mean-square spectral width	2.4 to 4 nm
Launch power in OMA	–4.5 to 1.5 dBm
Minimum extinction ratio	3.5 dB
Optical return loss tolerance (minimum)	–20 dB
Receiver characteristics	
Receiver damage threshold	1.5 dBm
Receiver reflectance (maximum)	–12 dB

For more information about the conditions used for the stressed receiver tests, and other information, see the IEEE 802.3–2012 standard.

The following table (from IEEE 802.3–2012) describes the maximum channel insertion loss. The channel insertion loss includes both attenuation and connector loss (1.5 dB); therefore the maximum fiber attenuation is 0.2 to 0.4 dB.

Table 16: 10GBASE-LRM channel insertion loss and range

Fiber type (core diameter and OFL bandwidth)	Range	Maximum channel insertion loss
62.5 µm (FDDI grade) • 160 MHz-km at 850 nm • 500 MHz-km at 1300 nm	Up to 220 m	1.9 dB
62.5 µm (ISO/IEC OM1) • 200 MHz-km at 850 nm • 500 MHz-km at 1300 nm	Up to 220 m	1.9 dB
50 µm (ISO/IEC OM2) • 500 MHz-km at 850 nm • 500 MHz-km at 1300 nm	Up to 220 m	1.9 dB
50 µm • 400 MHz-km at 850 nm • 400 MHz-km at 1300 nm	Up to 100 m	1.7 dB
50 µm (ISO/IEC OM3) • 1500 MHz-km at 850 nm (includes laser launch bandwidth) • 500 MHz-km at 1300 nm (includes laser launch bandwidth)	Up to 220 m	1.9 dB

The following abbreviations are used in the preceding tables:

- FDDI – Fiber Distributed Data Interface
- ISO – International Standards Organization
- IEC – International Electrotechnical Commission
- OFL – Over Filled Launch

10GBASE-CX specifications

The 10GBASE-CX is a 2-pair twinaxial copper cable that plugs into the SFP+ socket and connects two 10-gigabit ports. The reach for this cable is up to 15 m with a bit error rate (BER) better than 10^{-12}.

The 10GBASE-CX is a lower cost alternative to the optical SFP+ devices.

For more information about the 10GBASE-CX, including test and measurement information and more specifications, see the IEEE 802.3–2012 standard. The following table identifies the part numbers for specific cable lengths.

Table 17: 10GBASE-CX cables

Cable length	Part number
3 meter	AA1403019-E6
5 meter	AA1403020-E6
7 meter	AA1403022-E6
10 meter	AA1403018-E6
15 meter	AA1403021-E6

10GBASE CWDM DDI SFP+ (40 km) specifications

The following table lists the part numbers of the 10GBASE CWDM DDI SFP+ (40 km) with corresponding wavelengths.

Table 18: Part number and center wavelength assignment

Part number	Center wavelength assignment	Reach	Insertion loss Tx to Rx
AA1403153-E6	1471 nm	up to 40 km	5 dB
AA1403154-E6	1491 nm	up to 40 km	5 dB
AA1403155-E6	1511 nm	up to 40 km	5 dB
AA1403156-E6	1531 nm	up to 40 km	5 dB
AA1403157-E6	1551 nm	up to 40 km	5 dB
AA1403158-E6	1571 nm	up to 40 km	5 dB
AA1403159-E6	1591 nm	up to 40 km	5 dB
AA1403160-E6	1611 nm	up to 40 km	5 dB

The following table lists the transmitter and receiver specifications for the 10GBASE CWDM DDI SFP+ (40 km).

Table 19: 10GBASE-ER CWDM DDI SFP+ specifications

Parameter	Specifications
Transmitter characteristics:	
Optical Data Rate (nominal)	9.95 Gbps to 10.313 Gbps
Center wavelength	Nominal –6.5 nm to nominal +6.5 nm
Spectral width (RMS at –20 dB)	1 nm
Average launched power	–0.2 dBm to 4 dBm
Extinction ratio (minimum)	8.2 dB
Tx power, OMA (minimum)	+1.5 dBm
Tx power, OMA-TDP (minimum)	–0.2 dBm

Table continues…

Parameter	Specifications
TDP at 800 ps dispersion (maximum)	2.8 dB
Receiver characteristics:	
Wavelength (requirement)	1450 nm to 1620 nm
Receiver sensitivity (unstressed), OMA	–14.1 dBm, P_OMA
IEEE 10GBASE-ER Stressed Rx Sensitivity	–11.3 dBm, P_OMA
Receiver overload	–1 dBm, P_avg
Receiver reflectance	–26 dB
Receiver damage threshold	+4 dBm

10GBASE CWDM DDI SFP+ (70 km) specifications

The following table lists the part numbers for the 10GBASE CWDM DDI SFP+ (70 km) transceivers with corresponding wavelengths.

The reach for this SFP+ transceiver is up to 70 km* at a wavelength of 1551 nm.

Table 20: Part number and center wavelength assignment

Part number	Center wavelength assignment	Reach	Minimum insertion loss Tx and Rx
AA1403161-E6	1471 nm	70 km	10 dB
AA1403162-E6	1491 nm	70 km	10 dB
AA1403163-E6	1511 nm	70 km	10 dB
AA1403164-E6	1531 nm	70 km	10 dB
AA1403165-E6	1551 nm	70 km	10 dB
AA1403166-E6	1571 nm	70 km	10 dB
AA1403167-E6	1591 nm	70 km	10 dB
AA1403168-E6	1611 nm	70 km	10 dB

The following table lists the transmitter and receiver specifications for the 10GBASE CWDM DDI SFP+ (70 km) transceiver.

Table 21: 10GBASE-ZR CWDM DDI SFP+ specifications

Parameter	Specifications
Transmitter characteristics	
Optical Data Rate (nominal)	9.95 Gbps to 10.313 Gbps
Center wavelength	Nominal –6.5 nm to nominal +6.5 nm
Spectral width (RMS at –20 dB)	1 nm
RIN OMA	–128 dB/Hz

Table continues…

Parameter			Specifications
Extinction ratio (minimum)			8.2 dB
Tx output:	Min	Max	Units
P_avg	–1	4	dBm
OMA	+0.7	—	dBm
OMA-TDP	–2.3	—	dBm
TDP at 1400 ps dispersion			3 dB
Optical return loss tolerance			21 dB
Receiver characteristics			
Wavelength range			1460 nm to 1620 nm
Rx sensitivity:	Min	Max	Units
back-to-back	—	–23	dBm
with 70 km fiber	—	–21	dBm
with 70 km fiber, OMA	—	–19.3	dBm
Receiver overload			–7 dBm, P_avg
Receiver reflectance			–27 dB
Receiver damage threshold			+5 dBm, P_avg

* Achievable link distance is primarily dependent on cable plant insertion loss. 70 km is not possible in some situations.

