6

Cabling the Cisco RFGW-10 UEQAM

The Cisco RFGW-10 UEQAM is a "cable once" system allowing removal of individual front-side Universal RF line cards without disconnecting any specific physical RF coaxial connection. All RF signaling is terminated at the rear-side RF switching modules.

There are 12 RF switch cards per RFGW-10 chassis (the chassis MUST include all the 12 RF switch cards for proper operation). Each Switch Card supports a single Cisco UCH2 connector header; each UCH2 supports 10 MCX style coaxial connections per RF switch card. The RF switch card is physically separate from the RF line card slots allowing insertion and removal of the RF line cards without disrupting the cable plant wiring.

Note　Quad-shield coaxial cable bundles for the Cisco RFGW-10 RF switch card can be purchased from Cisco, with the Universal Cable Holders (UCH) already connected to the coaxial cable bundles. Alternatively, custom-length quad-shield coaxial cable bundles can be purchased from third-party vendors, with the UCH either connected to the cable bundles or provided as seperate components. The preconfigured cable bundles from Cisco comprise of 10 MCX terminated RF cables connected to UCH2. The twelve preconfigured cable bundles are required to fully connect the Cisco RFGW-10 chassis.

Figure 1 shows the cable bundle for Cisco RFGW-10 line card to hybrid fiber-coaxial (HFC) plant that has 25 F connectors attached to one end and three UCH2 units attached to the other end. This cable is 9.84 feet (3 m) long and the part number is CAB-RFSW520QTIMF2.

Figure 1   *Cable Bundle with UCH2 Units and F Connectors*
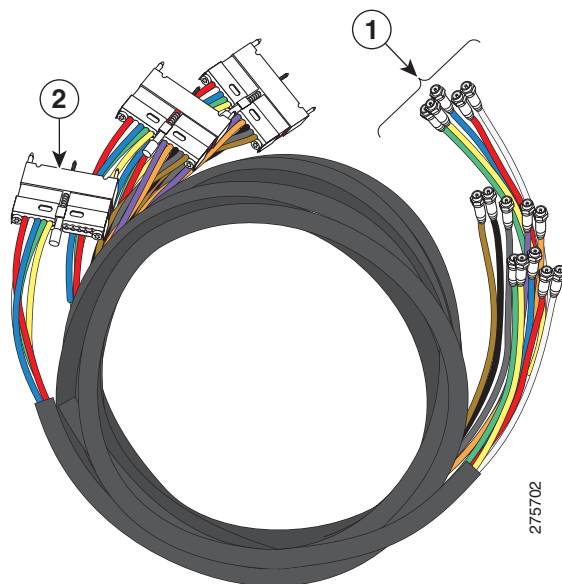
1	F Connector	2	UCH2

Figure 2 shows the cable bundle for Cisco RFGW-10 line card to RF switch that has three UCH2 units attached to one end and two RF switch header blocks attached to the other end. This cable is 3.2 feet (1 m) long and the part number is CAB-RFSW520QTIMM2.

Figure 2   *Cable Bundle with UCH2 Units and RF Switch Header Blocks*
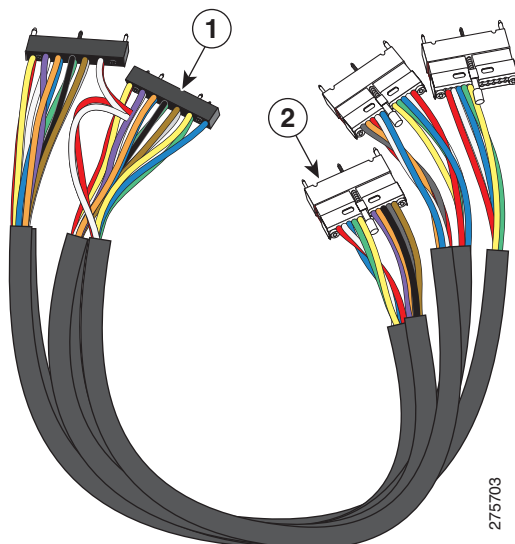
1	RF Switch Header Blocks	2	UCH2

Figure 3 shows the cable bundle for RF switch to HFC plant that has two RF switch header blocks attached to one end and 25 F connectors attached to the other end. This cable is 9.84 feet (3 m) long and the part number is CAB-RFSW520QTPMF2.

*Figure 3*   ***Cable Bundle with RF Switch Header Blocks and F Connectors***
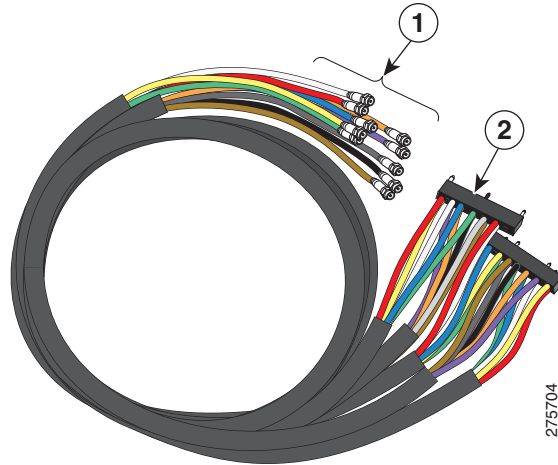
1	F Connectors	2	RF Switch Header Blocks

✎
Note   Customers purchasing custom-length quad-shield coaxial cable bundles from third party vendors can purchase spare Universal Cable Holders and spare RF switch header blocks from Cisco. Refer to Table 6-1 for the applicable Cisco part numbers.

Figure 5-6 shows the rear of the Cisco RFGW-10 UEQAM with 12 RF switch cards installed with UCH2 (see Figure 6-4).

Figure 6-4   *Universal Cable Holder UCH2*
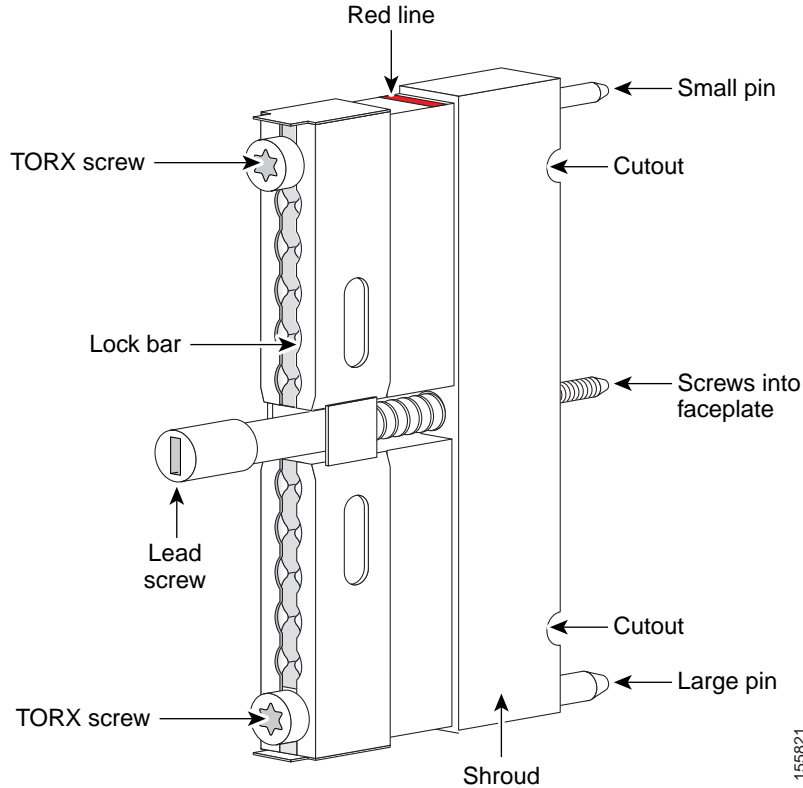
The T-10 TORX driver tool and a 1/4-inch flathead screwdriver are used to remove and install the cable bar clamp on the UCH, and loosen the line card captive screws.

The Cisco RFGW-10 UEQAM coaxial cable interface uses 75-ohm precision miniature video cable bundled cables terminated to 75-ohm MCX connectors. The cables come in bundles of five that will fit into the provided rear RF cable-management bracket. (See Figure 6-5.)

Note   The Cisco RFGW-10 UEQAM coaxial termination must use quad-shielded 75-ohm precision miniature video cable.

Note   Other bundle types exist for quad-shielded 75-ohm precision miniature video cable but only the five bundle will fit into the provided cable management bracket and allow for easy removal of the RF Switch Cards.

Figure 6-5   *5-Bundle Quad-Shielded Cable with MCX Connectors*

MCX connectors

F connectors

273862

⚠
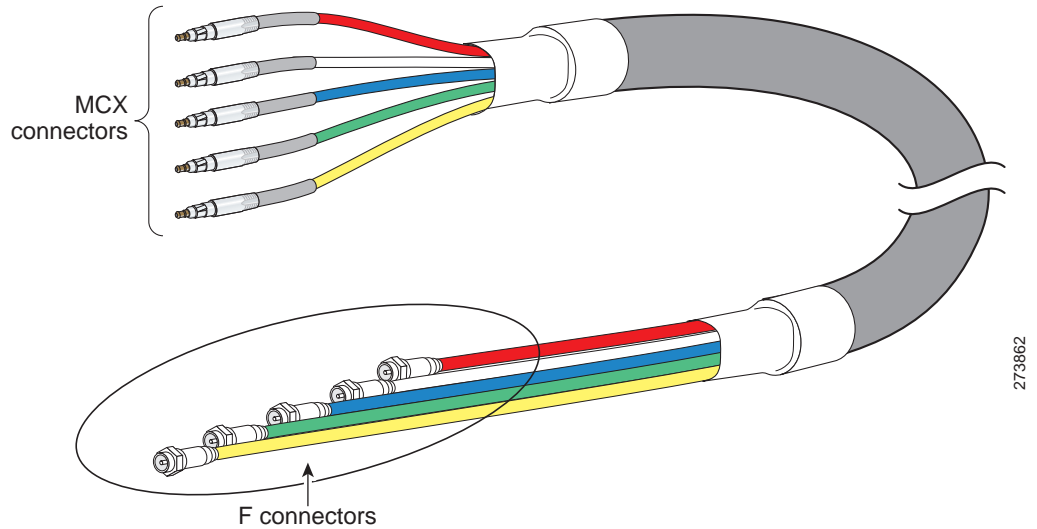
Caution   The Cisco RFGW-10 UEQAM must be used with the UCH for all cable connections to the RF Switch Card. Failure to use the UCH may cause permanent damage to the line card connectors, resulting in low or no RF output in the downstream or low or no RF input in the upstream.

