Installing Transceivers and Optical Components on Avaya Ethernet Routing Switch 4800 Series

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Chapter 1: Introduction

Purpose

You can use this document to help you select, install, and remove Small Form Factor Pluggable (SFP), Small Form Factor Pluggable Plus (SFP+), and 10 Gigabit Small Form Factor Pluggable (XFP) transceivers. Specifications for each supported device are also included.

Chapter 2: New in this release

The following sections detail what's new in *Installing Transceivers and Optical Components on Avaya Ethernet Routing Switch 4800 Series*, NN47205-301 Release 5.8.

Features

See the following sections for information about feature changes:

Note:

Release 5.8 features are supported only on ERS 4800 series.

10GBASE-ZR/ZW SFP+

Support for a 10GBASE-ZR SFP+ is added on ERS 4800 series. For more information about the SFP+ specifications, see 10GBASE-ZR/ZW SFP+ specifications on page 59

Other changes

See the following sections for information about changes that are not feature-related.

Title change for documents

Installing Transceivers and Optical Components on Avaya Ethernet Routing Switch 4000 Series is renamed *Installing Transceivers and Optical Components on Avaya Ethernet Routing Switch 4800 Series*.

Introduction chapter

Information about Related resources and Support are moved to the last chapter in this document.

Installing an SFP

Information about wrap-around latch-type extraction mechanism is removed from SFP installation, as the wrap-around style is not supported.

Chapter 3: Safety and equipment care information

This chapter contains important safety and regulatory information.

Read this section before you install Small Form Factor Pluggable (SFP), Small Form Factor Pluggable Plus (SFP+), and 10 Gigabit Small Form Factor Pluggable (XFP) transceivers.

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 transceivers

This section describes how to select and install Small Form Factor Pluggable (SFP) transceivers.

Use an SFP to connect a device motherboard to a fiber optic or unshielded twisted pair network cable. The SFP transceivers described in this section provide Ethernet at 1 gigabit per second (Gbps).

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 steps

1. Determine the required reach.

   Depending on the product, SFPs 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 Lucent connector (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) SFPs.

4. Determine if you need digital diagnostic monitoring (DDM).

   Not all SFPs or products support DDM.

5. Use the following job aids to determine the appropriate SFP for your application.

Job aid

The following table describes the reach provided by various SFPs. This table is informational only—not all Avaya Ethernet switching and routing products support all the SFPs listed here.

SFP model	Common application
T1 Fast Ethernet to T1 Remote Bridge	Provides 1.544 Mb/s connectivity with up to 2874 m reach over 22 AWG cable. You can reduce the distance when you use common 24 AWG UTP CAT5/5E cable. Applications include connecting remote LANs and providing transparent LAN services over leased lines.
100BASE-FX	Provides 100 Mb/s LAN services with up to 2 km reach.
1000BASE-BX10	Up to 10 km reach. Bidirectional over one single mode fiber.
1000BASE-BX40	Up to 40 km reach. Bidirectional over one single mode fiber.
1000BASE-LX	Up to 10 km reach over a single mode fiber (SMF) pair. Up to 550 m reach over a multimode fiber (MMF) pair.
1000BASE-SX	Well-suited for campus local area networks (LAN) and intrabuilding links. Up to 275 or 550 m reach (fiber-dependent) over a fiber pair.
1000BASE-T	Lowest-cost gigabit Ethernet solution. Up to 100 m reach over Category 5 (CAT5) unshielded twisted pair (UTP).
1000BASE-XD	Up to 40 km reach over a single mode fiber pair.
1000BASE-ZX	Up to 70 km reach over a single mode fiber pair.

Job aid

SFPs are hot-swappable input and output enhancement components designed for use with Avaya products to allow gigabit Ethernet ports to link with other gigabit Ethernet ports over various media types.

The SFPs described in this section do not have Digital Diagnostic Interface capability, and are RoHS -E5 compliant.

The system also supports CWDM SFPS. CWDM technology consolidates multiple optical channels on a common optical fiber. CWDM uses multiple wavelengths to expand available bandwidth.

CWDM SFPs 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.

Model and connector	Product number	Description
1000BASE-SX (LC)	AA1419013-E5	850 (nm), up to 275 or 550 m

Table continues…

Model and connector	Product number	Description
		NOTE: After December 31, 2008 the Ethernet Routing Switch 4000 also supports the DDI-capable SFP, part number AA1419048-E6. The DDI-capable version is compatible with AA1419013-E5. The 1000Base-SX non-DDI SFP order code is still supported, but it is discontinued and no longer available for purchase.
1000BASE-SX (MT-RJ)	AA1419014-E5	850 nm, up to 275 or 550 m The 1000Base-SX non-DDI SFP order code is still supported, but it is discontinued and is no longer available for purchase.
1000BASE-LX (LC)	AA1419015-E5	1310 nm, up to 10 km **Note:** After December 31, 2008 the Ethernet Routing Switch 4000 also supports the DDI-capable SFP, part number AA1419049-E6. The DDI-capable version is compatible with AA1419015-E5. The 1000Base-LX non-DDI SFP order code is still supported, but is discontinued and is no longer available for purchase.
1000BASE-XD CWDM (LC)	AA1419025-E5 to AA1419032-E5	1470 nm to 1610 nm, up to 40 km The 1000Base-XD non-DDI CWDM (40 km) SFP order codes are still supported, but are discontinued and no longer available for purchase.
1000BASE-ZX CWDM (LC)	AA1419033-E5 to AA1419040-E5	1470 nm to 1610 nm, up to 70 km The 1000Base-ZX non-DDI CWDM (70 km) SFP order codes are still supported, but are discontinued and no longer available for purchase.
1000BASE-T (RJ-45)	AA1419043-E5	CAT5 UTP, up to 100 m. Supports 1 Gbps. **Note:** Supports 1 Gbps and 100 Mbps in the following units: • ERS 4826GTS

Table continues…

Model and connector	Product number	Description
		• ERS 4826GTS-PWR+ • ERS 4850GTS • ERS 4850GTS-PWR+
100BASE-FX (LC)	AA1419074-E6	1310 nanometers (nm), up to 2 km Supported by the following switch models: 4826GTS, 4826GTS-PWR+, 4850GTS, and 4850GTS-PWR+.
T1 (RJ-48C)	AA1419075-E6	1.544 Mb/s Fast Ethernet to T1 remote bridge. Supported by the following switch models: 4826GTS, 4826GTS-PWR+, 4850GTS, and 4850GTS-PWR+.

For more information about specifications for these SFPs, see SFP specifications on page 43.

Job aid

You can use a Digital Diagnostic Indicating (DDI) SFP in a switch that supports SFPs beginning with Release 5.2. The switch supports the optical functions of the SFP. A future release will provide access to the DDI information.

The following table lists and describes the Avaya SFP models with DDI capability.

Model	Product number	Description
1000BASE-T (RJ-45)	AA1419043-E6	CAT5 UTP, up to 100 m. Because the 1000BASE-T device is all electrical, there is no need for DDI support.
1000BASE-SX	AA1419048-E6	850 nm, up to 275 or 550 m
1000BASE-LX	AA1419049-E6	1310 nm, up to 10 km
1000BASE-XD	AA1419050-E6	1310 nm, up to 40 km
1000BASE-XD	AA1419051-E6	1550 nm, up to 40 km
1000BASE-ZX	AA1419052-E6	1550 nm, up to 70 km
1000BASE-XD CWDM	AA1419053-E6 to AA1419060-E6	1470 nm to 1630 nm, up to 40 km
1000BASE-ZX CWDM	AA1419061-E6 to AA1419068-E6	1470 nm to 1630 nm, up to 70 km
1000BASE-BX (LC type)	AA1419069-E6, AA1419070-E6	Bidirectional 1310 nm and 1490 nm, up to 10 km
1000BASE-EX	AA1419071-E6	1550 nm, up to 120 km
1000BASE-BX (LC type)	AA1419076-E6, AA1419077-E6	Bidirectional 1310 nm and 1490 nm, up to 40 km

Installing an SFP

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

Installing an SFP takes about three minutes.