10GBASE-BX SFP+ specifications

The 10GBASE-BX SFP+ provides 10 Gigabit Ethernet (GbE) service with single mode bidirectional transceivers. One transceiver transmits at 1270 nm and receives at 1330 nm and the mating transceiver transmits at 1330 nm and receives at 1270 nm.

Note:

Transceivers AA1403169-E6 and AA1403170-E6 must be used only as a pair.

The following table provides the wavelength and distance details for the transceiver pair:

AA1403169-E6	1270 nm Tx	1330 nm Rx	up to 10 km	Paired with AA1403170-E6
AA1403170-E6	1330 nm Tx	1270 nm Rx	up to 10 km	Paired with AA1403169-E6

The following table lists the specifications for the 10GBASE-BX SFP+ transceivers.

Parameter	Specifications
Connector	Single-fiber LC
Data rate	10 Gbps
Line rate	10.3125 Gbps
Distance	Up to 10 km

Table continues…

Parameter	Specifications
Single power supply	3.3 V
Maximum transmitter and dispersion penalty	3.2 dBm
Operating case temperature range	–40 to +85 °C
Transmitter characteristics	
Wavelength	1270 +/– 10 nm or 1330 +/– 10 nm
Launch power	–8.2 to +0.5 dBm
Average launch power of OFF transmitter $_{P}$OFF	–30 dBm
Minimum extinction ratio	3.5 dB
Optical Modulation Amplitude $_{P}$OMA	–5.2 dBm
OMA-TDP, min	–6.2 dBm
Receiver characteristics	
Wavelength	1330 +/– 10 nm or 1270 +/– 10 nm
Average receive power	–14.4 to +0.5 dBm
Maximum receiver sensitivity in OMA	–12.6 dBm
Maximum receiver reflectance	–12 dB
Stressed receiver sensitivity in OMA	–10.3 dBm

SFP+ cable assembly specifications

This section provides cable assembly specifications for Small Form Factor Pluggable plus (SFP+) transceivers.

SFP+ direct attach cable specifications

This section provides technical specifications for the supported direct attach cable (DAC).

Cable type	Part number	Description	Minimum software version
10GBASE-CX SFP+ 2-pair twinaxial copper cable that plugs into the SFP+ socket and connects two 10-gigabit ports	AA1403019–E6	SFP+ DAC 3 meter	4.1
10GBASE-CX SFP+ 2-pair twinaxial copper cable that plugs into the SFP+ socket and connects two 10-gigabit ports	AA1403020–E6	SFP+ DAC 5 meter	4.1

Table continues…

Cable type	Part number	Description	Minimum software version
10GBASE-CX SFP+ 2-pair twinaxial copper cable that plugs into the SFP+ socket and connects two 10-gigabit ports.	AA1403022–E6	SFP+ DAC 7 meter	4.1
10GBASE-CX SFP+ 2-pair twinaxial copper cable that plugs into the SFP+ socket and connects two 10-gigabit ports	AA1403018–E6	SFP+ DAC 10 meter	3.0
10GBASE-CX SFP+ 2-pair twinaxial copper cable that plugs into the SFP+ socket and connects two 10-gigabit ports.	AA1403021–E6	SFP+ DAC 15 meter	4.1

Chapter 6: QSFP+

This chapter provides installation procedures and specifications for quad small form factor pluggable plus (QSFP+) transceivers.

QSFP+ transceivers

This section describes how to select and install quad small form factor pluggable plus (QSFP+) transceivers.

Use QSFP+ transceivers to connect a port to fiber optic cables to communicate to another transceiver. Direct attach cables (DAC) connect to QSFP+ ports. QSFP+ transceivers support 40–gigabit per second (Gbps) connections, or for some transceiver types, fan out to four 10–Gbps transceivers.

Virtual Services Platform 9000 supports QSFP+ transceivers in the 9012QQ-2 module.

Important:

- The Virtual Services Platform 9000 operates in strict mode for QSFP+ transceivers, which means that the switch will not bring up the port operationally when using non-Avaya QSFP + transceivers.
- The Virtual Services Platform 9000 operates in forgiving mode for QSFP+ DACs, which means that the switch will bring up the port operationally when using non-Avaya direct attached cables. Avaya does not provide support for operational issues related to these DACs, but the DACs will operate and the port link will come up.

All Avaya QSFP+ transceivers support Digital Diagnostic Monitoring (DDM). For information on DDM, see *Monitoring Performance on Avaya Virtual Services Platform 9000,* NN46250-701.

Selecting a QSFP+

Use a QSFP+ transceiver to interface a port to a fiber optic cable. Depending on the product, you can obtain QSFP+ transceivers for cable distances of up to 40 km. Alternatively, you can use a direct attach cable (QSFP+ to QSFP+ DAC) to connect ports for cable distances of up to 5 meters.

About this task

Select the appropriate transceiver to provide the required reach.

Procedure

1. Determine the required reach.
2. Determine wavelength restrictions or requirements.
3. Use the following job aid to determine the appropriate QSFP+ transceiver or cable for your application.

Job aid

QSFP+ transceivers are hot-swappable data input and output components that allow 40–gigabit Ethernet ports to link with other 40–gigabit Ethernet ports. Avaya QSFP+ transceivers use duplex LC connectors or MPO/MTP connectors to provide precision keying and low interface losses.

The following table lists and describes the Avaya QSFP+ models.

Note:

Avaya Virtual Services Platform 9000 does not support the 40 Gigabit Ethernet ends of the QSFP+ breakout cables because the platform does not support channelization on the VSP 9012QQ-2 module. Avaya Virtual Services Platform 9000 supports only the four SFP+ 10 Gigabit Ethernet ends of the following QSFP+ breakout cables: AA1404033-E6, AA1404035-E6, AA1404036-E6, and AA1404041-E6.