✎

Note   The cable used with the dense connector UCH must be 75-ohm precision miniature video cable and Cisco specified MCX connectors.

Part Numbers

Table 6-1 lists the part numbers for the Cisco RFGW-10 UEQAM RF Switch cards, cable kits, cables, connectors, tubing, and tools.

Table 6-1   *Part Numbers*

Description	Part Numbers
Cisco RFGW-10 RF switch line card	RFGW-10-RFSW1
Cisco Cable kit (3m MCX to F cables) 10 Quad-shielded RF cables, preconnected UCH2 header, RFGW/3G60 to HFC, 3m. 12 Cable kits required for Cisco RFGW-10 Chassis.	CAB-RFGW3G60QTIMF, Cisco Systems, Inc.

Description	Part Numbers
Individual Universal Cable Holder (UCH2) Universal Cable holder for MCX connectors, qty 3 pcs	CAB-520-MULT-UCH2, Cisco Systems, Inc.
1. Cable bundle for RF card to HFC plant: 3 UCH2 units attached to one end and 25 F connectors attached to the other end, 9.84 feet (3 m) long.	1. CAB-RFSW520QTIMF2=
2. Cable bundle for RF card to RF switch: 3 UCH2 units attached to one end and 2 RF switch header blocks attached to the other end, 3.2 feet (1 m) long.	2. CAB-RFSW520QTIMM2=
3. Cable bundle for RF switch to HFC plant: 2 RF switch header blocks attached to one end and 25 F connectors attached to the other end, 9.84 feet (3 m) long.	3. CAB-RFSW520QTPMF2=

> **Note**   Do not use shrink tubing with quad-shielded MCX Connectors.

Nominal Attenuation

Table 6-2 and Figure 6-6 show the nominal attenuation for specified cable lengths.

Table 6-2   Nominal Attenuation for a 75-Ohm Miniature Headend Coaxial Cable

MHz	dB/100 ft	MHz	dB/100 ft	MHz	dB/100 ft
1	0.39	71	3.06	270	5.40
3.58	0.78	88	3.16	360	6.20
5	0.92	100	3.33	540	7.70
7	1.08	135	3.81	720	9.47
10	143	143	3.92	750	9.59
67.5	2.83	180	4.38	1000	10.50

Figure 6-6   Nominal Attenuation Graph for 75-Ohm Miniature Headend Coaxial Cable
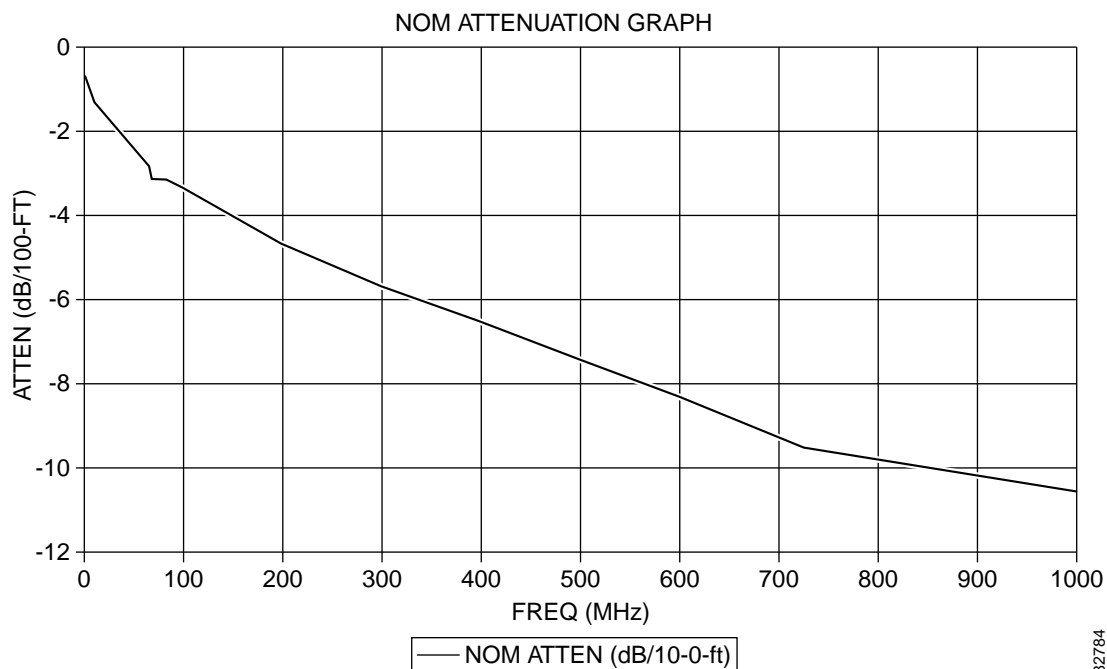
Safety Information and Warnings

Following are the safety guidelines that you should follow when working with any equipment that connects to the electrical power.

Electrical Equipment Guidelines

Follow these basic guidelines when working with any electrical equipment:

- Before beginning any procedure requiring access to the chassis interior, locate the emergency power-off switch for the room you are working in.
- Disconnect all the power and external cables before moving a chassis.
- Do not work alone when potentially hazardous conditions exist.
- Never assume that the power has been disconnected from a circuit. Always check before proceeding.
- Do not perform any action that would result in a potential hazard or make the equipment unsafe.
- Carefully examine your work area for possible hazards such as moist floor, ungrounded power extension cables, and missing safety grounds.

Preventing Electrostatic Discharge Damage

Electrostatic discharge (ESD) damage, which occurs when electronic cards or components are improperly handled, can result in complete or intermittent failures. The Cisco RFGW-10 UEQAM and its modules contain printed circuit cards that are fixed in a metal carrier. Electromagnetic interference (EMI) shielding and connectors are integral components of the carrier. Although the metal carrier helps to protect the cards from ESD, it is recommended to use an antistatic strap when you handle the modules.

Following are the guidelines for preventing ESD damage:

- Always use an ESD preventive wrist or ankle strap and ensure that it makes good skin contact. Before removing a card from the chassis, connect the end of the equipment's strap to a bare metal, unpainted surface on the chassis or rack-mount. Make sure that the chassis and/or rack has a grounding cable installed. For more details see "Attaching a Chassis Ground Connection" section on page 3-18.

- Handle components by the carrier edges only; avoid touching the card components or any connector pins.

- When removing a module, place it on an antistatic surface or in a static-shielding bag. If the module will be returned to the factory, place it in a static-shielding bag immediately.

- Avoid contact between the modules and clothing. The wrist-strap protects the card from ESD voltages on the body only and those on the clothing can still cause damage.

⚠
Caution   For safety, periodically check the resistance value of the antistatic strap. The measurement should be between 1 and 10 megaohms.

✎
Note   The Installing the UCH on the Cisco RFGW-10 UEQAM RF Switch Card and Installing or Replacing the Cables in the UCH2 sections describe the connection and removal process for the customized RF cables and the maintenance of the Cisco preconfigured cable bundles.

## Installing the UCH on the Cisco RFGW-10 UEQAM RF Switch Card

⚠
Caution   The UCH must be used for all cable connections to the RF switch line card. Failure to use the UCH may cause permanent damage to the line card connectors, resulting in low or no RF output in the downstream and low or no RF input in the upstream.

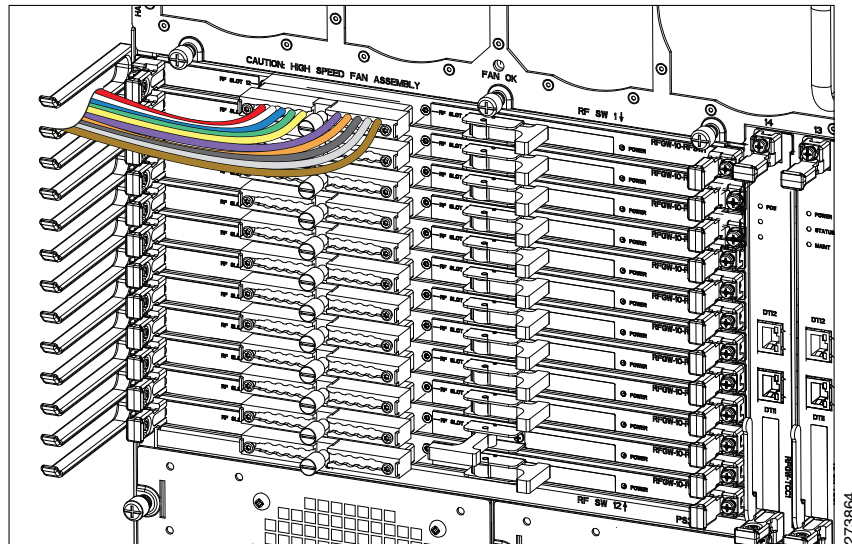To install the UCH, complete the following steps:

Step 1   Position the UCH red line to the red line on the RF switch card (see Figure 6-7).

