



Cisco RF Gateway 10 Hardware Installation Guide

July 25, 2012

THE SPECIFICATIONS AND INFORMATION REGARDING THE PRODUCTS IN THIS MANUAL ARE SUBJECT TO CHANGE WITHOUT NOTICE. ALL STATEMENTS, INFORMATION, AND RECOMMENDATIONS IN THIS MANUAL ARE BELIEVED TO BE ACCURATE BUT ARE PRESENTED WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED. USERS MUST TAKE FULL RESPONSIBILITY FOR THEIR APPLICATION OF ANY PRODUCTS.

Cisco Systems, Inc.

www.cisco.com

Cisco has more than 200 offices worldwide. Addresses, phone numbers, and fax numbers are listed on the Cisco website at www.cisco.com/go/offices.

THE SOFTWARE LICENSE AND LIMITED WARRANTY FOR THE ACCOMPANYING PRODUCT ARE SET FORTH IN THE INFORMATION PACKET THAT SHIPPED WITH THE PRODUCT AND ARE INCORPORATED HEREIN BY THIS REFERENCE. IF YOU ARE UNABLE TO LOCATE THE SOFTWARE LICENSE OR LIMITED WARRANTY, CONTACT YOUR CISCO REPRESENTATIVE FOR A COPY.

The Cisco implementation of TCP header compression is an adaptation of a program developed by the University of California, Berkeley (UCB) as part of UCB's public domain version of the UNIX operating system. All rights reserved. Copyright © 1981, Regents of the University of California.

NOTWITHSTANDING ANY OTHER WARRANTY HEREIN, ALL DOCUMENT FILES AND SOFTWARE OF THESE SUPPLIERS ARE PROVIDED "AS IS" WITH ALL FAULTS. CISCO AND THE ABOVE-NAMED SUPPLIERS DISCLAIM ALL WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, WITHOUT LIMITATION, THOSE OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NON-INFRINGEMENT OR ARISING FROM A COURSE OF DEALING, USAGE, OR TRADE PRACTICE.

IN NO EVENT SHALL CISCO OR ITS SUPPLIERS BE LIABLE FOR ANY INDIRECT, SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES, INCLUDING, WITHOUT LIMITATION, LOST PROFITS OR LOSS OR DAMAGE TO DATA ARISING OUT OF THE USE OR INABILITY TO USE THIS MANUAL, EVEN IF CISCO OR ITS SUPPLIERS HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

Cisco and the Cisco logo are trademarks or registered trademarks of Cisco and/or its affiliates in the U.S. and other countries. To view a list of Cisco trademarks, go to this URL: www.cisco.com/go/trademarks. Third-party trademarks mentioned are the property of their respective owners. The use of the word partner does not imply a partnership relationship between Cisco and any other company. (1110R)

Any Internet Protocol (IP) addresses and phone numbers used in this document are not intended to be actual addresses and phone numbers. Any examples, command display output, network topology diagrams, and other figures included in the document are shown for illustrative purposes only. Any use of actual IP addresses or phone numbers in illustrative content is unintentional and coincidental.

© 2012 Cisco Systems, Inc. All rights reserved.



iii

CHAPTER 1

Overview 1-1

Cisco RFGW-10 Features	1-2
Cisco RFGW-10 Functional Overview	1-2
Cisco RFGW-10 IOS Software	1-4
Cisco RFGW-10 Hardware	1-5
Cisco RFGW-10 System Configuration	1-5
Cisco RFGW-10 Slot Numbering	1-6
Cisco RFGW-10 Components	1-7
Fan Assembly	1-7
DC PEMs	1-10
Front Panel Display	1-14
Supervisor Engines	1-15
Cisco Supervisor Engine V-10GE	1-15
Supervisor Engine Components	1-16
Supervisor Engine LEDs	1-16
Ethernet Management Port	1-16
Supervisor Memory	1-17
Cisco RFGW 10 Supervisor Engine 7-E	1-17
Features of the Cisco RFGW-10 Supervisor Engine 7-E	1-18
Front Panel LED	1-19
Physical and Environmental Specifications	1-20
Cisco RFGW-10 DS-48 Line Card	1-20
DS-48 Line Card Components	1-21
Cisco RFGW-10 DS-384 Line Card	1-23
TCC/DTI Card	1-23
RF Switch Card	1-27
Supported External AC-Input Power Shelf	1-29
Lineage AC-DC Power Shelf	1-29