Table 22: Compatible 40 gigabit QSFP+ transceivers and cables

Hardware	Description	Minimum software version	Part number
Active optical DAC	10 meter	4.1	AA1404028–E6
Passive copper DAC	QSFP+ to QSFP+ DAC 1 meter	4.0.1	AA1404029–E6
Passive copper DAC	QSFP+ to QSFP+ DAC 3 meter	4.0.1	AA1404031–E6
Passive copper DAC	QSFP+ to QSFP+ DAC 5 meter	4.0.1	AA1404032–E6
Passive copper DAC	0.5 meter	4.0.1	AA1404037–E6GS
Passive copper DAC	1 meter	4.0.1	AA1404038–E6GS
Passive copper DAC	3 meter	4.0.1	AA1404039–E6GS
Passive copper breakout cable	QSFP+ to SFP+ DAC BOC 1 meter	4.1	AA1404033–E6
Passive copper breakout cable	QSFP+ to SFP+ DAC BOC 3 meter	4.1	AA1404035–E6
Passive copper breakout cable	QSFP+ to SFP+ DAC BOC 5 meter	4.1	AA1404036–E6
Active optical breakout cable	10 meter	4.1	AA1404041–E6
40GBASE-LR4 QSFP+	10 km 1300 nm with duplex LC connector	4.0.1	AA1404001–E6

Table continues…

Hardware	Description	Minimum software version	Part number
40GBASE-LM4 QSFP+	80 meters on 50 µm multimode fiber	4.1	AA1404002–E6
40GBASE-ER4 QSFP+	40 km	4.1	AA1404003–E6
40GBASE-SR4 4x10GBASE-SR QSFP+	100 meters with OM3 fiber cable 150 meters with OM4 fiber cable	4.0.1	AA1404005–E6

Important:

Avaya recommends using Avaya-branded SFP, SFP+, and QSFP+ transceivers as they have been through extensive qualification and testing. Avaya will not be responsible for issues related to non-Avaya branded transceivers.

Installing a QSFP+ transceiver

Install a QSFP+ transceiver to provide a 40-gigabit Ethernet interface between the device and other network devices.

Before you begin

- Verify that the QSFP+ is the correct model for your network configuration.
- Before you install the optical connector, ensure it is clean.

Danger:

Risk of eye injury by laser

Fiber optic equipment can emit laser or infrared light that can injure your eyes. Never look into an optical fiber or connector port. Always assume that fiber optic cables connect to a light source.

Electrostatic alert:

Risk of equipment damage

ESD can damage electronic circuits. Do not touch electronic hardware unless you wear a grounding wrist strap or other static-dissipating device.

Warning:

Risk of equipment damage

Only trained personnel can install this product.

Warning:

Risk of equipment damage

QSFP+ transceivers are keyed to prevent incorrect insertion. If the QSFP+ resists pressure, do not force it; turn it over, and reinsert it.

About this task

Installing a QSFP+ takes approximately 3 minutes.

Procedure

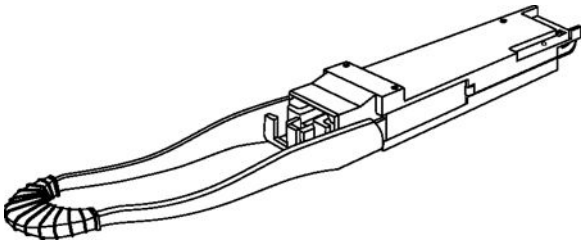
1. Remove the QSFP+ from its protective packaging.
2. Remove the dust cover from the QSFP+ optical bores and insert the fiber optic cable.
3. Grasp the QSFP+ between your thumb and forefinger.
4. Insert the device into a QSFP+ port.

   Apply a light pressure to the QSFP+ until the device clicks and locks into position in the port.

Job aid

Avaya uses the QSFP+ transceiver with the pull-tab type of locking and extractor mechanism.

The following figure shows the QSFP+ transceiver with a bore plug installed. Pull the tab to release the device.



Removing a QSFP+ transceiver

Remove a QSFP+ transceiver to replace it or to commission it elsewhere.

Before you begin

Danger:

Risk of eye injury by laser

Fiber optic equipment can emit laser or infrared light that can injure your eyes. Never look into an optical fiber or connector port. Always assume that fiber optic cables connect to a light source.

Electrostatic alert:

Risk of equipment damage

To prevent damage from electrostatic discharge, always wear an antistatic wrist strap connected to an electrostatic discharge (ESD) jack.

Procedure

1. Disconnect the network fiber optic cable from the QSFP+ connector.
2. Grasp the pull-tab and slide the QSFP+ transceiver out of the module QSFP+ slot.

If the QSFP+ transceiver does not slide easily from the module slot, use a gentle side-to-side rocking motion while firmly pulling the QSFP+ transceiver from the slot.

3. Remove connector from transceiver and affix dust covers over the fiber optic bore and connector.
4. Store the QSFP+ transceiver in a safe place until needed.

Important:

If you discard the QSFP+ transceiver, dispose of it according to all national laws and regulations.

QSFP+ specifications

The following section provides specifications for supported QSFP+ transceivers.

QSFP+ transceiver labels

A label can be located on either the top or bottom of the typical Avaya QSFP+ transceiver. The following figure shows an example label.

Avaya uses alternate labels, depending on the size of the device and space available for label information.

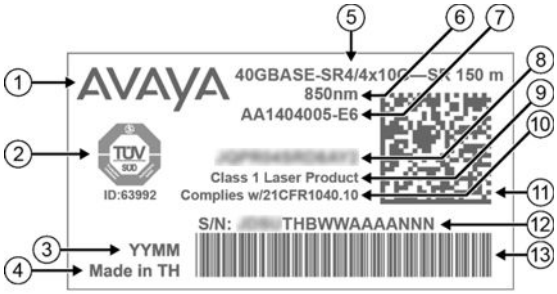


Figure 4: 40GBASE–SR4 QSFP+ transceiver label example

The following table identifies the numbered items in the preceding figure.

Table 23: Figure notes for a 40GBASE–SR4 QSFP+ transceiver label

1. Avaya logo
2. Optical safety certification logos
3. Year and month of manufacture
4. Country of origin

Table continues…

5. Name
6. Operating wavelength
7. Avaya PEC
8. Vendor part number
9. U.S. FDA CDRH laser classification
10. U.S. FDA CDRH laser classification compliance number
11. 2D serial number barcode
12. Serial number
13. 1D serial number barcode

General QSFP+ transceiver specifications

The following table describes general QSFP+ transceiver specifications.

Table 24: General QSFP+ specifications

Parameter		Specification
Dimensions (H x W x D)		8.5 x 18.35 x 72.4 mm (0.33 x 0.72 x 2.85 in.), unless otherwise stated. **Note:** The length of the pull tab latch varies depending on the vendor and the body, with a length of 125 to 132 mm (4.92 to 5.20 in.).
Connectors	40GBASE–SR4 QSFP+	MPO or MTP
	40GBASE–LR4 QSFP+	LC Duplex
Storage temperature		–40 °F (–4 °C) to 185 °F (85 °C)
Operating temperature		23 °F (−5 °C) to 158 °F (70 °C)

40GBASE-SR4 QSFP+ specifications

The 40GBASE-SR4 4x10GBASE-SR transceiver provides a high-speed link at an aggregate signaling rate.