Figure 6-7   *Aligning the UCH with the RF Switch Card Dense Connector Ports*
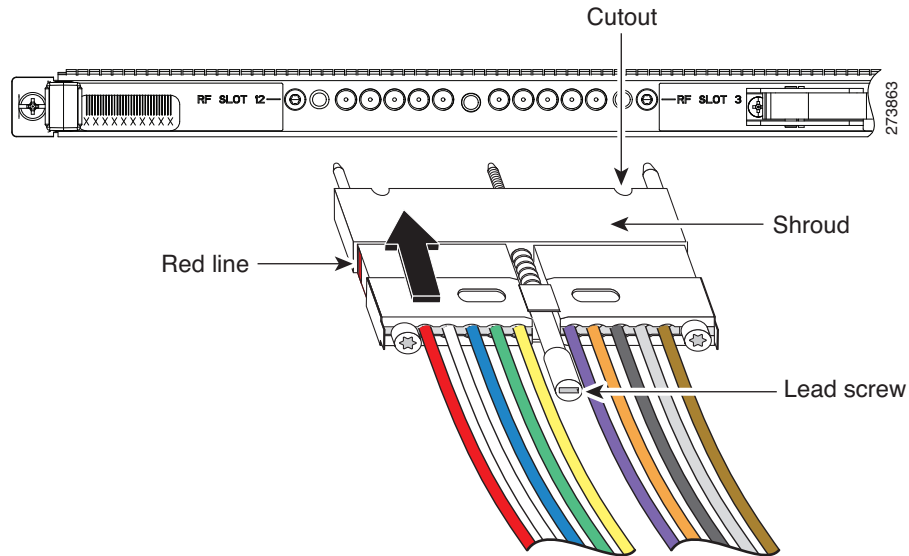
Step 2   Align the end pins on the UCH with the pin holes in the faceplate.

Figure 6-8   *Installing the UCH on the Faceplate*

⚠ **Caution**   While replacing the UCH, be careful not to bend the cables in the holder at right angles.

Step 3   While holding the UCH and the cables in place on the faceplate, use your fingers to tighten the lead screw. If the UCH and cables do not set securely in place on the faceplate, wiggle the holder to set the connectors.

Step 4   Use the flathead screwdriver to tighten the lead screw. Turn the lead screw clockwise until it no longer turns (10 in-lbs, maximum torque 15 in-lbs).

⚠

Caution   Torquing the lead screw to more than the maximum of 20 in-lbs can cause the lead screw to fail.

✎

Note   For the UCH2, as you turn the lead screw clockwise, the outer shroud on the UCH moves to cover the red line on the top and the black line on the bottom of the UCH. The half circles on the edge of the shroud close as the shroud fits down over the UCH. Full engagement is indicated by visible metal-to-metal contact between the UCH and the faceplate (check the half circle cutouts).

Step 5   Repeat Step 1 through Step 4 for the remaining 11 UCH to RF switch card interconnects.

✎

Note   The RF switch cards connect orthogonally across all Universal RF line cards in the system picking up one connector off each card. It is required to install all the 12 UCH to all the 12 RF switch cards so that the coaxial cables can be connected even if only one RF line card is installed in the system.

Installing or Replacing the Cables in the UCH2

This section describes how to install and replace the UCH2 cables. The UCH2 universal cable holders must be used with the Cisco RFGW-10 RF switch line cards. The UCH is designed to stabilize the cables and hold them in place.

✎

Note   Do not use heat-shrink wrap on quad-shielded cables.

Installing the Cables in the UCH2

✎

Note   Customers who have the new UCH2 cable kits can skip performing this task since the cable kit consists of coaxial cables clamped to the cable headers.

Cisco cables are color-coded for easy reference and installation. The cable color corresponds to a specific port on the card.

See Table 6-3 for a list of the cable ports and its associated cable color for a five bundle quad-shielded cabling. The table includes a column for you to define ports and color definitions.

✎

Note   Other color options for precision miniature video coaxial cables may be available with the RF cable vendors. You can use any cable color combination but Table 6-3 is the reference color configuration.

Table 6-3   *RF Switch Universal Cable Holder Reference Color Coding*

RF Switch Line Card Port	Cable Color	RF Switch User-Defined
RFSW Slot 12	Red	
RFSW Slot 11	White	
RFSW Slot 10	Blue	
RFSW Slot 9	Green	
RFSW Slot 8	Yellow	
RFSW Slot 7	Violet	
RFSW Slot 6	Orange	
RFSW Slot 5	Black	
RFSW Slot 4	Gray	
RFSW Slot 3	Brown	

To replace cables or install new cables in an UCH2, complete the following steps:

Step 1   Use the T-10 TORX driver tool to loosen the lock bar on the side where the cable will be installed (See Figure 6-9).

Figure 6-9   *Using the T-10 TORX Driver Tool to Loosen the UCH2 Lock Bar*
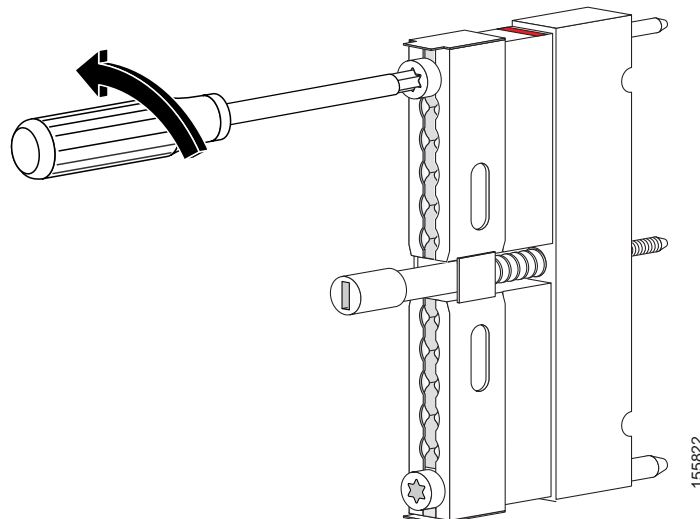
Step 2   Use a flat-head screwdriver as a lever to slide open the lock bar (if needed). (See Figure 6-10.)

Figure 6-10   *Using a Screwdriver to Slide Open the Lock Bar on the UCH2*
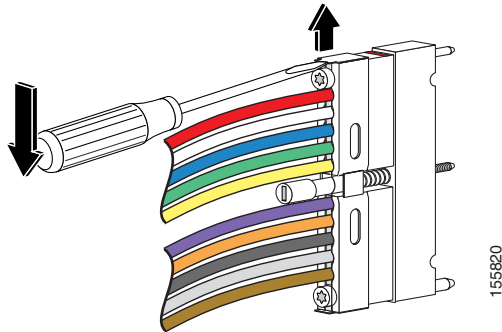
Step 3   Remove the ESD cap from a cable (see Figure 6-11 and Figure 6-12) and place it in the hole in the UCH2. (See Figure 6-13.) Use Table 6-3 to determine the correct color and location for each colored cable.

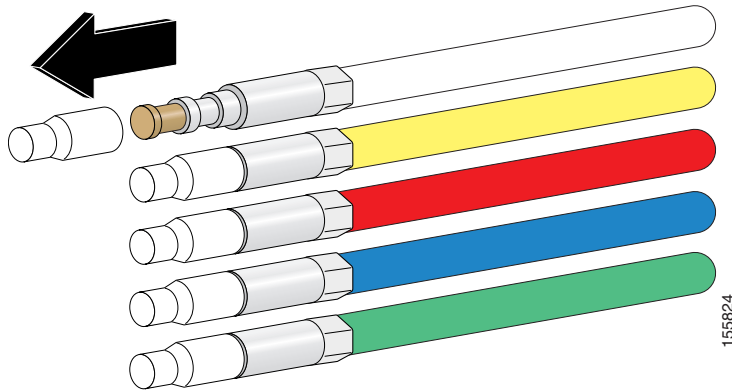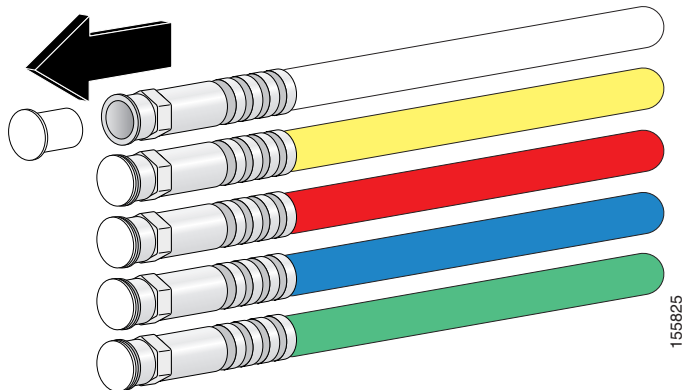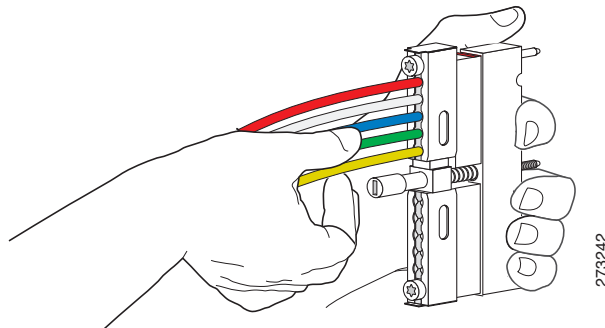*Figure 6-11*   *Removing an ESD Cap from an MCX Connector*

Figure 6-12   *Removing an ESD Cap from an F Connector*

Step 4   Insert and wiggle the connector into the hole.

Figure 6-13   Placing Cables in the UCH2

> **Note**   The cables fit loosely in the holes, and are not locked into place until the lock bar is closed (Step 6).