CHAPTER 2

Preparing Your Site for Installation 2-1

Safety Recommendations	2-2
------------------------	-----

REVIEW DRAFT—CISCO CONFIDENTIAL

Compliance Requirements 2-3

NEBS Level 3 Compliance 2-3

Cautions and Regulatory Compliance Statements for NEBS 2-3

Standard Warning Statements 2-4

 General Safety Warnings 2-4

Site Planning 2-7

 General Precautions 2-7

 Site Selection Guidelines 2-7

 Site Environmental Requirements 2-8

 Physical Characteristics 2-8

 Floor Loading Considerations 2-9

 Site Power Guidelines 2-9

 Electrical Circuit Requirements 2-10

 Site Cabling Guidelines 2-10

 Asynchronous Terminal Connections 2-11

 Interference Considerations 2-11

 Rack-Mounting and Location Guidelines 2-12

 Precautions for Rack-Mounting 2-12

 Rack Selection Guidelines 2-13

 Equipment Rack Guidelines 2-13

 Site Planning Checklist 2-14

Preventing Electrostatic Discharge Damage 2-15

Electrical Safety 2-15

Receiving a Cisco RFGW-10 UEQAM 2-17

Chassis-Lifting Guidelines 2-17

Tools and Equipment 2-19

 Unpacking and Verifying Shipping Contents 2-19

Checking the Shipping Container Contents 2-20

Cisco RFGW-10 UEQAM Installation Checklist 2-21

CHAPTER 3

Cisco RFGW-10 UEQAM Installation 3-1

 Cisco RFGW-10 UEQAM Description 3-1

 Front View 3-2

 Rear View 3-3

 Installation Methods 3-4

 General Rack Installation Guidelines 3-4

 Rack-Mounting a Cisco RFGW-10 UEQAM 3-5

 Verifying Rack Dimensions 3-5

REVIEW DRAFT—CISCO CONFIDENTIAL

Installing the Chassis Installation Brackets	3-6
Installing the Chassis Installation Handles	3-7
Attaching the Chassis Rack-Mount Brackets	3-9
Chassis Front Rack-Mount Brackets Installation	3-9
Chassis Mid-Mounted Rack-Mount Bracket Installation	3-10
Installing the Cisco RFGW-10 UEQAM in a Rack	3-12
Two-Post Rack Installation Mid-Mounted	3-16
Attaching a Chassis Ground Connection	3-18
Attaching the Cable-Management Bracket	3-20
Connecting Power to Cisco RFGW-10 UEQAM	3-21
Connecting DC-Input Power to Cisco RFGW-10 UEQAM	3-22
Powering On the Cisco RFGW-10 UEQAM	3-28
Connecting System Cables	3-28
Connecting the Lineage Power Shelf to the Cisco RFGW-10	3-28
Cabling the Power Shelf	3-29
Prerequisites	3-29
Required Tools and Equipment	3-29
Steps	3-29
Connecting a Single Power Shelf	3-30
Required Tools and Equipment	3-30
Steps	3-31
Connecting Dual Power Shelves	3-32
Required Tools and Equipment	3-32
Steps	3-32
Disconnecting Cables from the Power Shelf	3-34
Steps	3-34

CHAPTER 4

Thermal Management	4-1
Blank Panels	4-1
Cooling Path	4-2
Fan Tray Removal	4-2
Environmental Monitoring	4-3

CHAPTER 5

Installing and Removing FRUs	5-1
Installation and Removal of the DC PEM	5-2
Installing a DC PEM	5-3
Removing a DC PEM	5-6
Installation and Removal of the Fan Assembly	5-7

REVIEW DRAFT—CISCO CONFIDENTIAL

- Removing the Fan Assembly 5-7
- Installing the Fan Assembly 5-8
- Verifying the Fan Assembly Installation 5-9
- Installation and Removal of the Supervisor Cards 5-9
 - Installing the Supervisor Cards 5-10
 - Verifying the Status of the Supervisor Card 5-13
 - Removing the Supervisor Card 5-13
- Installation and Removal of the RF Switch Card 5-14
 - Installing the RF Switch Card 5-15
 - Verifying the RF Switch Card Status 5-17
 - Removing the RF Switch Card 5-18
- Installation and Removal of the TCC Cards 5-19
 - Installing the TCC Card 5-19
 - Verifying the Status of the TCC Card 5-22
 - Removing the TCC Card 5-22
- Installation and Removal of the Line Cards 5-23
 - Installing the DS-48 Line Card 5-23
 - Verifying the Status of the DS-48 Line Card 5-26
 - Removing the DS-48 Line Card 5-26
- Installation and Removal of the SFP Modules 5-27
 - Installing SFP Modules 5-27
 - Mylar Tab SFP Modules 5-28
 - Actuator/Button SFP Modules 5-29
 - Bale Clasp SFP Modules 5-31