Important:

Not all Avaya networking products support the 4x10GBASE-SR mode of operation.

The 40GBASE-SR4 transceiver supports the MPO connector and the duplex LC connector. Typically, the MPO connector has two alignment pins, which keeps the connector and the fibers aligned to the mating cable.

For more information about the 40GBASE-SR4 4x10GBASE-SR QSFP+ transceiver, including test and measurement information, see the IEEE 802.3-2012 standard.

The following table lists the specifications for the 40GBASE-SR4 4x10GBASE-SR QSFP+ transceiver. The part number of this QSFP+ transceiver is AA1404005-E6.

Table 25: 40GBASE-SR4 4x10GBASE-SR QSFP+ transceiver specifications

Parameter			Specification
Line rate			10.3125 Gbps
Center wavelength range			840 to 860 nanometers
Distance			Up to: • 328 feet (100 meters) – with OM3 fiber cable. • 492 feet (150 meters) – with OM4 fiber cable.
Transmitter characteristics			
Signaling rate, each lane			10.3125 Gbps
RMS spectral width			0.65 nanometers maximum
Average launch power, each lane	**Min**	**Max**	**Units**
	–8.0	–1.0	dBm
Optical modulation amplitude (OMA), each lane	**Min**	**Max**	**Units**
	–5.6	3	dBm
Maximum transmitter and dispersion penalty (TDP), each lane			3.9 dB
Minimum launch power in OMA minus TDP, each lane			–7.8 dBm
Minimum extinction ratio			3 dB
Maximum optical return loss tolerance			12 dB
Receiver characteristics			
Signaling rate, each lane			10.3125 Gbps
Average receive power, each lane	**Min**	**Max**	**Units**
	–9.5	2.4	dBm
Receive power in OMA, each lane	**Min**	**Max**	**Units**
	–7.5	3	dBm
Receive input optical power (damage threshold)			3.4 dBm

40GBASE-LR4 QSFP+ transceiver specifications

The 40GBASE-LR4 QSFP+ transceiver can attain link lengths of up to 10 kilometers on International Telecommunication Union (ITU) recommendation G.652 single-mode fiber (SMF) cable.

The following table lists the transmitter and receiver specifications for the 40GBASE-LR4 transceiver. The part number of this QSFP+ transceiver is AA1404001-E6.

For more information about the 40GBASE-LR4 transceiver, including test and measurement information, see the IEEE 802.3–2012 standard.

Table 26: IEEE 802.3–2012 40GBASE-LR4 transceiver specifications

Parameter	Specification
Distance	Up to 10 kilometers
Transmitter characteristics	
Line rate	10 Gbps
Signaling rate, each lane 10GBase	10.3125 Gbps
Data rate, total 40GBase	41.25 Gbps
Lane wavelength ranges	1264.5 nanometers to 1277.5 nanometers 1284.5 nanometers to 1297.5 nanometers 1304.5 nanometers to 1317.5 nanometers 1324.5 nanometers to 1337.5 nanometers
Total average optical power	8.3 dBm
Minimum average optical power, each lane at 10.3125 Gbps.	–7 dBm
Maximum average optical power, each lane at 10.3125 Gbps.	2.3 dBm
Difference in optical power between any two lanes	6.5 dB
Minimum side mode suppression ratio	30 dB
Minimum optical modulation amplitude	–4 dBm
Maximum optical modulation amplitude	3.5 dBm
Maximum average optical power of OFF transmitter, each lane	–30 dBm
Minimum extinction ratio at 10.3125 Gbps	3.5 dB
$RIN_{20}OMA$ (maximum)	–128 dB/Hz
Maximum optical return loss tolerance	20 dB
Receiver characteristics	
Line rate	10 Gbps

Table continues…

Parameter	Specification
Signaling rate, each lane 10GBase	10.3125 Gbps
Data rate, total 40GBase	41.25 Gbps
Lane wavelength ranges	1264.5 nanometers to 1277.5 nanometers 1284.5 nanometers to 1297.5 nanometers 1304.5 nanometers to 1317.5 nanometers 1324.5 nanometers to 1337.5 nanometers
Average receive power, each lane at 10.3125 Gbps.	–13.7 to 2.3 dBm
Maximum receiver power, each lane in OMA.	3.5 dBm
Maximum receiver sensitivity in OMA, each lane at 10.3125 Gbps.	–11.5 dBm
Maximum receiver reflectance	–26 dBm
Stressed receiver sensitivity, each lane at 10.3125 Gbps.	–9.6 dBm
Receive input optical power (damage threshold per lane)	3.3 dBm

40GBASE-LM4 QSFP+ specifications

This transceiver operates up to 80 meters on 50 µm MMF cable plant and is compliant with channel insertion loss specified in IEEE standard 802.3-2012, Table 52-10, for 2000 (OM3) or 4700 MHz*km (OM4) 50 um multimode fiber.

Note:

Channel insertion loss includes connectors.

The 40GBASE-LM4 QSFP+ transceiver supports a link configuration of a backbone cable between patch panels with one jumper from the transceiver to the patch panel at each end. All ends support duplex LC connectors. Connector return loss requirement is 20 dB or greater (reflectance –20 dB or less).

Other 10GBASE-S transceivers and link parameters do not apply, as the LM4 operates in the 1310 nm region. The 40GBASE-LM4 QSFP+ transceiver contains four transmitters where the signal is internally multiplexed to the Tx port and contains four receivers where the signal is internally demultiplexed at the Rx port.

The 40GBASE-LM4 QSFP+ transceiver replaces a 40GBASE-SR4 QSFP+ transceiver for applications up to 80 meters. The transceiver uses one pair of MMF fibers and a duplex LC connector versus the eight fibers with MPO/MTP connectors that are used with the 40GBASE-SR4 QSFP+ transceiver. The transceiver is not interoperable with 40GBASE-SR4 or 10GBASE-SR transceivers.

The following table lists the transmitter, cable plant, and receiver specifications for the 40GBASE-LM4 QSFP+ transceiver. The part number is AA1404002-E6.

Parameter	Specification
Data rate (nominal)	4 X 10 Gbps
Nominal transmitter center wavelengths	1271, 1291, 1311, 1331
Link distance (OM3 and OM4)	Up to 80 m maximum
Operating temperature range	0 °C to +70 °C
Transmitter characteristics	
Maximum total average launch power	10.3 dBm
Maximum average launch power, each lane	4.3 dBm
Maximum average launch power of OFF transmitter	–30 dBm
Maximum optical return loss tolerance	20 dB
Applicable cable plant	
Maximum insertion loss, including connectors	2.6 dB (OM3) or 2.9 dB (OM4)
Minimum optical return loss	20 dB
Maximum link distance	80 m
Receiver characteristics	
Maximum average receive power, each lane	4.3 dBm
Maximum input optical power	Tolerates direct Tx to Rx connection
Stressed receiver sensitivity	–5.0 dBm

40GBASE-ER4 QSFP+ specifications

The following table lists the transmitter and receiver specifications for the 40GBASE-ER4 QSFP+ transceiver with corresponding wavelengths. The reach for this QSFP+ transceiver is up to 40 kilometers. The part number is AA1404003-E6.