Step 5   Repeat Step 3 and Step 4 for the remaining cables you are installing.

> **Note**   Make sure the cables are aligned correctly and inserted completely otherwise the slide bar will not close.

Step 6   Slide the lock bar close completely, and use the T-10 TORX driver tool to tighten the screws clockwise (torque 10 in-lbs, 1.13 Newton meters [Nm]). The locking bar is completely closed when they are interlocked with the metal by the lead screw.

> **Note**   The clamp bar maximum torque is 15 in-lbs (1.69 Nm).

Removing Cables

To remove the old cables, complete the following steps:

Step 1   Use the T-10 TORX driver tool to loosen the UCH2 lock bar on the side you want to remove a cable. (See Figure 6-9.)

Step 2   Slide open the lock bar by hand, or with a flathead screw driver, if the bar is tight or hard to access. (See Figure 6-10.)

Step 3   Carefully pull the cable completely out of the UCH2.

> ⚠ **Caution**   Be careful not to bend the cables at right angles.

Note If the cable is not released from the UCH2, make sure the lock bar is completely open.

Verifying the RF Switch Card Installation

Check the following:

1. Verify that the captive screws are secure.

2. Verify that the card is properly seated in the chassis.

   a. Release the captive screws.

   b. Use the handle on the front of the RF switch card to disconnect the midplane connectors.

   c. Slide the card partially out of the chassis and then slide it back in, making sure that it is properly seated in the midplane.

   d. Tighten the captive screws.

3. Verify that the UCH is secured in place on the faceplate by checking if the lead screw is secure.

Note The recommended maximum torque that should be applied to a lead screw is 15 in-lbs (1.69 Nm).

4. Verify that the connectors are properly seated in the ports on the faceplate.

   a. Verify that no cables are broken at the connector.

   b. Verify that the cables are properly secured in the UCH.

   c. Verify that all the MCX connectors are protruding the same distance out of the UCH.

Note Use the MCX to F connector adapter provided in the accessory kit to easily adapt the MCX connection for testing the cables.

5. Verify that the lock bar on the UCH2 is in place and tightened.

Downstream RF Power Measurement Caution

Caution Exposure to ESD can damage this product.

If the downstream RF power measurements are made from the RF switch line card, all the ESD precautions listed below must be followed to prevent damage to the product:

1. Check for a proper ground on the equipment and chassis before connecting any cable.

2. Ensure there is a common ground between all the test equipment and the unit under test.

3. Keep the test cables as short as possible to limit static buildup.

4. Before attaching any test cables to the unit under test, momentarily ground the center pin of the test cable to remove any static buildup that may be present.

Broken Lead Screws

To remove a broken lead screw in the faceplate of the card, complete the following steps:

Step 1   Remove the cable bundle and the UCH from the faceplate.

     a. Take hold of the entire bundle of cables with one hand, and hold the card in place with the other.

     b. Pull the cables and the UCH away from the card.

Note   If the UCH does not immediately come away from the faceplate, gently wiggle the UCH up and down while at the same time pulling it away from the faceplate.

Step 2   Inspect the screw hole and blow away any debris.

Step 3   Insert a small flathead screwdriver into the lead screw hole.

Step 4   Press down and rotate the screwdriver counterclockwise until the broken part of the lead screw emerges from the hole.

Step 5   Use your fingers or needle-nose pliers to rotate the lead screw the rest of the way out of the hole.

Cabling the Supervisor Engine

Note   For information about Cisco RFGW-10 Supervisor Engine 7-E, see "Cisco RFGW 10 Supervisor Engine 7-E" section on page 1-17.
For more information on istalling and removing the SFP and SFP+ transceiver modules for the Supervisor 7-E, see the *Cisco SFP and SFP+ Transceiver Module Installation Notes* at http://www.cisco.com/en/US/docs/interfaces_modules/transceiver_modules/installation/note/78_15160.html.

The following section provides an overview of the cabling requirements and installation of the SFP modules for the Supervisor Card V-10GE for the Cisco DS-48 line card.

Features of the Supervisor Engine Front Panel

The following sections describe the LEDs, connectors, and switches on the Cisco RFGW-10 UEQAM Supervisor Engine V-10GE:

LEDs

Table 1-7 describes the LEDs on the Supervisor Engine front panel.

10-Gigabit Ethernet Uplink Ports

The 10-Gigabit Ethernet uplink ports operate in full-duplex mode only. These ports use the hot-swappable 10GBASE-LR long-reach X2 optical transceivers. The X2s have SC connectors to interface with multimode fiber (MMF) and single-mode fiber (SMF) cable.

There is the option to use either a Gigabit Ethernet uplink using SFPs or two X2 (10G) uplinks. In the first case, the total bandwidth would be 48G+4G = 52G, and in the second case, the bandwidth would be 48G+20G=68G. SFP and 10-Gigabit Ethernet uplink options cannot be used simultaneously. When two Supervisor Engine V-10GEs are present in a Cisco RFGW-10 UEQAM, one X2 uplink is active on both the primary (active) and secondary (standby) Supervisor Engines by default, or two uplinks will be active in a non-redundant configuration.

Gigabit Ethernet SFP Uplink Ports

The four Gigabit Ethernet uplink ports operate in full-duplex mode only. These ports use the 1000BASE-T, 1000BASE-SX, 1000BASE-LX/LH, and 1000BASE-ZX small form-factor pluggables (SFPs). The SFPs have line card connectors to interface with multimode fiber (MMF) and single-mode fiber (SMF) cable.

When two Supervisor Engine V-10GEs are present in a Cisco RFGW-10 UEQAM, two SFP uplinks are active on both the primary (active) and secondary (standby) supervisor engines by default, or four uplinks will be active in a non-redundant configuration.

Ethernet Management Port

The supervisor includes an "out of band management" Ethernet port on the front panel known as "fa1". This FastEthernet port on the management supervisor can be enabled using the following command in the ROMMON mode:

```
fa1Enable=1
```

This enables the management port after reload. Once enabled the interface is available via IOS.

```
interface FastEthernet1
ip address 10.5.30.183 255.255.255.0
speed auto
duplex auto
```

To disable this port, **fa1Enable** should be set to 0 in the rommon mode.

⚠ **Warning**   **The FastEthernet port is not intended for heavy traffic load since it is not connected to the switching fabric on the supervisor. It is a simple NIC-style interface to which the CPU has software-level access. The "fa1" port is directly connected to the CPU. This implies that traffic on "fa1" port adversely affects the CPU performance. You should not use this port for data traffic under any circumstance. Moreover, the CPU is an easy target for Denial-of-Service attacks through the "fa1" port. You need to build your network topology such that the "fa1" port is restricted to management traffic only.**

Console Port

The Cisco RFGW-10 UEQAM Supervisor Engine V-10GE console port has an EIA/TIA-232 RJ-45 connector.

The console port allows you to perform the following functions:

- Configure the switch from the CLI

- Monitor network statistics and errors

- Configure SNMP agent parameters

> **Note**   EIA/TIA-232 was known as recommended standard RS-232 before its acceptance as a standard by the Electronic Industries Alliance (EIA) and Telecommunications Industry Association (TIA).

Reset Button

The Reset button is used to restart the switch.

> **Note**   Use a paper clip or other small, pointed object to press the Reset button.

Compact Flash Port

The compact Flash port accepts a Type 1 compact Flash card. You can use it for file transfer tasks such as loading a new software image. The Flash card is optional and can be obtained from third-party suppliers.

Port Cabling Specifications

This section provides port cabling specifications.

The length of your networks and the distances between connections depend on the type of signal, the signal speed, and the transmission medium (the type of cabling used to transmit the signals). The distance and rate limits in this document are the IEEE-recommended maximum speeds and distances for signaling. Table 6-4 shows the transmission speed versus the distance.

Table 6-4   EIA/TIA-232 Transmission Speed in Contrast with Distance

Rate (bps)	Distance (ft)	Distance (m)
2400	200	60
4800	100	30
9600	50	15
19,200	25	7.6
38,400	12	3.7
56,000	8.6	2.6

Maximum Cable Distances

Table 6-5 shows the maximum cable distances for transceiver speed and cable type.

Table 6-5   *Maximum Cable Distances*

Transceiver Speed (Mbps)	Cable Type	Duplex Mode	Maximum Distance Between Stations
10	Category 3 UTP	Half or full	328 ft (100 m)
10	MMF	Half or full	1.2 miles (2 km)
100	Category 5 UTP	Half or full	328 ft (100 m)
100	MMF	Half	1312 ft (400 m)
100	MMF	Full	1.2 miles (2 km)

Attaching Module Interface Cables

The connector types used to attach interface cables to the Supervisor Engine are:

- RJ-45 (see Figure 6-14)
- SC-Type Fiber-Optic (see Figure 6-15)

Figure 6-14   *RJ-45 Connector*
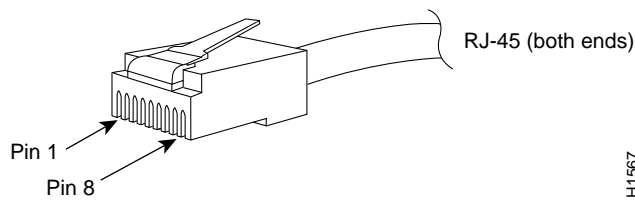
Warning   **To avoid electric shock, do not connect safety extra-low voltage (SELV) circuits to telephone-network voltage (TNV) circuits. LAN ports contain SELV circuits, and WAN ports contain TNV circuits. Some LAN and WAN ports both use RJ-45 connectors. Use caution when connecting cables.** Statement 1021
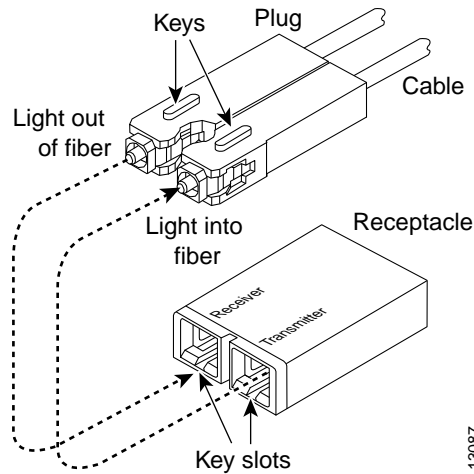
Note   Always keep caps and plugs on the fiber-optic connectors on the cable and the switch when they are not in use.