CHAPTER 6 **Cabling the Cisco RFGW-10 UEQAM 6-1**

- Part Numbers 6-5
- Nominal Attenuation 6-6
- Safety Information and Warnings 6-7
 - Electrical Equipment Guidelines 6-7
 - Preventing Electrostatic Discharge Damage 6-8
- Installing the UCH on the Cisco RFGW-10 UEQAM RF Switch Card 6-8
- Installing or Replacing the Cables in the UCH2 6-10
 - Installing the Cables in the UCH2 6-10
 - Removing Cables 6-13
- Verifying the RF Switch Card Installation 6-14
 - Downstream RF Power Measurement Caution 6-14
 - Broken Lead Screws 6-15

REVIEW DRAFT—CISCO CONFIDENTIAL

Cabling the Supervisor Engine	6-15
Features of the Supervisor Engine Front Panel	6-15
LEDs	6-15
10-Gigabit Ethernet Uplink Ports	6-16
Gigabit Ethernet SFP Uplink Ports	6-16
Ethernet Management Port	6-16
Console Port	6-16
Reset Button	6-17
Compact Flash Port	6-17
Port Cabling Specifications	6-17
Maximum Cable Distances	6-18
Attaching Module Interface Cables	6-18
SC Connector	6-19
LC Connector	6-20
Configuring Your Supervisor Engine	6-20
X2 Handling Guidelines and Installation	6-21
Installing the 10-Gigabit Ethernet X2 Transceiver	6-22
Removing the 10-Gigabit Ethernet X2 Transceiver	6-24
X2 Transceiver Maintenance Guidelines	6-24
SFP Guidelines	6-25
Fiber-Optic SFP Modules	6-25
1000BASE-T SFP Modules	6-27
CWDM SFP Modules	6-27
Cleaning the Fiber-Optic Connectors	6-28
Cabling the TCC Card	6-29
Preventing Electrostatic Discharge Damage	6-29
TCC Card LED Summary	6-30
DTI Physical Connector	6-30
Cabling the Line Cards	6-31
Preventing ESD Damage	6-31
Connecting the Gigabit Ethernet Ports	6-32
Installing SFP Transceiver Modules in the Line Cards	6-32
Removing SFP Transceiver Modules	6-34
Connecting to the ASI Monitor Port (Optional)	6-36
Configuring the ASI Port for Monitoring	6-37
CHAPTER 7	
Cisco RFGW-10 UEQAM System Specifications	7-1
System Specifications	7-1
Power Requirements	7-2

REVIEW DRAFT—CISCO CONFIDENTIAL



Preface

This preface discusses the objectives, audience, and organization of the *Cisco RF Gateway 10 Hardware Installation Guide*. The following sections are in this preface:

- [Document Revision History, page 1](#)
- [Document Objectives, page 2](#)
- [Audience, page 2](#)
- [Document Organization, page 2](#)
- [Document Conventions, page 3](#)
- [Safety Warnings, page 4](#)
- [Related Documentation, page 4](#)
- [Obtaining Documentation and Submitting a Service Request, page 5](#)

Document Revision History

The Document Revision History table below records technical changes to this document.

Document Version	Date	Change Summary
OL-16264-01	January 2009	This is the first version of this document.
OL-16264-02	April 2009	Updated with the new cable assembly information.
OL-16264-03	June 2012	Updated with information about: <ul style="list-style-type: none">• Cisco RF Gateway 10 UEQAM Downstream 384 Line Card (also called Cisco RFGW-10 DS-384)• Cisco RF Gateway 10 Supervisor Engine 7-E
OL-16264-04	September, 2012	Added information about Lineage AC-DC power shelf

Document Objectives

This publication describes Cisco RF Gateway 10 (RFGW-10) Universal Edge Quadrature Amplitude Modulation (UEQAM) installation, and replacement or upgrading of field-replaceable units (FRUs). The purpose of this guide is to enable a safe and efficient installation of the Cisco RFGW-10 UEQAM.

Audience

This publication is primarily designed for the person responsible for installing, and maintaining the Cisco RFGW-10 UEQAM. The users of this guide should:

- Be familiar with electronic circuitry and wiring practices.
- Have experience as electronic or electromechanical technicians.
- Have experience in installing high-end networking equipment. Certain procedures described in this guide require a certified electrician.

Document Organization

The major sections of this installation guide are:

Section	Description
Chapter 1, “Overview”	This chapter provides an overview of the Cisco RFGW-10 UEQAM.
Chapter 2, “Preparing Your Site for Installation”	This chapter provides site preparation guidelines for installing the Cisco RFGW-10 UEQAM.
Chapter 3, “Cisco RFGW-10 UEQAM Installation”	This chapter describes the installation procedures of the Cisco RFGW-10 UEQAM.
Chapter 4, “Thermal Management”	This chapter describes thermal management of the Cisco RFGW-10 UEQAM.
Chapter 5, “Installing and Removing FRUs”	This chapter describes the installation and removal procedures for the field-replaceable units (FRUs).
Chapter 6, “Cabling the Cisco RFGW-10 UEQAM”	This chapter describes the cabling information for the Cisco RFGW-10 UEQAM.
Chapter 7, “Cisco RFGW-10 UEQAM System Specifications”	This chapter lists the specifications of the Cisco RFGW-10 UEQAM.