40GBASE-ER4 QSFP+

The cable plant must have a minimum of 9 dB insertion loss between the transmitter and receiver for correct operation. If the fiber cable does not have this much loss, use an attenuator to meet the 9 dB requirement. No attenuator is needed if insertion loss is at least 9 dB.

Table 27: IEEE 802.3ae 40GBASE-ER4 QSFP+ specifications

Parameter	Specification
Distance	Up to 40 kilometers
Loss budget	18.5 dB
Transmitter characteristics	
Line rate	10 Gbps
Signaling rate, each lane 10GBASE	10.3125 Gbps
Lane wavelength ranges	1264.5 nanometers to 1277.5 nanometers

Table continues…

Parameter	Specification
	1284.5 nanometers to 1297.5 nanometers 1304.5 nanometers to 1317.5 nanometers 1324.5 nanometers to 1337.5 nanometers
Total average optical power	10.5 dBm

Average optical power, each lane at 10.3125 Gbps	Min. –2.7	Max. 4.5	Units dBm
Difference in optical power between any two lanes			4.7 dB OMA
Minimum side mode suppression ratio			30 dBm
Optical modulation amplitude	Min. 0.3	Max. 5	Units dBm
Maximum average optical power of OFF transmitter, each lane			–30 dBm
Launch power in OMA minus TDP, each lane, (min.)			–0.5 dBm
Minimum extinction ratio at 10.3125 Gbps			5.5 dB
$RIN_{20}OMA$ (maximum)			–128 dB/Hz
Maximum optical return loss tolerance			20 dB
Receiver characteristics			
Line rate			10 Gbps
Signaling rate, each lane 10GBASE			10.3125 Gbps
Damage threshold per lane (min.)			3.8 dBm
Lane wavelength ranges			1264.5 nanometers to 1277.5 nanometers 1284.5 nanometers to 1297.5 nanometers 1304.5 nanometers to 1317.5 nanometers 1324.5 nanometers to 1337.5 nanometers
Average receive power, each lane at 10.3125 Gbps			–21.2 to –4.5 dBm
Maximum receiver power, each lane in OMA			–4 dBm
Receiver sensitivity (OMA), each lane			–19 dBm
Stressed receiver sensitivity (OMA), each lane (max.)			–16.8 dBm
Maximum receiver reflectance			–26 dBm

Link Engineering for greater than 30 km operation

Caution:

Operating ranges that are greater than 30 km for the same link power budget are considered engineered links. If your operating range is greater than 30 km, you require engineering skills to

determine correct device and cable plant specifications, and installation practices. Avaya recommends that you consider the potential impact of operating with near zero assured margin.

The following list provides the requirements for achieving operation to 40 km:

- Ensure fiber insertion loss, in dB/km, is less than (18.5 – connector loss, dB)/length.
- Observe strict limits on number and insertion loss of connectors.
- Note that operation to 40 km can possibly eliminate power margin allocated to aging, additional connectors, or cable repairs. This increases risk of additional remediation effort in the event of cable or configuration changes. Cable cuts are the dominant cause of link failure and have been observed to occur on average 4.39 times per thousand sheath miles per year.

Table 28: 40GBASE-ER4 operating ranges

Required operating range
2 m to 30 km
2 m to 40 km

Interoperation

40GBASE-ER4 and 40GBASE-LR4 QSFP+ transceivers can interoperate with a properly-engineered link. It requires the cabling (channel) characteristics for 40GBASE-LR4 to be met, with the exception of the maximum and minimum channel insertion loss values, as shown in the following table, for the two link directions separately.

Direction	Min. loss	Max. loss	Unit
40GBASE-LR4 transmitter to 40GBASE-ER4 receiver	7.5	14.2	dB
40GBASE-ER4 transmitter to 40GBASE-LR4 receiver	2.2	11	dB

QSFP+ to QSFP+ 40-gigabit DAC specifications

The QSFP+ to QSFP+ 40-gigabit direct attach cable (DAC) assembly directly connects two QSFP+ ports.

The following table identifies the part numbers for specific cable assembly lengths.

Cable length	Part number
10 meter	AA1404028–E6
QSFP+ to QSFP+ DAC 1 meter	AA1404029–E6
QSFP+ to QSFP+ DAC 3 meter	AA1404031–E6
QSFP+ to QSFP+ DAC 5 meter	AA1404032–E6

Table continues…

Cable length	Part number
QSFP+ to QSFP+ DAC 0.5 meter	AA1404037–E6
0.5 meter	AA1404037–E6GS
1 meter	AA1404038–E6GS
3 meter	AA1404039–E6GS

Important:

Not all Avaya products support all cable lengths.

QSFP+ cable assembly specifications

This section provides cable assembly specifications for the supported 40-gigabit QSFP transceiver module.

Note:

Avaya Virtual Services Platform 9000 operates in forgiving mode for QSFP+ direct attach cables, which means that the switch will bring up the port operationally when using non-Avaya direct attach cables. Avaya does not proide support for operational issues related to these DACs, but they will operate and the port link will come up.

QSFP+ breakout cable specifications

This section provides technical specifications for the supported breakout cables (BOC).

QSFP+ to four SFP+ 10-gigabit BOC

The QSFP+ to four SFP+ 10 Gigabit Ethernet direct attach breakout cable assembly directly connects one QSFP+ port to four SFP+ ports.

The following table identifies the part numbers for specific cable assembly lengths.

Note:

- Avaya Virtual Services Platform 9000 does not support the 40 Gigabit Ethernet ends of the QSFP+ breakout cables because the platform does not support channelization on the VSP 9012QQ-2 module. Avaya Virtual Services Platform 9000 supports only the four SFP+ 10 Gigabit Ethernet ends of the following QSFP+ breakout cables: AA1404033-E6, AA1404035-E6, AA1404036-E6, and AA1404041-E6.