Warning   **Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments.** Statement 1051

Figure 6-15   SC-Type Fiber-Optic Connector

SC Connector

The SC connector, shown in Figure 6-16, is used to connect fiber-optic module ports or transceivers with the external SMF or MMF network.

Warning   **Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments.** Statement 1051

Note   Make sure that the optical connectors are clean before making the connections. Contaminated connectors can damage the fiber and cause data errors.

Figure 6-16   SC Fiber-Optic Connector
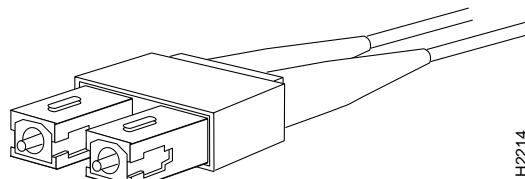
Always insert the network connector completely into the socket. A secure connection is especially important when you are establishing a connection between a module and a long distance (1.24 miles or 2 km) network or a module and a suspected highly attenuated network. If the link LED does not light, try removing the network cable plug and reinserting it firmly into the module socket. It is possible that dirt or skin oils have accumulated on the plug faceplate (around the optical-fiber openings), generating significant attenuation and reducing the optical power levels below threshold levels so that a link cannot be made.

⚠️

Caution   Use extreme care when removing or installing connectors so that you do not damage the connector housing or scratch the end-face surface of the fiber. Always install protective covers on unused or disconnected components to prevent contamination. Always clean fiber connectors before installing them.

LC Connector

⚠️

Warning   **Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments.** Statement 1051

The LC fiber-optic connector, shown in Figure 6-17, is a small form-factor fiber-optic connector that provides high density fiber connectivity. The line card connector can be used with either MMF cable or SMF cable. The line card connector uses a latching clip mechanism that is similar to the one used on the RJ-45 copper connector.

✎

Note   Make sure that the optical connectors are clean before making the connections. Contaminated connectors can damage the fiber and cause data errors.

Figure 6-17   *LC Fiber-Optic Connector*
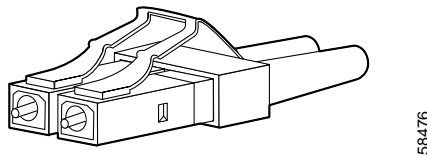
Configuring Your Supervisor Engine

For information and commands to configure your Supervisor Engine, refer to the *1:1 Supervisor Card Redundancy* feature guide.

✎

Note   In Supervisor redundancy mode, the **Cisco RFGW-10 Supervisor 7-E** allows users to use the top two front panel data ports on a Standby Supervisor in slot 2. The downstream data traffic from the uplink is routed from the Standby Supervisor in slot 2 to the Active Supervisor in slot 1. The upstream data traffic to uplink is routed from the Active Supervisor in slot 1 to the Standby Supervisor in slot 2. However, in the RFGW-10 chassis if the uplink is plugged into any of the top two front panel SFP/SFP+ ports (SFP ports 1 and 2) on Supervisor in slot 1, then when Supervisor card in slot 2 takes over as the Active Supervisor, there will be a measurable error rate in the uplink direction from the Active Supervisor in slot 2 to the Standby Supervisor in slot 1. Hence, when Supervisor redundancy is configured, it is highly recommended to use the two 10 Gbps-capable SFP+ ports and two 1 Gbps SFP ports on the Cisco RFGW-10 DS384 line cards instead.

Note The **Cisco RFGW-10 Supervisor 7-E** does not support the Fast Ethernet port. For network management applications, use the 1 Gbps SFP port on a Cisco RFGW-10 DS-384 line card or the Cisco DS-48 line card instead.

X2 Handling Guidelines and Installation

An X2 transceiver is a hot-swappable input/output device that plugs into the 10-Gigabit Ethernet port of the Supervisor Engine and links the Supervisor Engine with a fiber-optic network. The X2 transceivers are online swappable.

Table 6-6 lists the specifications for the 10-Gigabit Ethernet X2 transceiver.

Table 6-6   X2 10-Gigabit Ethernet Transceiver Specifications

Specification	Description
Wavelength	1310 nm (1260 nm–1355 nm)
Cabling distance	Up to 6.2 miles (10 km)
Connector	SC Duplex
Mean launch power (maximum)	+0.5 dBm
Minimum sensitivity	-14.4 dBm
Dimensions	3.5 in. x 1.58 in. x 0.76 in. (89.05 mm x 40.05 mm x 19.25 mm)

Warning **Class 1 laser product.** Statement 1008

Warning **Do not stare into the beam or view it directly with optical instruments.** Statement 1011

Warning **Use of controls, adjustments, or performing procedures other than those specified may result in hazardous radiation exposure.** Statement 1057

The following transceiver media types are supported:

- 1000BASE-T (WS-G5483)
- 1000BASE-SX (WS-G5484)
- 1000BASE-LX/LH (WS-G5486)
- 1000BASE-ZX (WS-G5487)
- 10GBASE-LR (X2-10GBASE-LR)

Caution Because of interoperability issues, Cisco does not support xenpaks purchased from third-party vendors.

Cisco RF Gateway 10 Hardware Installation Guide

Cisco 1000BASE-LX/LH interfaces fully comply with the IEEE 802.3z 1000BASE-LX standard. However, their higher optical quality allows them to reach 10 km over SMF cable instead of the 5 km specified in the standard.

If an LR X2 designed for operation on an SMF cable is directly coupled to an MMF cable, an effect known as Differential Mode Delay (DMD) might occur.

This section describes the following topics:

Installing the 10-Gigabit Ethernet X2 Transceiver

⚠️
Caution   The 10-Gigabit Ethernet X2 transceiver is a static-sensitive device. Always use an ESD wrist-strap or similar individual grounding device when handling X2 transceivers or coming into contact with modules.

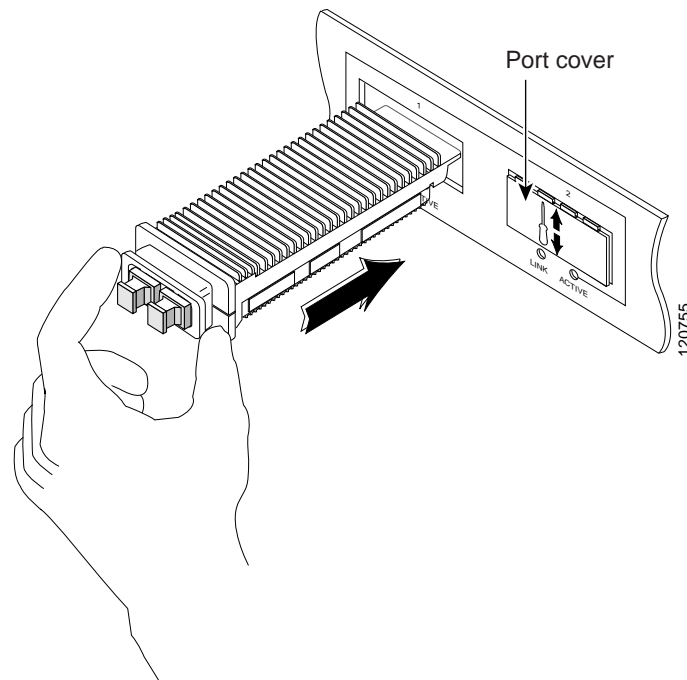To install a 10-Gigabit Ethernet X2 transceiver, follow these steps:

Step 1   Using a small flat-blade screwdriver, carefully pry the X2 transceiver port cover off the module faceplate. Use the two arrows on the port cover as guides for inserting the screwdriver blade. Save the port cover for future use.

Step 2   Remove the 10-Gigabit Ethernet X2 transceiver from its protective packaging.

Step 3   Check the label on the 10-Gigabit Ethernet X2 transceiver to verify that the 10-Gigabit Ethernet X2 transceiver is the correct model for your network.

Step 4   Grip the sides of the 10-Gigabit Ethernet X2 transceiver sleeve with your thumb and forefinger, and insert the 10-Gigabit Ethernet X2 transceiver into the X2 socket on the module front panel. You will hear a click when the X2 transceiver is approximately 90 percent installed. Continue sliding the X2 transceiver into the socket until you hear a second click. The X2 transceiver connector is now mated to the socket connector. Verify that the X2 transceiver EMI gasket is in contact with the module faceplate. See Figure 6-18.

🔎
Tip   With some X2 transceivers you might need to pull out the latching sleeve as you slide the X2 transceiver into the socket. When the EMI gasket makes contact with the module faceplate, slide the latching sleeve in to secure the X2 transceiver in the socket.

Figure 6-18   Installing the 10-Gigabit Ethernet X2 Transceiver

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Note   10-Gigabit Ethernet X2 transceivers are keyed to prevent incorrect insertion.

Before removing the dust plugs and making any optical connections, observe the following guidelines:

- Always keep the protective dust plugs on the unplugged fiber-optic cable connectors and the transceiver optical bores until you are ready to make a connection.
- Always inspect and clean the SC connector end-faces just before making any connections.
- Always grasp the SC connector housing to plug or unplug a fiber-optic cable.

Step 5   Remove the dust plugs from the network interface cable SC connectors. Save the dust plugs for future use.