Document Conventions

This document uses the following conventions:

Convention	Indication
bold font	Commands and keywords and user-entered text appear in bold font .
<i>italic font</i>	Document titles, new or emphasized terms, and arguments for which you supply values are in <i>italic font</i> .
[]	Elements in square brackets are optional.
{ x y z }	Required alternative keywords are grouped in braces and separated by vertical bars.
[x y z]	Optional alternative keywords are grouped in brackets and separated by vertical bars.
string	A nonquoted set of characters. Do not use quotation marks around the string or the string will include the quotation marks.
<code>courier font</code>	Terminal sessions and information the system displays appear in <code>courier font</code> .
< >	Nonprinting characters such as passwords are in angle brackets.
[]	Default responses to system prompts are in square brackets.
!, #	An exclamation point (!) or a pound sign (#) at the beginning of a line of code indicates a comment line.



Note

Means *reader take note*.



Tip

Means *the following information will help you solve a problem*.



Caution

Means *reader be careful*. In this situation, you might perform an action that could result in equipment damage or loss of data.



Timesaver

Means *the described action saves time*. You can save time by performing the action described in the paragraph.



Warning

Means *reader be warned*. In this situation, you might perform an action that could result in **bodily injury**.

Safety Warnings

Most safety warnings for the Cisco RF Gateway 10 are placed in relevant sections throughout the document. For translated safety warnings, see the [Regulatory Compliance and Safety Information for the Cisco RF Gateway 10](#).

Warning Definition



Warning

IMPORTANT SAFETY INSTRUCTIONS

This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. To see translations of the warnings that appear in this publication, refer to the translated safety warnings that accompanied this device. Statement 1071

Note: SAVE THESE INSTRUCTIONS

Note: This documentation is to be used in conjunction with the specific product installation guide that shipped with the product. Please refer to the Installation Guide, Configuration Guide, or other enclosed additional documentation for further details.

Related Documentation

Your Cisco RF Gateway 10 (RFGW-10) Universal Edge Quadrature Amplitude Modulation (UEQAM) and the Cisco IOS software running on it contain extensive features and functionality, which are documented in the following resources:

- All documentation related to the Cisco RF Gateway 10 is listed in the online [Cisco RF Gateway 10 Documentation Roadmap](#).
- The [Cisco RF Gateway 10 Quick Start Guide](#) contains installation and configuration information. It contains quick reference information about chassis or parts installation.
- The [Regulatory Compliance and Safety Information for the Cisco RF Gateway 10](#) document provides international agency compliance, safety, and statutory information for the Cisco RF Gateway 10.
- Cisco IOS software documentation contains Cisco IOS software configuration information and support. See the modular configuration and modular command reference publications in the set that corresponds to the software release installed on your Cisco hardware.
- To check the minimum software requirements of Cisco IOS software with the hardware installed on your router, Cisco maintains the Software Advisor tool on Cisco.com. This tool does not verify whether modules within a system are compatible, but it does provide the minimum IOS requirements for individual hardware modules or components.



Note Access to this tool is limited to users with Cisco.com login accounts.

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly *What's New in Cisco Product Documentation*, which also lists all new and revised Cisco technical documentation, at:

<http://www.cisco.com/en/US/docs/general/whatsnew/whatsnew.html>

Subscribe to the *What's New in Cisco Product Documentation* as a Really Simple Syndication (RSS) feed and set content to be delivered directly to your desktop using a reader application. The RSS feeds are a free service and Cisco currently supports RSS version 2.0.





Overview

The Cisco RF Gateway 10 (RFGW-10) is a Carrier Class Universal Edge QAM (UEQAM) platform that offers concurrent support for Standard and High Definition Digital Broadcast Television, Switched Digital Video (SDV), Video on Demand (VoD), and DOCSIS/Modular CMTS services.

The Cisco RFGW-10 UEQAM is a chassis-based product that is based on open standards with superior performance, capacity, power consumption, ease of management and scalability. All components of the Cisco RFGW-10 UEQAM are designed for high availability including dual Supervisor and Ethernet switching line cards, N:1 Universal Edge QAM line cards, dual Timing and Control line cards, dual load balancing and load sharing Direct Current Power Entry Modules (DC PEMs) and integrated RF switching modules.