Prerequisites

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

Warning:

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.

Electrostatic alert:

Risk of equipment damage

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

Caution:

Risk of equipment damage

Only trained personnel can install this product.

Procedure steps

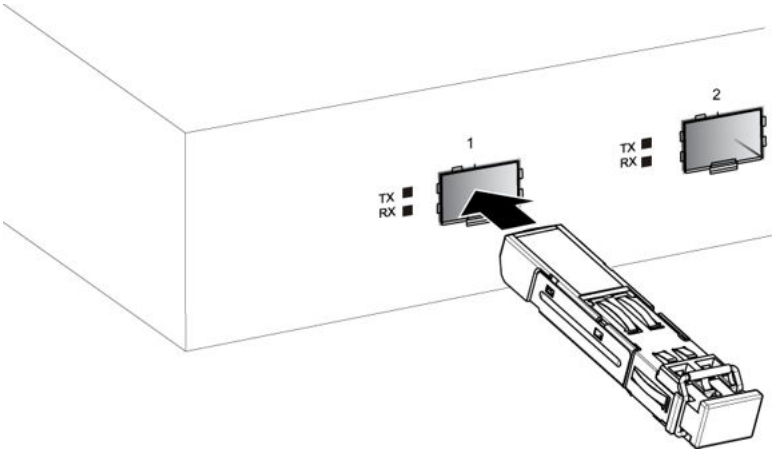
1. Remove the SFP from its protective packaging.
2. Grasp the SFP between your thumb and forefinger.
3. As shown in the following figure, insert the device into the slot on the module.

   Caution:

   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.

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

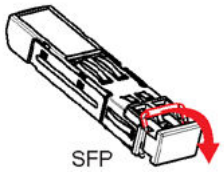


4. Remove the dust cover from the optical bore and insert the fiber optic connector.

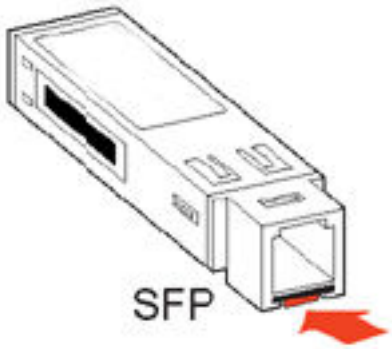
Job aid

Depending on the transceiver manufacturer, your SFP transceiver can have various types of locking and extractor mechanisms.

The following figures shows a typical mechanisms used on SFP transceivers; other locking and extractor mechanisms exist, although they are not shown here. In the following figure, the SFP still has the bore plug installed. Pull the bail to release the device.



The following figure shows the 1000BASE-SX MT-RJ SFP. Push the tab to release the device.



Removing an SFP

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

Prerequisites

- Wear an antistatic wrist strap.

Warning:

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.

Electrostatic alert:

Risk of equipment damage

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

Procedure steps

1. Disconnect the network fiber optic cable from the SFP connector.
2. Affix dust covers over the fiber optic bore and connector.
3. Depending on your SFP model, to release the SFP, press the locking and extractor mechanism.
4. 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.
5. Store the SFP in a safe place until needed.

   Important:

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

Chapter 5: SFP+

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

Related links

SFP+ specifications on page 25

SFP+ transceivers

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

transceivers.

Use an SFP+ transceiver 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 do not interoperate with SFP modules.

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 I/O enhancement components that allow 10–Gigabit connections.

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

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

Model	Description	Part number
10GBASE-LR/LW SFP+	10 km, 1310 nm SMF	AA1403011–E6
10GBASE-ER/EW SFP+	40 km, 1550 nm SMF	AA1403013–E6
10GBASE-SR/SW SFP+	400 m, 850 nm MMF	AA1403015–E6
10GBASE-ZR/ZW SFP+	70 km, 1550 nm SMF	AA1403016–E6
10GBASE-LRM SFP+	220 m, 1260 to 1355 nm; 1310 nm nominal MMF	AA1403017–E6
10GBASE-CX SFP+ 2-pair twinaxial copper cable that plugs into the SFP+ socket and connects two 10-gigabit ports	Cable length: SFP+ DAC 3 meter SFP+ DAC 5 meter SFP+ DAC 10 meter	AA1403019–E6 AA1403020–E6 AA1403018–E6
10GBASE-BX10 SFP+	10 km	AA1403169–E6 and AA1403170–E6

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.

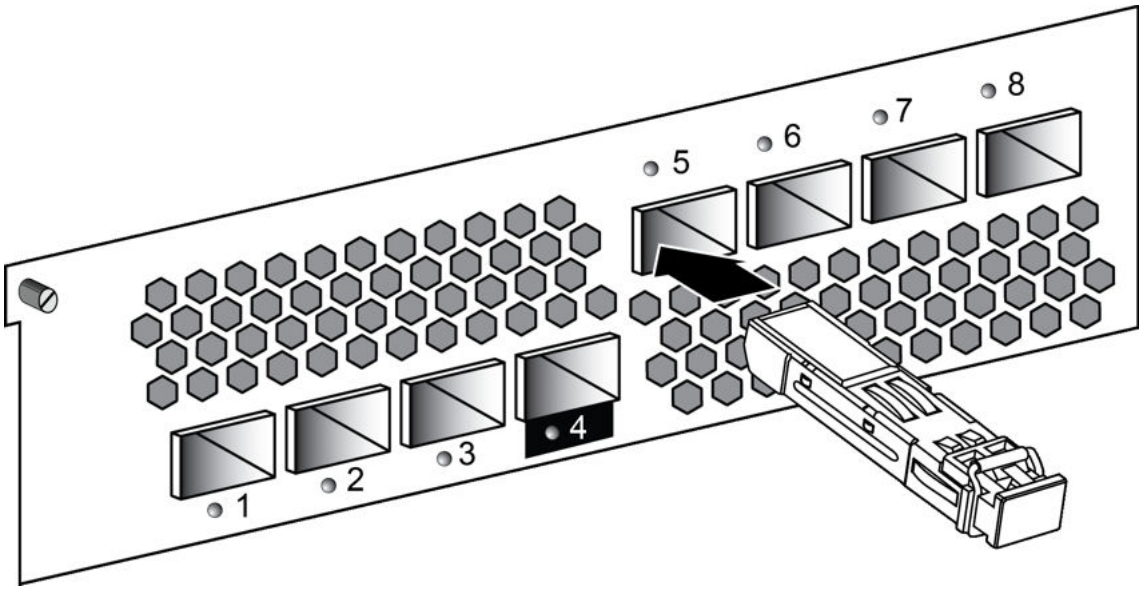
   Warning:

   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.

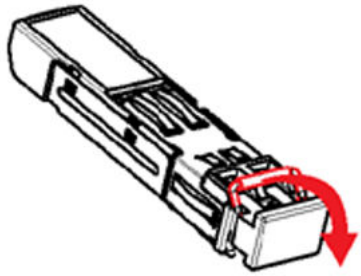
Example



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 Ethernet SFP+ models. Use these specifications to aid in network design.

The specifications in this section are a subset of the IEEE standard 802.3-2012. For more information, see these standards documents. All Avaya SFP+ transceivers meet or exceed these standards.