Step 6   Inspect and clean the SC connector's fiber-optic end-faces.

Tip   For complete information on inspecting and cleaning fiber-optic connections, refer to *Inspection and Cleaning Procedures for Fiber-Optic Connections*.

Step 7   Remove the dust plugs from the 10-Gigabit Ethernet X2 transceiver optical bores.

Step 8   Immediately attach the network interface cable SC connectors to the 10-Gigabit Ethernet X2 transceiver.

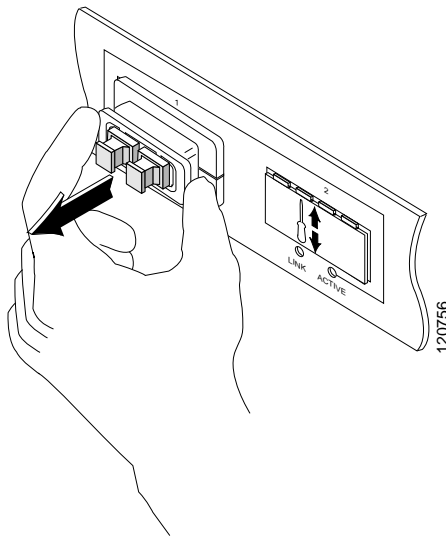## Removing the 10-Gigabit Ethernet X2 Transceiver

⚠
Caution   The 10-Gigabit Ethernet X2 transceiver is a static-sensitive device. Always use an ESD wrist-strap or similar individual grounding device when handling X2 transceivers or coming into contact with modules.

If you are removing a 10-Gigabit Ethernet X2 transceiver, follow these steps:

Step 1   Disconnect the network fiber-optic cable from the 10-Gigabit Ethernet X2 transceiver connectors. Immediately re-install the dust plugs in the X2 transceiver optical bores and the fiber-optic cable SC connectors.

Step 2   Grip the sides of the 10-Gigabit Ethernet X2 transceiver sleeve with your thumb and forefinger, and pull the sleeve out to release the X2 transceiver from the socket connector. (See Figure 6-19.)

Figure 6-19   *Removing the 10-Gigabit Ethernet X2 Transceiver*

Step 3   Slide the 10-Gigabit Ethernet X2 transceiver out of the socket and immediately place it in an antistatic bag.

Step 4   Re-install the socket cover if you are not installing an X2 transceiver in the empty socket.

    a.   Position the socket cover in front of the socket opening.

    b.   Snap the socket cover in place.

X2 Transceiver Maintenance Guidelines

To properly maintain X2 transceivers, follow these guidelines:

- To prevent ESD damage, follow normal handling procedures.

- When the transceiver is stored or when a fiber-optic cable is not plugged in, always keep plugs in the optical bores.

- The most common source of contaminants in the optical bores is debris picked up on the ferrules of the optical connectors. Use an alcohol swab or Kim-Wipe to clean the ferrules of the optical connector.

⚠

Warning   Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments. Statement 1051

SFP Guidelines

SFP modules are hot-pluggable and field-replaceable, and you can insert them into the four SFP module slots on the front panel of the Supervisor Engine V-10GE. You can use the SFP modules for connections to other network devices.

You can use any combination of supported SFP modules. Use only Cisco SFP modules on your Cisco device. Each SFP module has an internal serial EEPROM that is encoded with security information. This encoding provides a way for Cisco to identify and validate that the SFP module meets the requirements for the device.

The following SFP media types are supported:

- 1000BASE-SX (GLC-SX-MM)
- 1000BASE-LX/LH (GLC-LH-SM)
- 1000BASE-ZX (GLC-ZX-SM)
- 1000BASE-T (GLC-T)

Cisco 1000BASE-LX/LH interfaces fully comply with the IEEE 802.3z 1000BASE-LX standard. However, their higher optical quality allows them to reach 10 km over SMF cable instead of the 5 km specified in the standard.

If an LX/LH SFP designed for operation on an SMF cable is directly coupled to an MMF cable, an effect known as Differential Mode Delay (DMD) might occur.

This section describes the following topics:

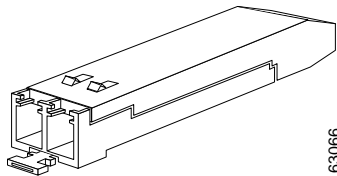## Fiber-Optic SFP Modules

Some fiber-optic SFP modules use LC-type connectors, as shown in Figure 6-20.

⚠

Caution   Protect your fiber-optic SFP modules by inserting clean dust plugs into the SFP modules after you remove the cables. Be sure to clean the optic surfaces of the fiber-optic cables with a soft antistatic cloth before you reconnect them to another SFP module. Avoid getting dust and other contaminants into the optical bores, as the optics do not work correctly when obstructed with dust.

Figure 6-20   LC Fiber-Optic SFP Module

LC SFPs provide duplex single-mode and multimode connections in supported devices. Table 6-7 lists the cable specifications for fiber-optic SFP module ports.

Note   When using shorter distances of single-mode fiber cable, you might need to insert an inline optical attenuator in the link to avoid overloading the receiver.

Table 6-7   Fiber-Optic SFP Module Port Cabling Specifications

SFP Module	Wavelength (nanometers)	Fiber Type	Core Size (micron)	Modal Bandwidth (MHz/km)	Cable Distance
1000BASE-SX	850	MMF	62.5	160	722 feet (220 m)
			62.5	200	902 feet (275 m)
			50.0	400	1640 feet (500 m)
			50.0	500	1804 feet (550 m)
1000BASE-LX/LH	1300	MMF[1]	62.5	500	1804 feet (550 m)
			50.0	400	1804 feet (550 m)
		SMF	50.0	500	1804 feet (550 m)
			9/10	—	32,810 feet (10 km)
1000BASE-ZX	1550	SMF	9/10	—	43.4 to 62 miles (70 to 100 km)[2]

1. A mode-conditioning patch cord is required. Using an ordinary patch cord with MMF, 1000BASE-LX/LH SFP modules, and a short link distance can cause transceiver saturation, resulting in an elevated bit error rate (BER). When using the LX/LH SFP module with 62.5-micron diameter MMF, you must also install a mode-conditioning patch cord between the SFP module and the MMF cable on both the sending and receiving ends of the link. The mode-conditioning patch cord is required for link distances greater than 984 feet (300 m).

2. 1000BASE-ZX SFP modules can reach up to 100 km by using dispersion-shifted SMF or low-attenuation SMF; the distance depends on the fiber quality, the number of splices, and the connectors.

Note   When using shorter distances of single-mode fiber cable, you might need to insert an inline optical attenuator in the link to avoid overloading the receiver.

When the fiber-optic cable span is less than15.43 miles (25 km), you should insert a 5-decibel (dB) or 10-dB inline optical attenuator between the fiber-optic cable plant and the receiving port on the 1000BASE-ZX SFP module at each end of the link.

Fiber-optic SFP modules also use MT-RJ connectors, as shown in Figure 6-21.

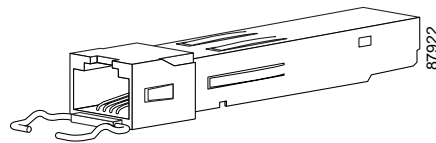*Figure 6-21   MT-RJ Fiber-Optic SFP Module*
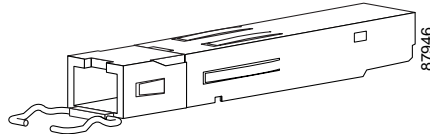
1000BASE-T SFP Modules

Copper 1000BASE-T SFP modules use RJ-45 connectors, as shown in Figure 6-22.

Figure 6-22   1000BASE-T Copper SFP Module

1000BASE-T copper SFP modules used with the Cisco RFGW-10 UEQAM Supervisor Engine V-10GE operate only in 1000BASE-T mode, or at 1000 Mbps. Copper 1000BASE-T SFP modules use standard four twisted-pair, Category 5 cable at lengths up to 328.08 feet (100 meters).

CWDM SFP Modules

You can connect the CWDM SFPs to CWDM passive optical system optical add/drop multiplexer (OADM) or multiplexer/demultiplexer plug-in modules using single-mode fiber-optic cables with standard SC connectors. Figure 1-23 shows a CWDM SFP with the optical port dust plug removed.

CWDM SFP Module (Yellow-Coded CWDM-SFP-1550= Shown)

CWDM SFPs come in eight wavelengths that range from 1470 nm to 1610 nm. Color markings on the devices identify the wavelength to which the Gigabit Ethernet channel is mapped. Table 1-9 lists the CWDM SFPs with their wavelengths and color codes.

Table 6-8   SFP Wavelengths and Color Coding

SFP Product Numbers	Wavelength	Color Identifier
CWDM-SFP-1470=	Longwave 1470 nm laser, single mode	Gray
CWDM-SFP-1490=	Longwave 1490 nm laser, single mode	Violet
CWDM-SFP-1510=	Longwave 1510 nm laser, single mode	Blue
CWDM-SFP-1530=	Longwave 1530 nm laser, single mode	Green
CWDM-SFP-1550=	Longwave 1550 nm laser, single mode	Yellow
CWDM-SFP-1570=	Longwave 1570 nm laser, single mode	Orange

SFP Product Numbers	Wavelength	Color Identifier
CWDM-SFP-1590=	Longwave 1590 nm laser, single mode	Red
CWDM-SFP-1610=	Longwave 1610 nm laser, single mode	Brown

Cleaning the Fiber-Optic Connectors

Fiber-optic connectors are used to connect two fibers together. When these connectors are used in a communications system, proper connection becomes a critical factor.

Fiber-optic cable connectors can be damaged by improper cleaning and connection procedures. Dirty or damaged fiber-optic connectors can result in communication that is not repeatable or inaccurate.