The Cisco RFGW-10 is part of the Cisco Cable ecosystem, and is fully integrated and tested as part of the Cisco Digital Broadband Delivery System (DBDS) video solution and Cisco uBR10012 DOCSIS 3.0 and Modular CMTS solution.

The Cisco RFGW-10 is a centralized switching architecture leveraged from the Cisco Catalyst 4500 Series switches. The Cisco RFGW-10 is a 13 rack unit carrier class, modular chassis designed for providing front-to-back airflow and system level redundancy. All chassis components are hot-swappable and redundant. The chassis supports “wire-once” cabling for RF line cards and an integrated dual-zone RF switch matrix. The supervisor engine provides non-blocking, Layer 2 to Layer 4 switching with the addition of wire-speed 10-Gigabit Ethernet uplinks, 136-Gbps capacity, and 102-mpps packet throughput.

The Cisco RFGW-10 system is a UEQAM that supports both upstream and downstream RF cards over a frequency range of 5 MHz to 1.2 GHz. The initial line card release is a UEQAM downstream card that supports the DOCSIS (1.0/2.0/3.0), the EURODOCIS, and J-DOCSIS specifications.

Based on the Cisco IOS networking software, the Cisco RFGW-10 supports advanced switching and routing features.

This document contains the following sections:

- [Cisco RFGW-10 Features, page 1-2](#)
- [Cisco RFGW-10 Functional Overview, page 1-2](#)
- [Cisco RFGW-10 IOS Software, page 1-4](#)
- [Cisco RFGW-10 Hardware, page 1-5](#)
- [Cisco RFGW-10 Components, page 1-7](#)
- [Supported External AC-Input Power Shelf, page 1-29](#)

Cisco RFGW-10 Features

The Cisco RFGW-10 has the following features:

- 13 Rack-Unit Carrier Class Chassis
 - 19-inch rack-mount capability
 - 4536 watt capacity
 - Front-to-rear airflow design
 - Integrated RF switching
 - Cable-once (wire-once) coaxial connections
 - LCD front panel display
 - Greater than 100 Gbps system performance
 - System level redundancy
- Redundancy System Architecture
 - All major FRUs redundant (supervisor, line card, power supply)
 - Dual zone integrated RF data path switch
 - 500-ms line card failover
 - Full software and hardware High Availability support
 - External Gigabit Ethernet and 10 Gigabit Ethernet redundancy
 - DOCSIS Timing Interface (DTI) redundancy
 - System operation from single power supply
- Major System Components
 - 2 Supervisor Card Slots (1:1 Redundant)
 - 2 Timing, Communication, and Control (TCC)/DTI Card Slots (1:1 Redundant)
 - 10 Universal Line Card Slots (N:1 Redundant)
 - 12 RF Switch Card Slots (Dual Zone Redundancy)
 - 2 DC PEM Slots (1:1 Redundant)
 - 1 Fan Tray Module

Cisco RFGW-10 Functional Overview

The Cisco RFGW-10 is a Carrier Class Universal Edge QAM (UEQAM) platform that offers concurrent support for Standard and High Definition Digital Broadcast Television, Switched Digital Video (SDV), Video on Demand (VoD), and DOCSIS/Modular CMTS services. The Cisco RFGW-10 is an edge modulation device that aggregates multiple High Speed Data and/or Video sources, processes and modulates the digital MPEG content, and forwards the QAM modulated MPEG data to the subscriber side devices (cable modems and set-top boxes).

The initial application of the Cisco RFGW-10 is primarily as a downstream data delivery system (downstream from the Cisco RFGW-10 to the cable modem or set-top box). External data and management sources (VoD servers, MCMTS devices, DNCS, and so on) aggregate into the system via the Gigabit Ethernet and 10 Gigabit Ethernet interfaces on the Supervisor and the RF line cards. The

Cisco RFGW-10 architecture is based on a centralized Layer 2 to Layer 4 Ethernet switch fabric. All external Ethernet interfaces, whether on the line cards or on the Supervisor front panel, terminate at the Supervisor engine's switch fabric. Traffic on any of the external interfaces can be routed to any card in the chassis.

The supervisor engine receives either DEPI (DOCSIS) data or Video data (MPEG/UDP/IP) and forwards the data to the RF line cards based on either the DEPI session content (IP/L2TP) or encapsulated video session information (IP/UDP). All data path traffic is terminated at the line cards. The supervisor receives data traffic, classifies the traffic, and forwards the data traffic to the line cards.

Control traffic for DOCSIS (DEPI mode), Video, and HA functionality is terminated on the Supervisor. Local video mode (CLI, GUI, SNMP), remote video mode control plane (DNCS, GQI), and Native video mode (GQI v2, object model) are implemented in the IOS and terminate at the Supervisor.