Important:

Avaya recommends that you only use Avaya qualified transceivers. If you do choose to use other vendor transceivers, Avaya does not support them.

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.

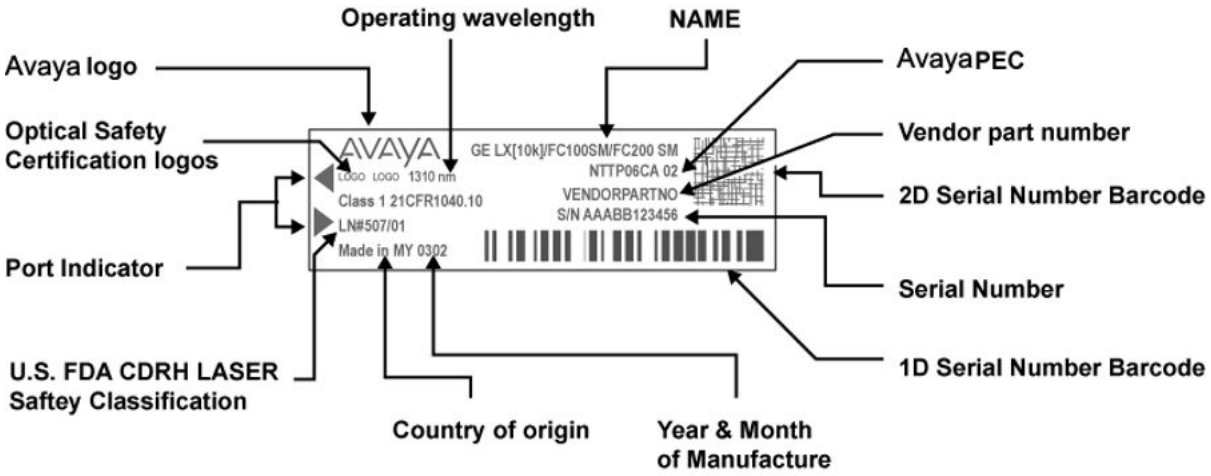


Figure 1: SFP+ top label

Figure 2: SFP+ bottom label

General SFP+ specifications

The following table describes general SFP+ specifications.

Table 1: 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-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 2: 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

Table continues…

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

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 3: 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 4: 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-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 5: 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-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 6: 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)

Table continues…

Parameter	Specifications
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-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 7: 10GBASE-CX cables

Cable length	Part number
3 meter	AA1403019-E6
5 meter	AA1403020-E6
10 meter	AA1403018-E6

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 8: 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.
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 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 9: 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 10: 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
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

Table continues…

Parameter	Specifications
Receiver overload	–1 dBm, P_avg
Receiver reflectance	–26 dB
Receiver damage threshold	+4 dBm

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
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

Chapter 6: 10 Gigabit XFP transceivers

This section describes how to select and install 10 Gigabit small form factor pluggable (XFP) transceivers.

XFP transceivers are hot-swappable I/O interface device designed for use with Avaya products to allow 10–Gigabit Ethernet ports to link with other 10–Gigabit Ethernet ports.

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

Selecting an XFP

Use an XFP transceiver to interface a device motherboard to a fiber optic cable. Select the appropriate transceiver to provide the required reach.

Procedure steps

1. Determine the required reach.

   Depending on the product, XFPs are available for cable distances of up to 300 meters (m), 10 kilometers (km), 40 km, and 80 km.

2. Determine wavelength restrictions or requirements.
3. Use the following job aids to determine the appropriate XFP for your application.

Job aid

XFPs are hot-swappable input and output enhancement components designed for use with Avaya products to allow 10 gigabit Ethernet ports to link with other 10 gigabit Ethernet ports.

Note:

XFP transceivers are not compatible with SFP+ transceivers.

All Avaya XFPs use Lucent connectors (LC) to provide precision keying and low interface losses.

The following table lists and describes the Avaya XFP models. For more information about specifications for these XFPs, see XFP on page 61. Not all products support all XFPs.

Model number	Product number	Description
10GBASE-SR	AA1403005-E5	850 nanometers (nm). The range is up to • 22 m using 62.5 micrometer (µm), 160 megaHertz times km (MHz-km) MMF • 33 m using 62.5 µm, 200 MHz-km MMF • 66 m using 62.5 µm, 500 MHz-km MMF • 82 m using 50 µm, 500 MHz-km MMF • 300 m using 50 µm, 2000 MHz-km MMF
10GBASE-ZR/ZW	AA1403006-E5	1550 nm SMF. The range is up to 80 km.
10GBASE-LR/LW	AA1403001-E5	1310 nm SMF. The range is up to 10 km.
10GBASE-LRM	AA1403007-E6	1310 nm. Up to 220 m reach over Fiber Distributed Data Interface (FDDI)-grade 62.5 µm multimode fiber. Suited for campus LANs.

Installing an XFP

Install an XFP to provide a 10 gigabit Ethernet interface between the switch and other network devices.

Installing an XFP takes approximately three minutes.

Prerequisites

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

Warning:

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.

Electrostatic alert:

Risk of equipment damage

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

Caution:

Risk of equipment damage

Only trained personnel can install this product.

Procedure steps

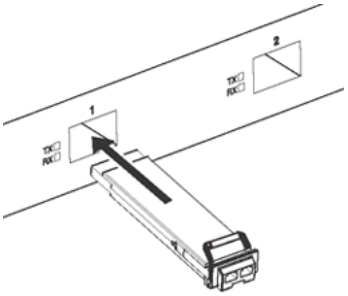
Caution:

Risk of equipment damage

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

1. Remove the XFP from its protective packaging.
2. Grasp the XFP between your thumb and forefinger.
3. Insert the XFP into the XFP slot on the module.

   Apply a light pressure to the XFP until the device clicks and locks into position in the module.

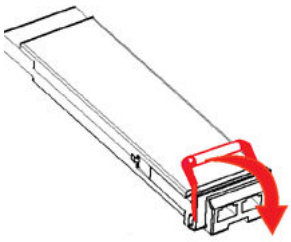


4. Remove the dust cover from the XFP optical bores and insert the fiber optic cable.

Job aid

Depending on the transceiver manufacturer, your XFP transceiver can have various types of locking and extractor mechanisms.

The following figure shows a typical bail-type mechanism used on XFP transceivers. Pull the bail down to release the device.



Removing an XFP

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

Warning:

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.

Electrostatic alert:

Risk of equipment damage

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

Procedure steps

1. Disconnect the network fiber cable from the XFP connector.
2. Affix a dust cover over the optical connector.
3. Pull the bail mechanism on the XFP to release the XFP.
4. Slide the XFP out of the module XFP slot.

   If the XFP does not slide easily from the module slot, use a gentle side-to-side rocking motion while firmly pulling the XFP from the slot.
5. Replace the port dust cover or EMI plug in the module.
6. Store the XFP in a safe place until needed.

   Important:

   If you discard the XFP, be sure to dispose of it according to all national laws and regulations.

Chapter 7: 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.

Use an SFP to connect a device motherboard to a fiber optic or unshielded twisted pair network cable. The SFP transceivers described in this section provide Ethernet at 1 gigabit per second (Gbps).

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 for selecting an SFP

SFP transceivers are hot-swappable I/O interface devices designed for use with Avaya products to allow gigabit Ethernet ports to link with other gigabit Ethernet ports over various media types.

The system also supports 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.