Cable type	Cable length	Minimum software version for VSP 9000	Part number
Passive copper breakout cable	QSFP+ to QSFP+ DAC 1 meter	4.1	AA1404033–E6
Passive copper breakout cable	QSFP+ to SFP+ DAC BOC 3 meter	4.1	AA1404035–E6
Passive copper breakout cable	QSFP+ to SFP+ DAC BOC 5 meter	4.1	AA1404036–E6
Active optical breakout cable	10 meter	4.1	AA1404041–E6

QSFP+ to QSFP+ 40-gigabit direct attach cable specifications

The QSFP+ to QSFP+ 40-gigabit Direct Attach Cable (DAC) assembly directly connects two QSFP+ ports. For more information, see the IEEE 802.3ba 40GBASE-CR4 cable assembly specification standard.

The following table identifies the part numbers for specific cable assembly lengths.

Cable type	Cable length	Minimum software version for VSP 9000	Part number
Passive copper DAC	QSFP+ to QSFP+ DAC 0.5 meter	4.0.1	AA1404037–E6
Active optical DAC	10 meter	4.1	AA1404028–E6

Chapter 7: Translations of safety messages

This section contains translations of precautionary notices that you must read and follow for safe operation of the Virtual Services Platform 9000.

Class A electromagnetic interference warning statement

Warning:

Risk of electromagnetic interference

This device is a Class A product. Operation of this equipment in a residential area is likely to cause harmful interference, in which case users are required to take appropriate measures necessary to correct the interference at their own expense.

Warning:

AVERTISSEMENT

Le périphérique est un produit de Classe A. Le fonctionnement de cet équipement dans une zone résidentielle risque de causer des interférences nuisibles, auquel cas l'utilisateur devra y remédier à ses propres frais.

Warning:

WARNUNG

Dies ist ein Gerät der Klasse A. Bei Einsatz des Geräts in Wohngebieten kann es Störungen des Radio- und Fernsehempfangs verursachen. In diesem Fall muss der Benutzer alle notwendigen Maßnahmen ergreifen, die möglicherweise nötig sind, um die Störungen auf eigene Rechnung zu beheben.

Warning:

ADVERTENCIA

Este es un producto clase A. El uso de este equipo en áreas residenciales puede causar interferencias nocivas, en cuyo caso, se requerirá que los usuarios tomen cualquier medida necesaria para corregir la interferencia por cuenta propia.

Warning:

AVISO

Este dispositivo é um produto Classe A. Operar este equipamento em uma área residencial provavelmente causará interferência prejudicial; neste caso, espera-se que os usuários tomem as medidas necessárias para corrigir a interferência por sua própria conta.

Warning:

AVVISO

Questo dispositivo è un prodotto di Classe A. Il funzionamento di questo apparecchio in aree residenziali potrebbe causare interferenze dannose, nel cui caso agli utenti verrà richiesto di adottare tutte le misure necessarie per porre rimedio alle interferenze a proprie spese.

Electrostatic discharge caution statement

Electrostatic alert:

ELECTROSTATIC ALERT

ESD can damage electronic circuits. Do not touch electronic hardware unless you wear a grounding wrist strap or other static-dissipating device.

Electrostatic alert:

ELEKTROSTATIKWARNUNG

Elektronische Schaltkreise können durch elektrostatische Entladung beschädigt werden. Berühren Sie elektronische Hardware nur, wenn Sie ein Erdungsarmband oder ein anderes Statik ableitendes Medium tragen.

Electrostatic alert:

ALERTA DE ELECTROESTÁTICA

Una descarga electroestática puede dañar los circuitos eléctrónicos. No toque el hardware electrónico a no ser que utilicé una muñequera antiestática u otro dispositivo disipador de estática.

Electrostatic alert:

ALERTA CONCERNANT LES DÉCHARGES ÉLECTROSTATIQUES

Une décharge électrostatique (DES) peut endommager les circuits électroniques. Ne touchez pas le matériel électronique, à moins de mettre à votre poignet une bande de mise à la masse ou autre dispositif dissipant l'électricité statique.

Electrostatic alert:

ALERTA DE ELETROSTÁTICA

ESD pode danificar circuitos eletrônicos. Não toque em equipamentos eletrônicos a menos que esteja utilizando pulseira de aterramento ou outro dispositivo para dissipação de energia estática.

Electrostatic alert:

AVVISO ELETTROSTATICO

Le scariche elettrostatiche (ESD) possono danneggiare i circuiti elettronici. Non toccare i componenti elettronici senza aver prima indossato un braccialetto antistatico o un altro dispositivo in grado di dissipare l'energia statica.

Laser eye safety danger statement

Danger:

Risk of eye injury by laser

Fiber optic equipment can emit laser or infrared light that can injure your eyes. Never look into an optical fiber or connector port. Always assume that fiber optic cables are connected to a light source.

Danger:

DANGER

Risques de blessure oculaire par lumière laser

L'équipement de fibres optiques peut émettre une lumière laser ou infrarouge nuisible à vos yeux. Ne regardez jamais en direction de fibres optiques ou d'un port connecteur. Supposez toujours que les câbles de fibres optiques sont connectés à une source de lumière.

Danger:

GEFAHR

Risiko einer Augenverletzung durch Laser

Risiko einer Augenverletzung durch Laser Glasfasergeräte können Laserstrahlen oder ultraviolettes Licht aussenden, das Ihre Augen verletzen kann. Schauen Sie nie direkt in einen Glasfaserleiter oder Verbindungsanschluss. Gehen Sie immer davon aus, dass Glasfaserkabel mit einer Lichtquelle verbunden sind.

Danger:

PELIGRO

Riesgo de lesión en los ojos por láser

El equipo de fibra óptica puede emitir una luz láser o infrarroja que dañe sus ojos. Nunca mire un puerto de fibra óptica o conector. Siempre asuma que los cables de fibra óptica están conectados a una fuente de luz.

Danger:

PERIGO

O laser pode causar ferimentos no olho

O equipamento de fibra ótica pode emitir laser ou luz infravermelha que pode causar danos a sua vista. Nunca olhe para dentro da fibra ótica ou da porta do conector. Tenha sempre em mente que os cabos de fibra ótica estão ligados a uma fonte de luz.

Danger:

PERICOLO

Rischio di ustioni agli occhi dovute al laser

Le apparecchiature con fibre ottiche possono emettere raggi laser o infrarossi in grado di provocare ferite agli occhi. Non guardare mai all'interno di una porta di connessione o una fibra ottica. Tenere sempre presente che i cavi a fibra ottica sono collegati a una sorgente luminosa.

Laser eye safety connector inspection danger statement

Danger:

Risk of eye injury

When you inspect a connector, ensure that light sources are off. The light source used in fiber optic cables can damage your eyes.

Danger:

DANGER

Risques de blessure oculaire

Assurez-vous que toutes les sources de lumière ont été désactivées avant de procéder au contrôle d'un connecteur. La source de lumière utilisée dans les câbles de fibres optiques risque de provoquer des lésions oculaires.