The Cisco RFGW-10 supports redundant, DTI source device inputs as part of the system clocking architecture. It includes redundant DTI/TCC cards, which support DTI client functionality.

All line cards and modules are redundant. The Supervisors (RPR, SS), TCC, and DC PEMs support 1:1 redundancy. The line card slots can be enabled in either a single N+1 redundancy configuration or a dual redundancy configuration (N+1, M+1). RF data path redundancy is enabled by the integrated RF Switch matrix, which supports dual redundancy groups.

The following sections provide a high-level overview of the downstream data path:

1. Data packets are received by the Cisco RFGW-10 UEQAM via either the 10GE or multiple 1GE interfaces.
2. Data packets are received by the switch fabric on the Supervisor card (all external Ethernet ports terminate at the Supervisor Switch fabric). The supervisor forwards data traffic to the line cards based on the session information and IP address. For data traffic, the supervisor de-encapsulates IP/L2TP DEPI traffic and for Video, the supervisor de-encapsulates based on the IP address/UDP range information.
3. All data path traffic terminates at the specific RF line card (chassis slots 3:12). All cards in the system are synchronous to the DTI system clock reference.
4. For DEPI traffic, the DS line card extracts L2TP header information, parses and processes DOCSIS packets, re-stamps data with DOCSIS time stamps, and completes the J.83 FEC processing.
5. For Video traffic, the DS line card classifies the video packets, manages intra-QAM scheduling, PCR re-stamping, PID re-mapping, and J.83/FEC encoding.
6. The J.83 FEC encoded data is forwarded to the upconverter module, which modulates, upconverts, and forwards data downstream in MPEG-2/MPEG-4 encoding.

Table 1-1 DOCSIS and EuroDOCSIS Downstream Data Rates

Downstream Channel Width, MHz	Modulation Scheme, bit/symbol	Baud Rate, MSym/sec	Raw Bit Rate, Mb/sec	Throughput (Bit Rate - Overhead), Mb/sec
6	64 QAM (6)	5.056	30.34	27
	256 QAM (8)	5.360	42.88	38
8	64 QAM (6)	6.952	41.71	37
	256 QAM (8)	6.952	55.62	48

Cisco RFGW-10 IOS Software

The Cisco RFGW-10 UEQAM runs the Cisco IOS software, which is stored on the compact flash memory disks that fit in the single compact flash memory slot on the front of the Supervisor Cards. The compact flash can store a Cisco IOS image or the configuration file.

In addition to the flash memory disks, each Supervisor module contains onboard flash memory that stores a boot loader. The loader executes following a system reset to reload and execute the Cisco IOS software on the flash memory disks.

The Supervisor module also stores the system configuration in the onboard flash memory. The configuration information read from the flash memory is buffered in the operational memory following initialization, and is written to the flash memory device when the configuration is saved.

Each line card also contains an onboard flash memory that is used to store a boot loader, similar in function to that used on the Supervisor card. However, the line card loader executes following a system reset, line card reset, or line card insertion to reload and executes any code that must run on the line card.

Software images may also be stored on an external TFTP server. Based on the configuration, the proper image might be downloaded from the TFTP server and executed.