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

Important:

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

Model	Description	Part number
1000BASE-T SFP	gigabit Ethernet, RJ–45 connector	AA1419043–E6
1000BASE-SX DDI SFP	850 nm, gigabit Ethernet, duplex LC connector	AA1419048–E6
1000BASE-LX DDI SFP	1310 nm, gigabit Ethernet, duplex LC connector	AA1419049–E6
1000BASE-BX10 DDI SFP	1310 nm (tx) and 1490 nm (rx) gigabit Ethernet, single-fiber LC connector	AA1419069–E6 (10 km at 1310 nm) and mating pair AA1419070–E6 (10 km at 1490 nm)
100BASE-FX SFP	1300 nm, 100 Mbps Ethernet, multimode fiber, duplex LC connector	AA1419074–E6

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:

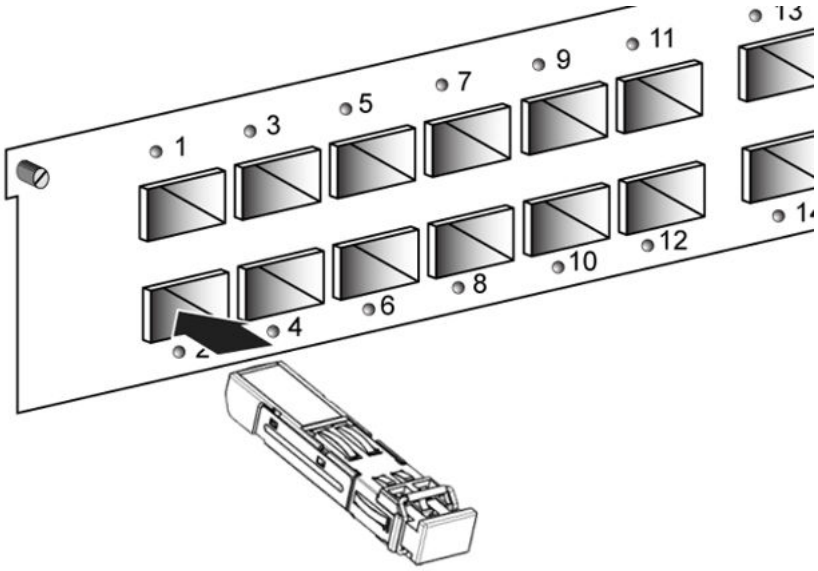
   Risk of equipment damage

   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

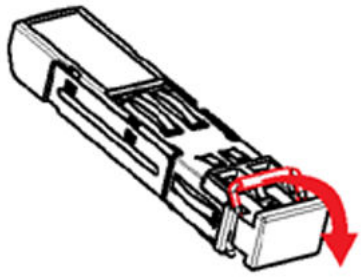
The following figure shows an example installation of a bore plug transceiver with the bail latch facing up. The figure does not represent a specific product.



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 the receiver is guaranteed to meet the bit error rate (BER) of 10_{-12}.

Important:

The switch 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 SFP transceivers, but they will operate and the port link will come up. The switch logs the device as an unsupported or unknown device.

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.

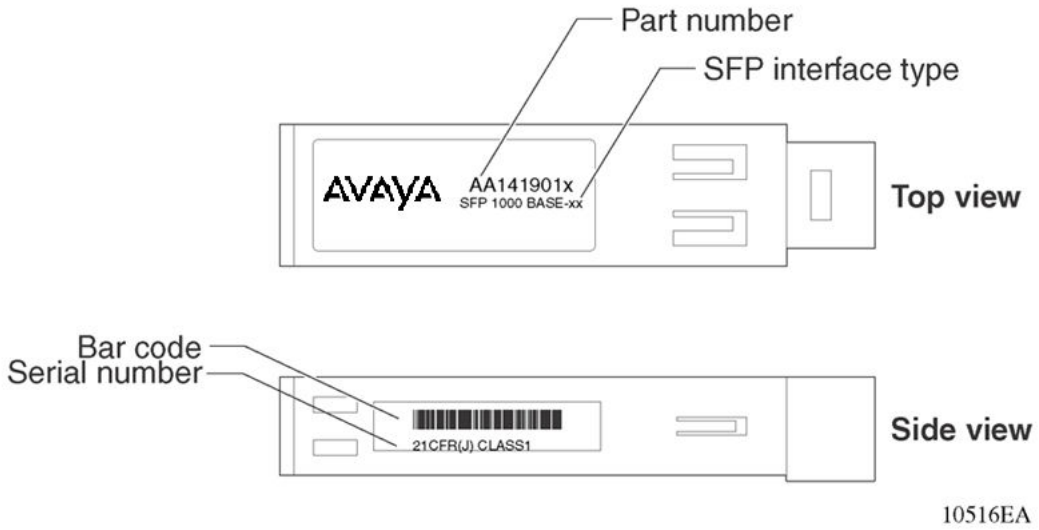


Figure 3: SFP label

General SFP specifications

The following table describes general SFP specifications.

Table 11: 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 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 12: 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 13: 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.

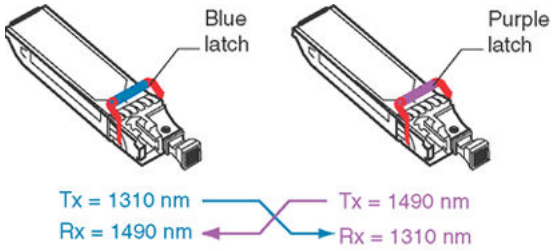
Table 14: 1000BASE-LX DDI SFP specifications

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 15: 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 16: 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
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

1000BASE-BX40 bidirectional SFP specifications

The 1000BASE-BX40 SFP transceivers (part numbers AA1419076-E6 and AA1419077-E6) can attain a reach of up to 40 km. The minimum IL is 6 dB.

The following table describes standards, connectors, cabling, and distances for the 1000BASE-BX40 SFP transceiver.

Table 17: 1000BASE-BX40 bidirectional SFP specifications

Parameter	Specifications
Connectors	Single-fiber LC
Data rate	1.0 Gbps

Table continues…

Parameter	Specifications
Line rate (8B/10B code)	1.25 Gbps
Distance	Up to 40 km with SMF
Wavelength	1310 nm and 1490 nm
Link optical power budget	20.0 dB
Maximum transmitter and dispersion power penalty	3.3 dB
Transmitter characteristics	
Maximum launch power	3.0 dBm
Minimum launch power	–3.0 dBm
Receiver characteristics	
Maximum receiver sensitivity	–23 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 part number for this model is AA1419074-E6.

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

Table 18: 100BASE-FX SFP specifications

Parameter	Specifications
Maximum electrical power consumption	1.5 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	
Maximum launch power	–14 dBm
Minimum launch power	–23.5 to –20 dBm
Receiver characteristics	
Receiver sensitivity	–33.5 dBm
Maximum input power	–14 dBm

T1 SFP specifications

The T1 SFP transceiver provides full-duplex Fast Ethernet to T1 connectivity. The part number for this model is AA1419075-E6.

You can use this device with the Ethernet Routing Switch 4526FX, 4526T, 4526T-PWR, 4526T-PWR+, 4550T, 4550T-PWR, 4550T-PWR+, 4524GT, 4524GT-PWR, 4826GTS, 4826GTS-PWR+, 4850GTS, and 4850GTS-PWR+.

Note:

You cannot use a T1 SFP on ERS 48xx SFP+ ports.

Important:

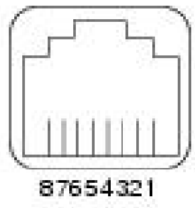
- The switch displays the interface speed of the T1/E1 SFP as a 100 Mbps connection even though the interface is operating at the appropriate WAN speed. The system uses this value for STP path cost and MLT utilization.
- Avaya recommends that you enable egress traffic shaping on the port to 1.544 Mbps when using the T1 SFP to guarantee appropriate Quality of Service and traffic prioritization.