Danger:

GEFAHR

Verletzungsrisiko der Augen

Achten Sie bei der Kontrolle der Anschlüsse darauf, dass die Lichtquellen abgeschaltet sind. Die für die Glasfaserkabel verwendeten Lichtquellen können Augenschäden hervorrufen.

Danger:

PELIGRO

Riesgo de lesiones oculares

Cuando inspeccione un conector, controle que las fuentes de luz estén apagadas. La fuente de luz que utilizan los cables de fibra óptica puede ocasionar daños en la vista.

Danger:

PERIGO

Risco de ferimento nos olhos

Ao inspecionar um conector, verifique se as fontes luminosas estão desligadas. A fonte luminosa usada nos cabos de fibra ótica pode causar danos a seus olhos.

Danger:

PERICOLO

Rischio di lesioni agli occhi

Quando si esamina un connettore, assicurarsi che le sorgenti di luce siano spente. La sorgente di luce utilizzata nei cavi a fibre ottiche potrebbero danneggiare gli occhi.

Connector cleaning safety danger statement

Danger:

Risk of eye injury

When you inspect a connector, ensure that light sources are off. The light source used in fiber optic cables can damage your eyes. To avoid getting debris in your eyes, wear safety glasses when you work with the canned air duster. To avoid eye irritation on contact, wear safety glasses when you work with isopropyl alcohol.

Danger:

DANGER

Risques de blessure oculaire

Assurez-vous que toutes les sources de lumière ont été désactivées avant de procéder au contrôle d'un connecteur. La source de lumière utilisée dans les câbles de fibres optiques risque de provoquer des lésions oculaires. Pour éviter tout risque de projection vers les yeux, portez des lunettes de protection lorsque vous utilisez la bombe dépoussiérante à air comprimé. Pour éviter tout risque d'irritation oculaire, portez des lunettes de protection lorsque vous utilisez de l'alcool à 90°.

Danger:

GEFAHR

Verletzungsrisiko der Augen

Achten Sie bei der Kontrolle der Anschlüsse darauf, dass die Lichtquellen abgeschaltet sind. Die für die Glasfaserkabel verwendeten Lichtquellen können Augenschäden hervorrufen. Zum Schutz vor Schmutzteilchen tragen Sie eine Schutzbrille, wenn Sie mit einem Pressluft-Spray arbeiten. Zum Schutz vor Augenirritationen tragen Sie eine Schutzbrille, wenn Sie mit Isopropanol arbeiten.

Danger:

PELIGRO

Riesgo de lesiones

Cuando inspeccione un conector, controle que las fuentes de luz estén apagadas. La fuente de luz que utilizan los cables de fibra óptica puede ocasionar daños en la vista. Cuando trabaje con el pulverizador de aire envasado, utilice gafas de seguridad para evitar el ingreso de residuos en los ojos. Utilice gafas de seguridad cuando trabaje con alcohol isopropilo para evitar irritación en los ojos.

Danger:

PERIGO

Risco de ferimento nos olhos

Ao inspecionar um conector, verifique se as fontes luminosas estão desligadas. A fonte luminosa usada nos cabos de fibra ótica pode causar danos a seus olhos. Para evitar que seus olhos sejam atingidos por resíduos, use óculos de segurança ao trabalhar com lata de ar comprimido. Para evitar irritação dos olhos, use óculos de segurança ao trabalhar com álcool isopropílico.

Danger:

PERICOLO

Rischio di lesioni agli occhi

Quando si esamina un connettore, assicurarsi che le sorgenti di luce siano spente. La sorgente di luce utilizzata nei cavi a fibre ottiche potrebbero danneggiare gli occhi. Per evitare l'accidentale introduzione di detriti negli occhi, indossare gli occhiali di sicurezza quando si lavora con un'impolveratrice ad aria compressa. Per evitare irritazioni oculari da contatto, indossare gli occhiali di sicurezza quando si lavora con alcool isopropilico.

Optical fiber damage warning statement

Warning:

Risk of equipment damage

Do not crush fiber optic cable. If fiber optic cable is in the same tray or duct with large, heavy electrical cables, the weight of the electrical cable can damage the fiber optic cable.

Warning:

AVERTISSEMENT

Risques d'endommagement de l'équipement

N'exercez pas de pression sur les câbles de fibres optiques. Ne placez pas de câbles de fibres optiques dans la même caisse ou dans le même fourreau que des câbles électriques lourds car leur poids risquerait de les endommager.

Warning:

WARNUNG

Risiko von Geräteschäden

Das Glasfaserkabel darf nicht zerdrückt werden. Wenn sich ein Glasfaserkabel zusammen mit großen und schweren Elektrokabeln im gleichen Kabelkanal oder in der gleichen Führung befindet, kann es durch das Gewicht der Elektrokabel beschädigt werden.

Warning:

ADVERTENCIA

Riesgo de daños en los equipos

Evite aplastar los cables de fibra óptica. Si el cable de fibra óptica se encuentra en la misma bandeja o conducto que otros cables eléctricos grandes y pesados, puede dañarse.

Warning:

AVISO

Risco de danos ao equipamento

Não amasse o cabo de fibra ótica. Se o cabo de fibra ótica estiver na mesma bandeja ou duto com cabos elétricos longos e pesados, ele pode ser danificado pelo peso do cabo elétrico.

Warning:

Avvertenza

Rischio di danno all'apparecchio

Non schiacciare o piegare il cavo a fibre ottiche. Se il cavo a fibre ottiche è posizionato in un vassoio o condotto con cavi elettrici pesanti e di grosse dimensioni, esso potrebbe essere danneggiato dal peso dei cavi elettrici.

Optical fiber connector damage warning statement

Warning:

Risk of equipment damage

To prevent further contamination, clean fiber optic equipment only when you see evidence of contamination.

To prevent contamination, cover the optical ports of all active devices with a dust cap or optical connector.

To avoid the transfer of oil or other contaminants from your fingers to the end face of the ferrule, handle connectors with care.

Warning:

AVERTISSEMENT

Risques d'endommagement de l'équipement

Pour éviter tout risque de nouvelle contamination, nettoyez uniquement le matériel en fibre optique lorsque les preuves de contamination sont avérées.

Pour éviter tout risque de contamination, assurez-vous que tous les ports optiques des périphériques sous tension sont protégés par un capuchon anti-poussière ou par un connecteur optique.

Manipulez les connecteurs avec précaution afin d'éviter toute application d'huile provenant de vos doigts ou d'autres contaminants sur l'extrémité de la ferrule.