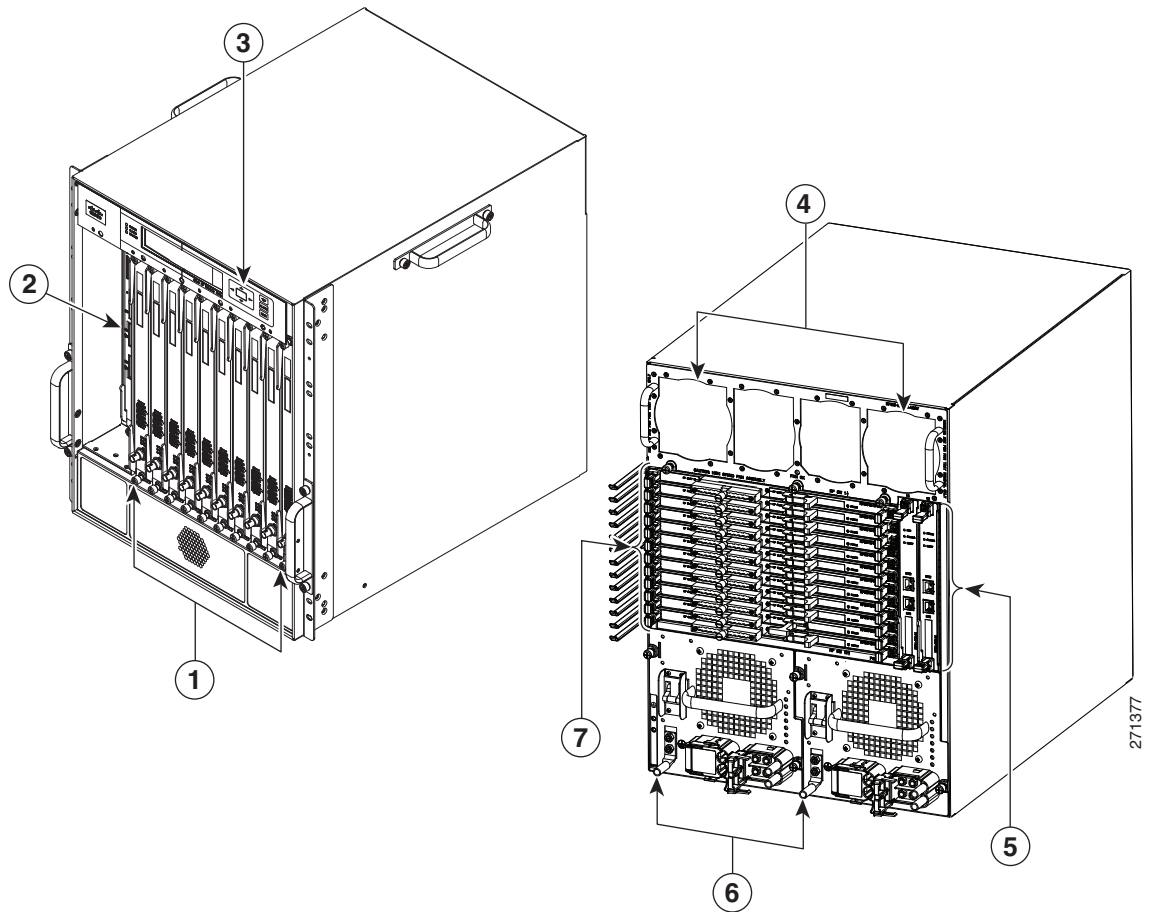
Cisco RFGW-10 Hardware

This section describes the Cisco RFGW-10 system and components.

Cisco RFGW-10 System Configuration

Figure 1-1 shows the location of the front and the rear system components for the Cisco RFGW-10 UEQAM.

Figure 1-1 Cisco RFGW-10 Chassis Components—Front and Rear View



1	Universal RF line card slots	5	TCC/DTI card slots
2	Supervisor card slots	6	DC PEMs
3	LCD/Push button panel	7	RF switch cards/coaxial cable termination slots
4	Fan assembly		

The Cisco RFGW-10 UEQAM is installed in a standard 19-inch equipment or telco rack. A rack-mount kit ships from the Cisco factory with each router. The rack-mount kit includes the hardware needed to mount the router in a standard 19-inch equipment rack or telco-type rack. Mounting in 23-inch equipment rack is possible with optional third-party mounting hardware.

The components in the front include the Supervisor Cards, RF line cards, and the front panel LCD. The components on the rear include the Fan Assembly, RF Switch cards (coaxial terminations), TCC (DTI Clock) cards, and the power supply modules.

All components (excluding the LCD) are hot-swappable and field replaceable. A fully configured system will operate with a single DC PEM installed; the second PEM is required for power supply redundancy and power load sharing.