The following table describes the T1 SFP specifications.

Table 19: Fast Ethernet to T1 remote bridge specifications

Parameter	Specifications
Maximum power consumption	1 W
Dimensions	Height: 13.8 mm (0.54 in) Width: 15.8 mm (0.62 in) Depth: 75.9 mm (2.99 in)
Standards	Compliant with G.703, G.775, G.823, T1.403, IEEE 802.3
Connectors	RJ-48C
Cabling	CAT5 with RJ-48C pin connection
Distance	Up to 2874 m over 22 AWG cable. You can reduce the distance when you use common 24 AWG UTP CAT5/5E cable.
Line code	Binary 8 Zero Substitution (B8ZS) or Alternate Mark Inversion (AMI)

The T1 SFP uses an RJ-48C connector, as shown in the following figure, which is similar to an RJ-45 connection but with different pinouts.



The following table describes the RJ-48C pinouts.

Table 20: RJ-48C pinouts

Pin	Description
1	Receive ring
2	Receive tip
3	Receive shield
4	Transmit ring
5	Transmit tip
6	Transmit shield
7	Not used
8	Not used

The T1 equipment at the far end of the T1 connection must also use an RJ-48C jack. After you determine the pinout of the RJ-48C jack at the far end, determine if you need a straight-through or crossover cable. You can use an off-the-shelf straight-through cable to directly connect the T1 SFP module and the far-end T1 equipment if the far end has the pinout shown in the following table.

Table 21: RJ-48C pinouts (opposite Tx and Rx connection)

Pin	Description
1	Transmit (Tx) ring
2	Transmit tip
3	Transmit shield
4	Receive (Rx) ring
5	Receive tip
6	Receive shield
7	Not used
8	Not used

If the far end connection does not match the connections shown in the preceding table, then you must use a crossover cable. The following table shows the crossover connections.

Table 22: RJ-48C crossover cable connections

Terminal A		Terminal B	
Pin	**Description**	**Pin**	**Description**
1	Receive ring	1	Transmit ring
2	Receive tip	2	Transmit tip
3	Receive shield	3	Transmit shield
4	Transmit ring	4	Receive ring
5	Transmit tip	5	Receive tip

Table continues…

Terminal A		Terminal B	
Pin	**Description**	**Pin**	**Description**
6	Transmit shield	6	Receive shield
7	Not used	7	Not used
8	Not used	8	Not used

You can use a short crossover cable with a straight-through cable adapter to connect to a straight-through cable. Do this to convert a straight-through cable to a crossover cable.

T1 SFP—default settings

The switches automatically configure the following T1 SFP parameters after the system powers up:

- Transmit Line Build Out (TLBO): set according to cable length.
- Framed or Unframed: Insert framing word into the frame (1 bit for each T1 frame) or do not insert framing word into the frame.
- Line code: Binary 8 Zero Substitution (B8ZS) or Alternate Mark Inversion (AMI).
- Clock: Use Rx clock or internal clock for Tx clock (Avaya recommends internal clock for Tx clock).
- Framing: D4 or Extended Super Frame (ESF), depends on the framing word required by the T1 equipment at the far end.

Table 23: T1 SFP—default parameters

Parameter	Default setting
TLBO	0 (0 ft–133 ft)
Framed or unframed	1 (framed)
Line code	0 (B8ZS)
Tx clock source	1 (Tx clock)
Framing	1 (ESF)
Rx sensitivity	1 (limited long haul)
Yellow alarm	0 (normal operation)
Fault propagation	0 (normal operation)
Tx disabled behavior	2 (Alarm Indications Signal—AIS)
Transmit AIS	0 (normal operation)

Important:

You must configure the T1 SFP module to match the parameters of the T1 equipment at the far end. If you must change the parameters, contact Avaya Technical Support.

Chapter 8: SFP+ specifications

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

The specifications in this section are a subset of the IEEE standard 802.3-2012. For more information, see these standards documents. All Avaya SFP+ transceivers meet or exceed these standards.

Important:

Avaya recommends that you only use Avaya qualified transceivers. If you do choose to use other vendor transceivers, Avaya does not support them.

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

SFP+ labels

The typical Avaya SFP+ 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.

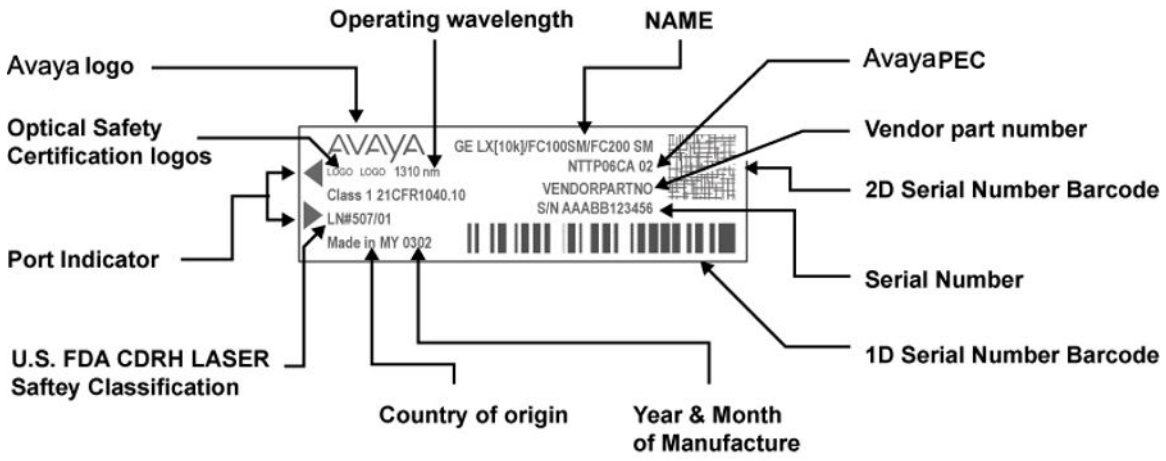


Figure 4: SFP+ top label

Figure 5: SFP+ bottom label

General SFP+ specifications

The following table describes general SFP+ specifications.

Table 24: General SFP+ specifications

Parameter	Specifications
Dimensions (H x W x D)	13.4 x 8.50 x 56.4 millimeters (mm) 0.53 x 0.33 x 2.22 inches (in.) unless otherwise stated
Connectors	LC ultra physical contact (UPC)
Storage temperature	–40 to 85C
Operating temperature	0 to 60C for RoHS -E5 models – 5 to 85C for RoHS -E6 models

SFP+ transceiver specifications

The following sections provide specifications for supported SFP+ transceivers:

- 10GBASE-SR/SW SFP+ specifications on page 53
- 10GBASE-LRM SFP+ specifications on page 55
- 10GBASE-LR/LW SFP+ specifications on page 57
- 10GBASE-ER/EW SFP+ specifications on page 58
- 10GBASE-CX specifications on page 59
- 10GBASE-ZR/ZW SFP+ specifications on page 59

10GBASE-SR/SW SFP+ specifications

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

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

For more information about the 10GBASE-SR/SW SFP+, 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.