Warning:

WARNUNG

Risiko von Geräteschäden

Zur Vermeidung weiterer Verunreinigungen reinigen Sie die Glasfiber-Ausrüstung nur dann, wenn sie offensichtlich kontaminiert ist.

Zur Vermeidung von Verunreinigungen schützen Sie die optischen Ports aller aktiven Geräte mit einer Staubkappe oder einem optischen Steckverbinder.

Zur Vermeidung von Verunreinigungen des hinteren Muffenteils durch Öl von den Fingern oder durch andere Kontaminationsstoffe behandeln Sie die Anschlüsse vorsichtig.

Warning:

ADVERTENCIA

Riesgo de daños en los equipos

Limpie los equipos de fibra óptica únicamente cuando existan rastros de contaminación para evitar diseminarla aun más.

Para evitar la contaminación, controle que los puertos ópticos de todos los dispositivos activos estén cubiertos con una tapa protectora o un conector óptico.

Maneje los conectores con cuidado para no contaminar la superficie de los casquillos con la grasa de los dedos ni otros contaminantes.

Warning:

AVISO

Risco de danos ao equipamento

Para evitar contaminação futura, limpe o equipamento ótico apenas quando houver evidência de contaminação.

Para evitar a contaminação, verifique se as portas óticas de todos os dispositivos ativos estão cobertas com uma proteção contra pó ou conector ótico.

Para evitar a transferência de óleo ou outro agente contaminador de seus dedos para a extremidade final da ponteira, manuseie os conectores com cuidado.

Warning:

Avvertenza

Rischio di danno all'apparecchio

Per evitare ulteriori contaminazioni, pulire l'apparecchio a fibre ottiche solo in presenza di evidente contaminazione.

Per evitare contaminazioni, assicurarsi che le porte ottiche di tutti i dispositivi attivi siano coperte da un tappo antipolvere o da un connettore ottico.

Per evitare il trasferimento di olio o di altri agenti contaminanti dalle dita alla parte finale della ghiera, maneggiare con cura i connettori.

SFP damage warning statement

Warning:

Risk of equipment damage

SFPs are keyed to prevent incorrect insertion. If the SFP resists pressure, do not force it; turn it over, and reinsert it.

Warning:

AVERTISSEMENT

Risques d'endommagement de l'équipement

Afin d'éviter tout risque d'insertion incorrecte, les modules SFP sont verrouillés. Si vous ne parvenez pas à insérer un module SFP, ne forcez pas. Retournez-le et renouvelez l'opération.

Warning:

WARNUNG

Risiko von Geräteschäden

Die SFPs sind so konstruiert, dass ein falsches Einsetzen verhindert wird. Lässt sich ein SFP auch auf Druck hin nicht einsetzen, versuchen Sie nicht, es gewaltsam einzusetzen, sondern drehen Sie es um, und setzen Sie es erneut ein.

Warning:

ADVERTENCIA

Riesgo de daños en los equipos

Los módulos SFP cuentan con cuñas que no permiten insertarlos de forma incorrecta. Si el módulo SFP opone resistencia a la presión, no lo fuerce; gírelo e insértelo nuevamente.

Warning:

AVISO

Risco de danos ao equipamento

Os SFPs são chaveados para evitar inserção indevida. Se o SFP resistir à pressão, não o force; inverta e recoloque-o.

Warning:

Avvertenza

Rischio di danni all'apparecchio

Gli SFP dispongono di chiavi in modo da evitarne l'inserimento errato. Se l'SFP resiste alla pressione, non forzarlo ma capovolgerlo e reinserirlo.

Glossary

attenuation	The decrease in signal strength in an optical fiber caused by absorption and scattering.
bit error rate (BER)	The ratio of the number of bit errors to the total number of bits transmitted in a specific time interval.
cable plant	All the optical elements, such as fiber connectors and splices, between a transmitter and a receiver.
coarse wavelength division multiplexing (CWDM)	A technology that uses multiple optical signals with different wavelengths to simultaneously transmit in the same direction over one fiber, and then separates by wavelength at the distant end.
demultiplexing	The wavelength separation in a wavelength-division multiplexing system. The opposite of multiplexing.
dense wavelength division multiplexing (DWDM)	A technology that uses many optical signals (16 or more) with different wavelengths to simultaneously transmit in the same direction across one fiber, and then separate by wavelength at the distant end.
dispersion	The broadening of input pulses as they travel the length of an optical fiber. The following types of dispersion exist: • modal dispersion—caused by the many optical path lengths in a multimode fiber • chromatic dispersion—caused by the differential delay at various wavelengths in an optical fiber • waveguide dispersion—caused by light traveling through both the core and cladding materials in single-mode fibers
gigabit Ethernet (GbE)	Ethernet technology with speeds up to 10 Gbps.
light emitting diode (LED)	A semiconductor diode that emits light when a current passes through it.
media	A substance that transmits data between ports; usually fiber optic cables or category 5 unshielded twisted pair (UTP) copper wires.

metropolitan area network (MAN)	A broadband network that covers an area larger than a Local Area Network.
multimode fiber (MMF)	A fiber with a core diameter larger than the wavelength of light transmitted that you can use to propagate many modes of light. Commonly used with LED sources for low speed and short distance lengths. Typical core sizes (measured in microns) are 50/125, 62.5/125 and 100/140.
multiplexing	Carriage of multiple channels over a single transmission medium; a process where a dedicated circuit is shared by multiple users. Typically, data streams intersperse on a bit or byte basis (time division), or separate by different carrier frequencies (frequency division).
nanometer (nm)	One billionth of a meter (10^{-9} meter). A unit of measure commonly used to express the wavelengths of light.
QSFP+	A hot pluggable, quad small form-factor pluggable plus (QSFP+) transceiver, which is used in 40 Gbps and 4x10 Gbps Ethernet applications.
SFP	A hot pluggable, small form-factor pluggable (SFP) transceiver, which is used in Ethernet applications up to 1 Gbps.
SFP+	A hot pluggable, small form-factor pluggable plus (SFP+) transceiver, which is used in Ethernet applications up to 10 Gbps. It is similar in physical appearance to SFP transceivers.
single-mode fiber (SMF)	One of the various light waves transmitted in an optical fiber. Each optical signal generates many modes, but in single-mode fiber only one mode is transmitted. Transmission occurs through a small diameter core (approximately 10 micrometers), with a cladding that is 10 times the core diameter. These fibers have a potential bandwidth of 50 to 100 gigahertz (GHz) per kilometer.
unshielded twisted pair (UTP)	A cable with one or more pairs of twisted insulated copper conductors bound in a single plastic sheath.
XFP	A pluggable 10 gigabit transceiver capable of providing different optical media for a switch. The XFP is similar to an SFP transceiver but is larger in size.