Fiber-optic connectors differ from electrical or microwave connectors. In a fiber-optic system, light is transmitted through an extremely small fiber core. Because fiber cores are often 62.5 microns or less in diameter, and dust particles range from a tenth of a micron to several microns in diameter, dust and any contamination at the end of the fiber core can degrade the performance of the connector interface where the two cores meet. Therefore, the connector must be precisely aligned, and the connector interface must be absolutely free of trapped foreign material.

Connector loss, or insertion loss, is a critical performance characteristic of a fiber-optic connector. Return loss is also an important factor. Return loss specifies the amount of reflected light; the lower the reflection, the better the connection. The best physical contact connectors have return losses greater than –40 dB, although –20 to –30 dB is more common.

The connection quality depends on two factors: the type of connector and the proper cleaning and connection techniques. Dirty fiber connectors are a common source of light loss. Keep the connectors clean at all times, and keep the dust covers installed when the connectors are not in use.

Before installing any type of cable or connector, use a lint-free alcohol pad from a cleaning kit to clean the ferrule, the protective white tube around the fiber, and the end-face surface of the fiber. As a general rule, whenever there is a significant, unexplained loss of light, clean the connectors.

⚠ **Caution** Use extreme care when removing or installing connectors so that you do not damage the connector housing or scratch the end-face surface of the fiber. Always install protective covers on unused or disconnected components to prevent contamination. Always clean fiber connectors before installing them.

To clean the optical connectors, use a CLETOP cassette cleaner (type A for SC connectors or type B for MT-RJ connectors) and follow the product directions. If a CLETOP cassette cleaner is not available, follow these steps:

Step 1 Use a lint-free tissue soaked in 99 percent pure isopropyl alcohol to gently wipe the faceplate. Wait five seconds for the surfaces to dry, and repeat.

Step 2 Remove any residual dust from the faceplate with clean, dry, oil-free compressed air.

⚠ **Warning** **Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments.** Statement 1051

Use a magnifying glass or inspection microscope to inspect the ferrule at an angle. Do not look directly into the aperture. Repeat the process if any contamination is detected. The connectors used inside the system have been cleaned by the manufacturer and connected to the adapters in the proper manner. The operation of the system should be error free if the customer provides clean connectors on the application side, follows the previous directions, and follows these guidelines:

- Clean the connectors using either a CLETOP cassette cleaner (Type A for SC connectors and Type B for MT-RJ connectors) or lens tissues before connecting to the adapters. Use pure alcohol to remove contamination.

- Do not clean the inside of the connector adapters.

- Do not use force or quick movements when connecting the fiber optic connectors in the adapters.

- Cover the connectors and adapters to keep the inside of the adapters or the surface of the connectors from getting dirty when you are not using the connectors or while you are cleaning the chassis.

Cabling the TCC Card

This section describes the procedure for cabling the TCC card.

Preventing Electrostatic Discharge Damage

Electrostatic discharge (ESD) damage, which occurs when electronic cards or components are improperly handled, can result in complete or intermittent failures. The AC-input power shelf and its AC power modules contain a printed circuit card fixed in a metal carrier. Electromagnetic interference (EMI) shielding and connectors are integral components of the carrier. Although the metal carrier helps to protect the cards from ESD, use an antistatic strap each time you handle the modules.

Following are guidelines for preventing ESD damage:

- Always use an ESD-preventive wrist or ankle strap and ensure that it makes good skin contact. Before removing a card from the chassis, connect the equipment end of the strap to a bare metal, unpainted surface on the chassis or rack-mount.

- Handle components by the carrier edges only. Avoid touching the card components or the connector pins.

- When removing a module, place it on an antistatic surface or in a static-shielding bag. If the module will be returned to the factory, immediately place it in a static-shielding bag.

- Avoid contact between the modules and your clothing. The wrist-strap protects the card from ESD voltages on the body only. The ESD voltages on your clothing can still cause damage.

⚠

Caution   For safety, periodically check the resistance value of the antistatic strap. The measurement should be between 1 and 10 megohms.

TCC Card LED Summary

The front panel on the TCC card has seven LEDs:

- POWER
- STATUS
- MAINTENANCE
- DTI 1 LINK
- DTI 1 ACT
- DTI 2 LINK
- DTI 2 ACT

Table 1-12 describes the LEDs on the TCC card.

✎ **Note** There are two LEDs for each DTI port (ACK and LINK). Only one of these can be on at a time. The upper LED (ACK) indicates whether the RFGW-TCC is connected (linked) with the DTI server. It does not indicated a frequency lock with the DTI server. Yellow illumination indicates a positive communication link with the server. The lower LED (LINK) can either be green or off. When green, it indicates that the DTI client has established connection with the server and the frequency is locked. A typical transition of the LEDS is the ACK LED illuminates yellow (linked) after the system comes up and when the DTI frequency is locked, the ACK LED becomes off and the LINK LED illuminates green.

DTI Physical Connector

The DTI interface on the TCC card is compliant with the DOCSIS Timing Interface Specification CM-SP-DTI-I04-061222 (DTI). It is a DTI client device and provides an RJ-45 (female) connector for each DTI link. These interfaces are redundant and can support separate DTI servers.

The cables used to connect the TCC card to a DTI server should use standard RJ-45 (female) terminated 10BaseT UTP Ethernet cables. The DTI interface operates normally over a maximum of 200 meters using category 5E rated UTP cables (or higher performance cable). The termination impedance for the DTI interface *must* be 100 ohms.

According to the DOCSIS Timing Interface Specification CM-SP-DTI-I04-061222, the interface is compliant with conventional Ethernet cabling pinouts and cable type. One distinction with DTI is that the DTI utilizes a single pair for transmission in both directions. Therefore a crossover function (similar to Ethernet crossover) is not required.

Table 6-9   DTI Physical Connector

RJ-45 Pin Number	Signal	Comment
1	SIG +	Compliant with 10baseT Ethernet Specifications
2	SIG-	Compliant with 10baseT Ethernet Specifications
3	NC	
4	NC	

RJ-45 Pin Number	Signal	Comment
5	NC	
6	NC	
7	NC	
8	NC	

> **Note** Whenever you connect cables to the TCC card, use a wrist-strap or other grounding device to prevent ESD damage.

Connect the DTI ports to the DTI server. The port can be connected either to the Root Server, or the subtending Slave Server, such that all ports have a common Root Server.

> **Note** Cables used to connect the TCC card to a DTI server must use standard RJ-45 (female) terminated 10BaseT UTP Ethernet cables. Cables must not be longer than 200 meters and be category 5E or more.

Cabling the Line Cards

This section describes the cabling procedure for the line card.s

Preventing ESD Damage

Electrostatic discharge (ESD) damage, which occurs when electronic cards or components are improperly handled, can result in complete or intermittent failures. The DS-48 line card printed circuit board is fixed in a metal carrier. Although the metal carrier helps to protect the cards from ESD, use an antistatic strap each time you handle the modules or connect cables.

Following are the guidelines for preventing ESD damage:

- Always use an ESD-preventive wrist or ankle strap and ensure that it makes good skin contact. Before removing a card from the chassis, connect the equipment end of the strap to a bare metal, unpainted surface on the chassis or rack-mount. Ensure that the chassis and/or rack has a grounding cable installed. For more information, see the "Rack-Mounting a Cisco RFGW-10 UEQAM" section on page 3-5.

- Handle the components by the carrier edges only. Avoid touching the card components or any connector pins.

- When removing a module, place it on an antistatic surface or in a static shielding bag. If the module will be returned to the factory, immediately place it in a static shielding bag.

- Avoid contact between the modules and your clothing. The wrist-strap protects the card from ESD voltages on the body only, ESD voltages on clothing can still cause damage.

> **Caution** For safety, periodically check the resistance value of the antistatic strap. The measurement should be between 1 and 10 megohms.

Note   Whenever you connect cables to a DS-48 line card, use a wrist-strap or other grounding device to prevent ESD damage.

Connecting the Gigabit Ethernet Ports

The Gigabit Ethernet ports support IEEE 802.3z specifications for 1000-Mbps transmission over fiber-optic cables. These ports also support autosensing and autonegotiation of the proper transmission mode (half duplex or full duplex) with an attached device. Cables connect to the Gigabit Ethernet ports via small form-factor pluggable (SFP) modules.

A list of compatible Cisco approved SFP modules is listed in Table 6-10.

Table 6-10   Cisco Approved SFP Modules for Use with the DS-48 Line Card

SFP Transceiver Modules Product Number	Transceiver Description
SFP-GE-T	Cisco1000BASE-T SFP transceiver module for copper networks
SFP-GE-L	Cisco 1000BASE-LX/LH SFP transceiver module for SMF, 1300-nm wavelength
SFP-GE-S	Cisco 1000BASE-SX SFP transceiver module for MMF, 850-nm wavelength

Installing SFP Transceiver Modules in the Line Cards

The SFP transceiver modules have three different types of latching devices to secure an SFP transceiver in a port socket:

- Mylar Tab SFP modules
- Actuator/Button SFP modules
- Bale Clasp SFP modules

Determine the type of latch your SFP transceiver uses before proceeding.

Caution   We strongly recommend that you do not install or remove the SFP transceiver module with fiber-optic cables attached to it because of the potential damage to the cables, the cable connector, or the optical interfaces in the SFP transceiver. Disconnect all cables before removing or installing an SFP transceiver.

Note   Do not remove and insert SFP transceivers more often than is absolutely necessary. Frequent removal and insertion will reduce the life of the SFP transceiver.

Caution   The SFP transceiver modules are static sensitive devices. Always use an ESD wrist-strap or similar individual grounding device when handling SFP transceivers.

To install an SFP transceiver, follow these steps:

Step 1   Wear an ESD protective wrist-strap on your wrist and attach the other end to a bare metal grounded surface or an ESD ground connector to prevent ESD damage.