Table 25: IEEE 802.3ae 10GBASE-SR/SW SFP+ specifications

Parameter	Specifications
Data rate	10.0 Gb/s
Line rate (64B/66B code)	10.3125 gigabits per second (Gb/s) ± 100 parts per million (ppm)
Mean Time Between Failures (MTBF)	675 000 hours
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 deciBels referenced to 1 milliwatt (dBm)
Maximum average launch power of OFF transmitter	– 30 dBm
Minimum extinction ratio	3.0 dB
Maximum relative intensity noise $_{12}$OMA	– 128 dB per Hertz (dB/Hz)
Maximum optical return loss tolerance	– 12 dB
Receiver characteristics	
Average receive power for BER 10^{-12}	– 9.9 to – 1.0 dBm
Maximum average receive power for damage	0 dBm
Maximum receiver sensitivity in OMA	– 11.1 dBm
Maximum receiver reflectance	– 12 dB
Stressed receiver sensitivity in OMA	– 7.5 dBm

Table continues…

Parameter	Specifications
Receiver electrical 3 dB upper cutoff frequency	12.3 gigaHertz (GHz)

The stressed sensitivity values are for system level BER measurements, which include the effects of clock and data recovery (CDR) circuits. Avaya recommends that you allocate at least 0.4 dB additional margin if you make component level measurements without the effect of CDR circuits.

10GBASE-LRM SFP+ specifications

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

The following table lists the transmitter and receiver specifications for the 10GBASE-LRM SFP+. These parameters meet the IEEE 802.3aq-2006 standard. The part number of this SFP+ 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 26: IEEE 802.3aq 10GBASE-LRM SFP+ specifications

Parameter	Specifications
Data rate	10.0 Gb/s
Line rate (64B/66B code)	10.3125 Gb/s ± 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
Maximum average launch power of OFF transmitter	– 30 dBm
Minimum extinction ratio	3.5 dB
Maximum relative intensity noise at OMA—$RIN_{12}OMA$	– 128 dB/Hz
Optical return loss tolerance (minimum)	– 20 dB
Receiver characteristics	
Maximum receive average power for damage	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 802.3aq standard.

The following table (from IEEE 802.3aq) 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 27: 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
50 µm (ISO/IEC OM4) • 3500 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

In the table, FDDI denotes Fiber Distributed Data Interface, ISO denotes International Standards Organization, IEC denotes International Electrotechnical Commission, and OFL denotes Over Filled Launch.

The following table uses the 802.3aq standard and specifies the measurement conditions for each fiber type.

Table 28: Launch conditions for each fiber type

Parameter	Minimum encircled flux	Notes
Optical launch for OM1 and FDDI-grade fiber	• 30% within 5 µm radius • 81% within 11 µm radius	Uses 62.5 µmmode conditioning patch cord
Optical launch for OM2 and 50 µm 400/400 fiber	• 30% within 5 µm radius • 81% within 11 µm radius	Uses 50 µmmode conditioning patch cord
Optical launch for OM3 and 50 µm fiber	• 30% within 5 µm radius • 81% within 11 µm radius	—
Optical launch for OM4 and 50 µm fiber	• 30% within 5 µm radius • 81% within 11 µm radius	—

10GBASE-LR/LW SFP+ specifications

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

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

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

Table 29: IEEE 802.3ae 10GBASE-LR/LW SFP+ 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 Gb/s ±100 ppm (10 GbE)
Average launch power	– 8.2 to 0.5 dBm
Minimum side mode suppression ratio	30 dB
Minimum launch power in OMA minus transmission and dispersion penalty (TDP)	– 6.2 dBm
Minimum optical modulation amplitude	– 5.2 dBm
Maximum average launch power of OFF transmitter[c]	– 30 dBm
Minimum extinction ratio	3.5 dB
$RIN_{12}OMA$ (maximum)	– 128 dB/Hz
Maximum optical return loss tolerance	–– 12 dB
Maximum transmitter reflectance	– 12 dB

Table continues…

Parameter	Specifications
Receiver characteristics	
Line rate (nominal)	10GBASE-LR 10.3125 Gb/s ± 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
Receiver electrical 3 dB upper cutoff frequency	12.3 GHz

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 shut down condition

10GBASE-ER/EW SFP+ specifications

The following table lists the transmitter and receiver specifications for the 10GBASE-ER/EW SFP+. The reach for this SFP+ is up to 40 km at a wavelength of 1550 nm. The part number of this SFP+ is AA1403013-E6.

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

Table 30: IEEE 802.3ae 10GBASE-ER/EW SFP+ specifications

Parameter	Specifications
Line rate (nominal)	10GBASE-ER 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	

Table continues…

Parameter	Specifications
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

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 shut down conditions.

10GBASE-CX specifications

The 10GBASE-CX is a 4-pair twinaxial copper cable that plugs into the SFP+ socket and connects two 10 Gb ports. The reach for this cable is up to 15 m with a bit error rate (BER) better than 10^{-12}. The signaling speed for each lane is 3.125 GBd ± 100 ppm. 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 802.3ak standard. The following table identifies the part numbers for specific cable lengths.

Table 31: 10GBASE-CX cables

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

10GBASE-ZR/ZW SFP+ specifications

The following table lists the transmit and receive specifications for the 10GBASE-ZR/ZW SFP +. The reach for this SFP+ is up to 80 km* at a wavelength of 1550 nm. The part number of this SFP+ is AA1403016–E6.

⚠ Caution:

Risk of BER increase

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

Table 32: 10GBASE-ZR/ZW SFP+ specifications

Parameter	Specifications
Line rate (nominal)	10GBASE-ZR 10.3125 Gb/s ±100 ppm (10GbE)
Distance	Up to 80 km*
Link optical power budget	24 dB
Dispersion power penalty	3.0 dB at 80 km (G.652 fiber)
Transmitter characteristics	
Center wavelength range	1530 nm to 1565 nm, nominal 1550 nm
Side mode suppression ratio (minimum)	30 dB
Average launch power	0 to 4.0 dBm
Optical modulation amplitude (minimum)	+1.7 dBm
Average launch power of OFF transmitter (maximum)	-30 dBm
Extinction ratio (ER) (minimum)	8.2 dB
RIN12OMA (maximum)	-128 dB/Hz
Maximum transmitter reflectance	-12 dB
Receiver specifications	
Wavelength range	1280 to 1575 nm. Sensitivity specified for 1530 to 1565 nm.
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. 80 km is not possible in some situations.

Chapter 9: XFP

This chapter provides installation procedures and specifications for 10 Gigabit small form factor pluggable (XFP) transceivers.

Important:

Avaya recommends that you only use Avaya-qualified XFP transceivers. Other vendor XFP transceivers will not work and Avaya does not support them.

XFP labels

As shown in the following figure, the Avaya label on a typical XFP contains an Avaya serial number, a bar code, a manufacturer code, an interface type, and a part number.

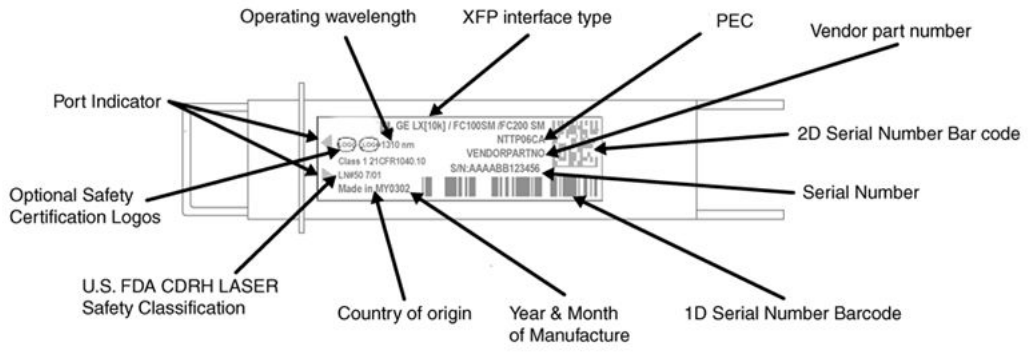


Figure 6: XFP label

XFP specifications

This section provides technical specifications for the supported 10-Gigabit Small form pluggable (XFP) models. Use these specifications to aid in network design.

The specifications in this section are a subset of the IEEE 802.3ae and 802.3aq specifications. For more information, see these standards documents. All Avaya XFP transceivers meet or exceed these standards.

Important:

Avaya recommends that you only use Avaya-qualified XFP transceivers. If you do choose to use other vendor XFP transceivers, be aware that Avaya does not support the use of other XFP transceivers.

10GBASE-SR XFP specifications

The 10GBASE-SR SFP provides 10 GbE service at 850 nm.

The following table lists the specifications for the 10GBASE-SR XFP. The part number of this XFP is AA1403005-E5.

For more information about the 10GBASE-SR XFP, 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 is present between the transmit and receive ports.

Table 33: IEEE 802.3ae 10GBASE-SR XFP specifications

Parameter	Specifications
Data rate	10.0 Gb/s
Line rate (64B/66B code)	10.3125 gigabits per second (Gb/s) ± 100 parts per million (ppm)
Mean Time Between Failures (MTBF)	675 000 hours
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
Link optical power budget	7.3 dB
Maximum transmitter and dispersion penalty	3.9 dB at 300 m
Transmitter characteristics	

Table continues…

Parameter	Specifications
Root-mean-square spectral width	0.05 to 0.40 nm
Launch power	– 7.3 to – 1.0 deciBels referenced to 1 milliwatt (dBm)
Maximum average launch power of OFF transmitter	– 30 dBm
Minimum extinction ratio	3.0 dB
Maximum relative intensity noise $_{12}$OMA	– 128 dB per Hertz (dB/Hz)
Maximum optical return loss tolerance	– 12 dB
Receiver characteristics	
Average receive power for BER 10^{-12}	– 9.9 to – 1.0 dBm
Maximum average receive power for damage	0 dBm
Maximum receiver sensitivity in OMA	– 11.1 dBm
Maximum receiver reflectance	– 12 dB
Stressed receiver sensitivity in OMA	– 7.5 dBm
Receiver electrical 3 dB upper cutoff frequency	12.3 gigaHertz (GHz)

The stressed sensitivity values are for system level BER measurements, which include the effects of clock and data recovery (CDR) circuits. Avaya recommends that you allocate at least 0.4 dB additional margin if you make component level measurements without the effect of CDR circuits.

10GBASE-LRM XFP specifications

The 10GBASE-LRM XFP provides 10 GbE service at a wavelength of 1310 nm. This XFP can attain a reach of up to 220 m on 62.5 µm multimode fiber. This XFP provides built-in electronic dispersion compensation.

The following table lists the transmitter and receiver specifications for the 10GBASE-LRM XFP. These parameters meet the IEEE 802.3aq-2006 standard. The part number of this XFP is AA1403007-E6.

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

Table 34: IEEE 802.3aq 10GBASE-LRM XFP specifications

Parameter	Specifications
Data rate	10.0 Gb/s
Line rate (64B/66B code)	10.3125 Gb/s ± 100 ppm
Center wavelength range	1260 to 1355 nm; 1310 nm nominal

Table continues…

Parameter	Specifications
Distance	Up to 220 m, for more information, see Table 35: 10GBASE-LRM channel insertion loss and range on page 64
Link optical power budget	1.7 to 1.9 dB, for more information, see Table 35: 10GBASE-LRM channel insertion loss and range on page 64
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
Maximum average launch power of OFF transmitter	– 30 dBm
Minimum extinction ratio	3.5 dB
Maximum relative intensity noise at OMA—$RIN_{12}OMA$	– 128 dB/Hz
Optical return loss tolerance (minimum)	– 20 dB
Receiver characteristics	
Maximum receive average power for damage	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 802.3aq standard.

The following table (from IEEE 802.3aq) 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 35: 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

Table continues…

Fiber type (core diameter and OFL bandwidth)	Range	Maximum channel insertion loss
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

In the table, FDDI denotes Fiber Distributed Data Interface, ISO denotes International Standards Organization, IEC denotes International Electrotechnical Commission, and OFL denotes Over Filled Launch.

The following table is based on the 802.3aq standard and specifies the measurement conditions for each fiber type.

Table 36: Launch conditions for each fiber type

Parameter	Minimum encircled flux	Notes
Optical launch for OM1 and FDDI-grade fiber	• 30% within 5 µm radius • 81% within 11 µm radius	Uses 62.5 µmmode conditioning patch cord
Optical launch for OM2 and 50 µm 400/400 fiber	• 30% within 5 µm radius • 81% within 11 µm radius	Uses 50 µmmode conditioning patch cord
Optical launch for OM3 and 50 µm fiber	• 30% within 5 µm radius • 81% within 11 µm radius	—

10GBASE-LR/LW XFP specifications

The 10GBASE-LX XFP provides 10 GbE or OC-192 service at a nominal wavelength of 1310 nm. This XFP can attain link lengths of up to 10 km.

The following table lists the transmitter and receiver specifications for the 10GBASE-LR/LW XFP. The part number of this XFP is AA1403001-E5.

For more information about the 10GBASE-LX XFP, including test and measurement information, see the IEEE 802.3ae standard.

Table 37: IEEE 802.3ae 10GBASE-LR/LW XFP specifications

Parameter	Specifications
MTBF	675 000 hours
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 Gb/s ±100 ppm (10 GbE) 10GBASE-LW 9.95328 Gb/s ±20 ppm (OC-192)
Average launch power	– 8.2 to 0.5 dBm
Minimum side mode suppression ratio	30 dB
Minimum launch power in OMA minus transmission and dispersion penalty (TDP)	– 6.2 dBm
Minimum optical modulation amplitude	– 5.2 dBm
Maximum average launch power of OFF transmitter[c]	– 30 dBm
Minimum extinction ratio	3.5 dB
$RIN_{12}OMA$ (maximum)	– 128 dB/Hz
Maximum optical return loss tolerance	–– 12 dB
Maximum transmitter reflectance	– 12 dB
Receiver characteristics	
Line rate (nominal)	10GBASE-LR 10.3125 Gb/s ± 100 ppm (10 GbE) 10GBASE-LW 9.95328 Gb/s ± 100 ppm (OC-192)
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
Receiver electrical 3 dB upper cutoff frequency	12.3 GHz

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 shut down condition

10GBASE-ZR/ZW XFP specifications

The following table lists the transmit and receive specifications for the 10GBASE-ZR/ZW XFP. The reach is up to 80 km at a wavelength of 1550 nm. The part number of this XFP is AA1403006-E5.

For more information about the 10GBASE-ZX XFP, including test and measurement information and more specifications, see the IEEE 802.3ae standard.

Caution:

Risk of BER increase

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

Table 38: 10GBASE-ZR/ZW XFP specifications

Parameter	Specifications
Line rate (nominal)	10GBASE-ZR 10.3125 Gb/s ±100 ppm (10 GbE) 10GBASE-ZW 9.95328 Gb/s ±20 ppm (OC-192)
MTBF	675 000 hours
Distance	Up to 80 km
Link optical power budget	24 dB
Maximum transmitter and dispersion penalty	3.0 dB at 80 km (G.652 fiber)
Transmitter characteristics	
Center wavelength range	1530 to 1565 nm; nominal 1550 nm
Side mode suppression ratio (minimum)	30 dB
Average launch power	0 to 4.0 dBm
Optical modulation amplitude (minimum)	– 1.7 dBm
Average launch power of OFF transmitter (maximum)	– 30 dBm
Extinction ratio (ER)	minimum 3.5 dB end of life maximum 7.0 dB start of life
$RIN_{12}OMA$ (maximum)	– 128 dB/Hz
Maximum optical return loss tolerance	– 26 dB
Maximum transmitter reflectance	– 12 dB
Receiver characteristics	
Wavelength range	1280 to 1575 nm. Sensitivity specified for 1530 to 1565 nm.
Signaling speed (nominal)	10GBASE-ZR 10.3125 Gb/s ± 100 ppm (10 GbE) 10GBASE-ZW 9.95328 Gb/s ± 100 ppm (OC-192)
Maximum average receiver sensitivity	– 24 dBm
Maximum receive power (for BER 10^{-12} and 9 dB ER)	– 7.0 dBm
Maximum average receive power for damage	5.0 dBm
Receiver reflectance (maximum)	– 27 dB
Receive electrical 3 dB upper cutoff frequency	9.3 GHz

Chapter 10: Resources

Support

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.