Step 2   Remove the SFP transceiver module from its protective packaging.

✎

Note   Do not remove the optical bore dust plugs until directed to do so later in the procedure.

Step 3   Check the label on the SFP transceiver body to verify that you have the correct model for your network.

Step 4   Find the send (Tx) and receive (Rx) markings that identify the top side of the SFP transceiver.

✎

Note   On some SFP transceivers, the Tx and Rx markings might be replaced by arrowheads pointing from the SFP transceiver connector (transmit direction or Tx) towards the connector (receive direction or Rx).

Step 5   Position the SFP transceiver in front of the socket opening.

✎

Note   Different Cisco devices have different SFP module socket configurations. Your Cisco device could have either a latch-up or a latch-down orientation. Ensure that you are installing the SFP transceiver in the correct orientation for your Cisco device. For more details, refer to the hardware installation instructions that was provided with your Cisco device.

Step 6   Insert the SFP transceiver into the socket until you feel the SFP transceiver module connector snap into the socket connector.

Figure 6-23   Inserting an SFP Transceiver into a Module Socket
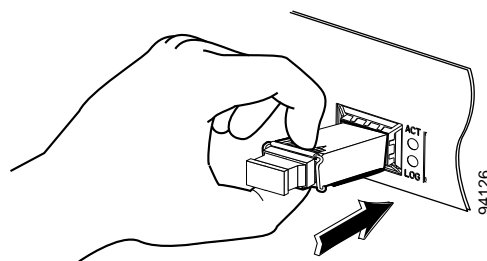
For optical SFP transceivers, before removing the dust plugs and making any optical connections, observe the following guidelines:

- Always keep the protective dust plugs on the unplugged fiber-optic cable connectors and the transceiver optical bores until you are ready to make a connection.
- Always inspect and clean the LC connector end-faces just before making any connections.
- Always grasp the LC connector housing to plug or unplug a fiber-optic cable.

Step 7   Remove the dust plugs from the network interface cable LC connectors. Save the dust plugs for future use.

Step 8   Inspect and clean the LC connector fiber-optic end-faces.

Tip For complete information on inspecting and cleaning fiber-optic connections, refer to *Inspection and Cleaning Procedures for Fiber-Optic Connections*.

Step 9 Remove the dust plugs from the SFP transceiver optical bores.

Step 10 Immediately attach the network interface cable LC connector to the SFP transceiver.

Step 11 To connect 1000BASE-T SFP transceivers to a copper network, do the following:

Caution To comply with GR-1089 intrabuilding lightning immunity requirements, you must use grounded, shielded, twisted-pair Category 5 cabling.

   a. Insert the Category 5 network cable RJ-45 connector into the SFP transceiver RJ-45 connector.

Note When connecting to a 1000BASE-T-compatible server, workstation, or router, use four twisted-pair straight-through Category 5 cabling for the SFP transceiver port. When connecting to a 1000BASE-T-compatible switch or repeater, use four twisted-pair crossover Category 5 cabling.

   b. Insert the other end of the network cable into an RJ-45 connector on a 1000BASE-T-compatible target device.

Step 12 Observe the port status LED:

- The LED illuminates green when the SFP transceiver and the target device have an established link.
- The LED illuminates amber while the STP discovers the network topology and searches for loops. This process takes about 30 seconds, and then the LED illuminates green.
- The LED is off when either the target device is not powered on, or there is a cable problem, or when there is a problem with the adapter installed in the target device.

Step 13 Reconfigure and reboot the target device if necessary.

Removing SFP Transceiver Modules

Caution The SFP transceiver modules are static sensitive devices. Always use an ESD wrist-strap or other grounding device when handling SFP transceivers.

To remove an SFP transceiver module, do the following:

Step 1 Wear an ESD protective wrist-strap on your wrist and attach the other end to a bare metal grounded surface or an ESD ground connector to prevent ESD damage.

Step 2 Disconnect the network fiber-optic cable or network copper cable from the SFP transceiver module connector. For optical SFP transceivers, immediately re-install the dust plugs in the SFP transceiver optical bores and the fiber-optic cable LC connectors.

Tip   Make a note of the send (Tx) and receive (Rx) connector plugs for attaching the fiber-optic cables later.

Step 3   Release and remove the SFP transceiver module from the socket connector, as shown in Figure 6-24, Figure 6-25, and Figure 6-26.
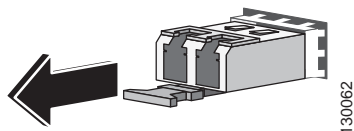
- If the SFP transceiver has a Mylar tab latch, pull the tab gently in a slightly downward direction until the transceiver disengages from the socket connector, and then pull the SFP transceiver straight out of the socket. Do not twist or pull the Mylar tab as you could detach it from the SFP transceiver.

*Figure 6-24   Removing an SFP Transceiver Equipped with a Mylar Tab*
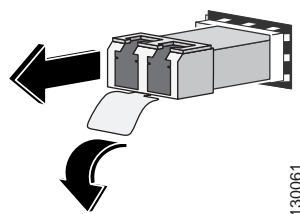
- If the SFP transceiver has an actuator button latch, gently press the actuator button on the front of the SFP transceiver until it clicks and the latch mechanism releases the SFP transceiver from the socket connector. Grasp the actuator button between your thumb and index finger, and carefully pull the SFP transceiver straight from the module slot.

Figure 6-25   Removing an SFP Transceiver Equipped with an Actuator/Button Latch

- If the SFP transceiver has a bale-clasp latch, pull the bale out and down to eject the SFP transceiver from the socket connector. If the bale-clasp latch is obstructed and you cannot use your index finger to open it, use a small, flat-blade screwdriver or a long, narrow instrument to open the bale-clasp latch. Grasp the SFP transceiver between your thumb and index finger, and carefully remove it from the socket.

Figure 6-26   *Removing an SFP Transceiver Equipped with a Bale-Clasp Latch*
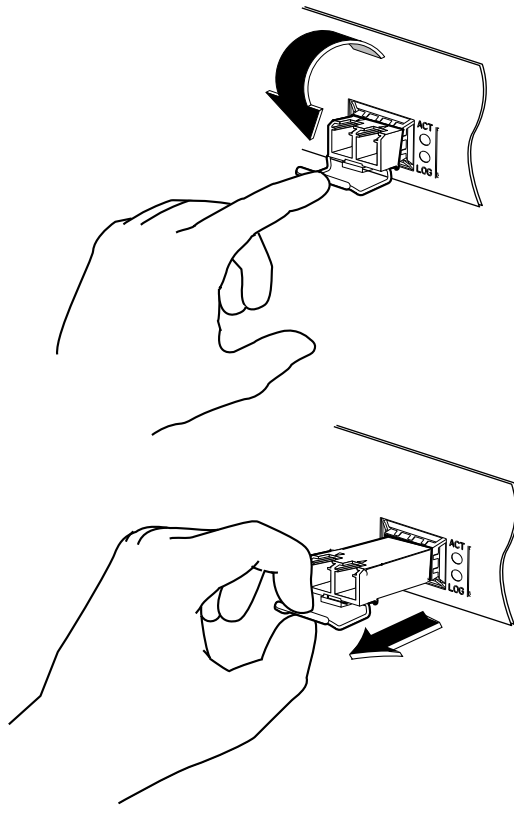
94127

Step 4   Place the removed SFP transceiver in an antistatic bag or other protective environment.

Connecting to the ASI Monitor Port (Optional)

You can route the input of a single QAM channel to the Asynchronous Serial Interface (ASI) port to monitor the channel on appropriate test equipment. A cable with a male BNC connector (not supplied) is required to connect to the port labeled ASI MON.

To connect to the ASI monitor port, do the following:

Step 1   Locate the BNC ASI connection on the line card (see Figure 1-12).

Step 2   Screw the barrel of the male BNC connector to the port labeled ASI MON. The connection should be snug but not overly tight.

Step 3   Connect the other end of the cable to the test equipment according to the instructions for that equipment.

Configuring the ASI Port for Monitoring

This section covers commands for the following operations on the ASI port:

Enabling and Disabling the ASI Port

The ASI port is port number 15 on a QAM card.

To enable and disable the ASI port, use the following command:

```
Router(config-if)# [no] shut
```

Examples:

Enable the ASI port on QAM line card in Slot 3:

```
Router# configure terminal
Router(config)# interface asi 3/15
Router(config-if)# no shut
```

Disable the ASI port on QAM line card in Slot 3:

```
Router# configure terminal
Router(config)# interface asi 3/15
Router(config-if)# shut
```

Monitoring a Specific QAM via the ASI Port

To route qam output to the ASI port, use the following commands:

```
Router# configure terminal
Router(config)# interface asi slot/15
Router(config-if)# cable monitor rf-port port channel channel
```

where:

slot = 3 - 12

port = 1 - 12

channel = 1 - 4 (depending on the stacking level)

Example:

To route qam3/5.1 output to the ASI port:

```
Router# configure terminal
Router(config)# interface asi 3/15
Router(config-if)# cable monitor rf-port 5 channel 1
Router(config-subif)#
```

✎

Note   Routing the input of a QAM channel to the ASI port does not disrupt the RF output.

Configuring the Byte-gap

To change the gap spacing of the data bytes within the output transport, use the following command:

```
Router(config-if)# cable byte-gap gap num
```

Where *gap num* is the number of NULL (ASI transport NULL) bytes between data bytes. This could be 1, 2 or 4. The default gap value is 1.

Example:

```
Router# configure terminal
Router(config)# interface asi 3/15
Router(config-if)# cable byte-gap 2
```

Retrieving ASI Statistics

To display interface statistics for the ASI port:

```
Router# show interface asi slot_num/15
```

Example:

```
Router# show interface asi 3/15
```