Documentation

For a list of the documentation for this product and more information about documents on how to configure other switch features, see *Documentation Reference for Avaya Ethernet Routing Switch 4800 Series*, NN47205–101.

For more information on new features of the switch and important information about the latest release, see *Release Notes for Avaya Ethernet Routing Switch 4800 Series*, NN47205-400.

For more information about how to configure security, see *Configuring Security on Avaya Ethernet Routing Switch 4800 Series*, NN47205-505.

For the current documentation, see the Avaya Support web site: www.avaya.com/support.

Training

Ongoing product training is available. For more information or to register, see http://avaya-learning.com/.

Enter the course code in the **Search** field and click **Go** to search for the course.

Course code	Course title
8D00020E	Stackable ERS and VSP Products Virtual Campus Offering

Viewing Avaya Mentor videos

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

About this task

Videos are available on the Avaya Support website, listed under the video document type, and on the Avaya-run channel on YouTube.

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.
- To find the Avaya Mentor videos on YouTube, go to www.youtube.com/AvayaMentor and perform one of the following actions:
  - Enter a key word or key words in the **Search Channel** to search for a specific product or topic.
  - Scroll down Playlists, and click the name of a topic to see the available list of videos posted on the website.

Note:

Videos are not available for all products.

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.

Subscribing to e-notifications

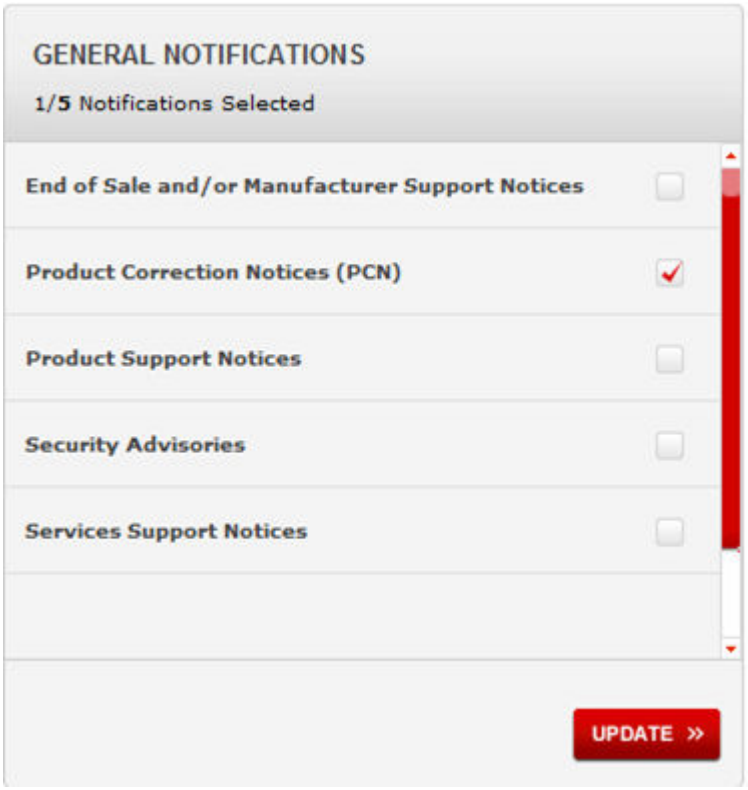
Subscribe to e-notifications to receive an email notification when documents are added to or changed on the Avaya Support website.

About this task

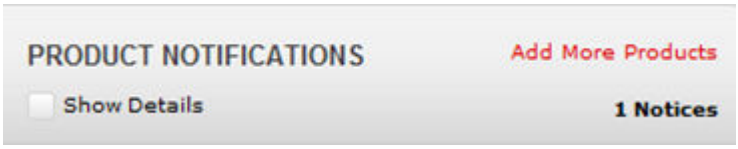
You can subscribe to different types of general notifications, for example, Product Correction Notices (PCN), which apply to any product or a specific product. You can also subscribe to specific types of documentation for a specific product, for example, Application & Technical Notes for Virtual Services Platform 7000.

Procedure

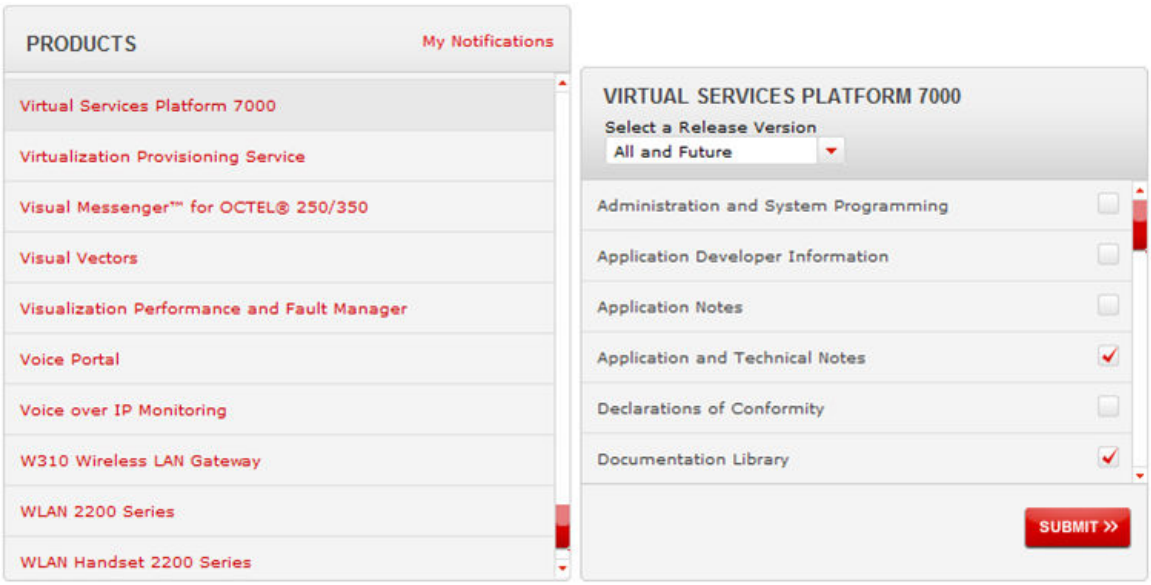
1. In an Internet browser, go to https://support.avaya.com.
2. Type your username and password, and then click **Login**.
3. Under **My Information**, select **SSO login Profile**.
4. Click **E-NOTIFICATIONS**.
5. In the GENERAL NOTIFICATIONS area, select the required documentation types, and then click **UPDATE**.



6. Click **OK**.
7. In the PRODUCT NOTIFICATIONS area, click **Add More Products**.



8. Scroll through the list, and then select the product name.
9. Select a release version.
10. Select the check box next to the required documentation types.



11. Click **Submit**.