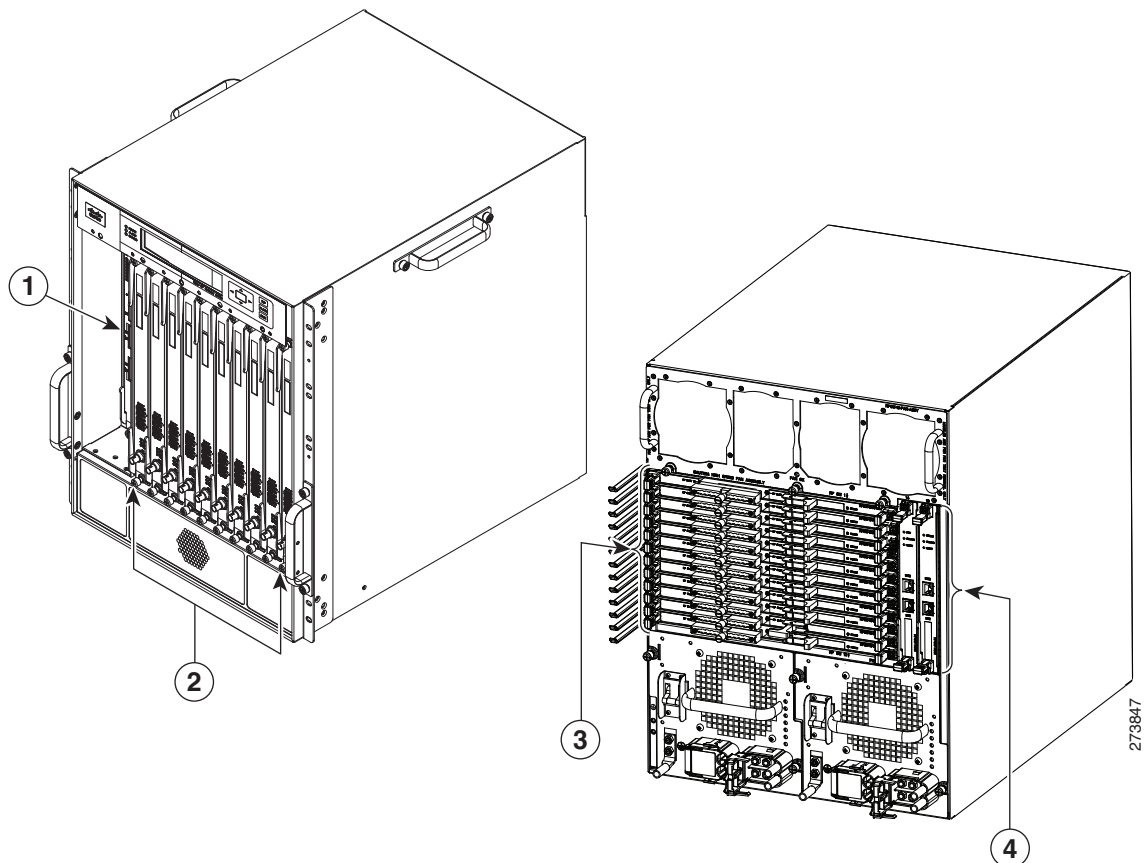
**Note**

Proper configuration of the DC power input requires that both Input 1 and Input 2 are connected to the external power source and the GND connections are connected to the Earth GND. Input 1 and Input 2 on the DC PEMs are *not* redundant power inputs. If only one of the inputs is connected to the external power, the Cisco RFGW-10 UEQAM will not power-on correctly.

Cisco RFGW-10 Slot Numbering

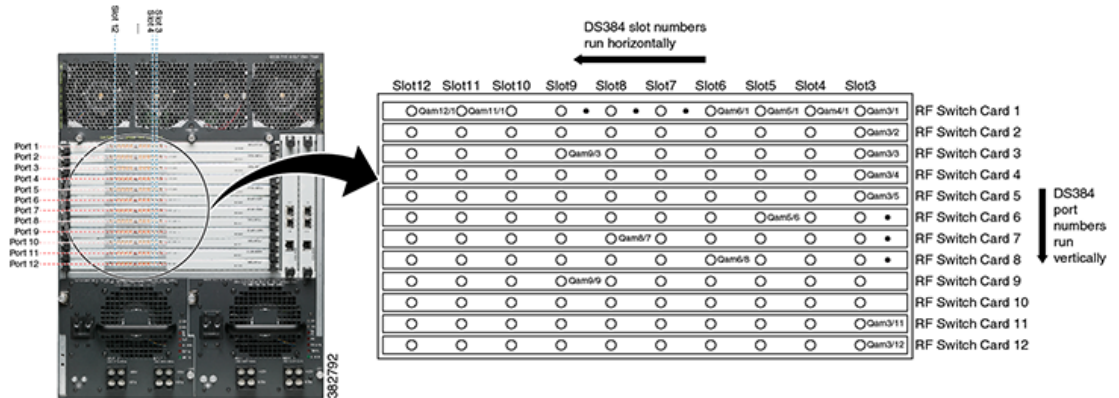
The figures below show the slot numbering in a Cisco RFGW-10 chassis.

Figure 1-2 Cisco RFGW-10 Slot Numbering



1	Supervisor Engine slots 1 and 2	3	RF Switch slots 1 through 12
2	Universal RF card slots 3 through 12	4	TCC cards slots 13 and 14

Figure 1-3 Cisco RFGW-10 Slot/Port Numbering



Cisco RFGW-10 Components

The following sections describe the components in the Cisco RFGW-10:

- [Fan Assembly, page 1-7](#)
- [DC PEMs, page 1-10](#)
- [Front Panel Display, page 1-14](#)
- [Supervisor Engines, page 1-15](#)
- [Cisco RFGW 10 Supervisor Engine 7-E, page 1-17](#)
- [Cisco RFGW-10 DS-48 Line Card, page 1-20](#)
- [Cisco RFGW-10 DS-384 Line Card, page 1-23](#)
- [TCC/DTI Card, page 1-23](#)
- [RF Switch Card, page 1-27](#)

Fan Assembly

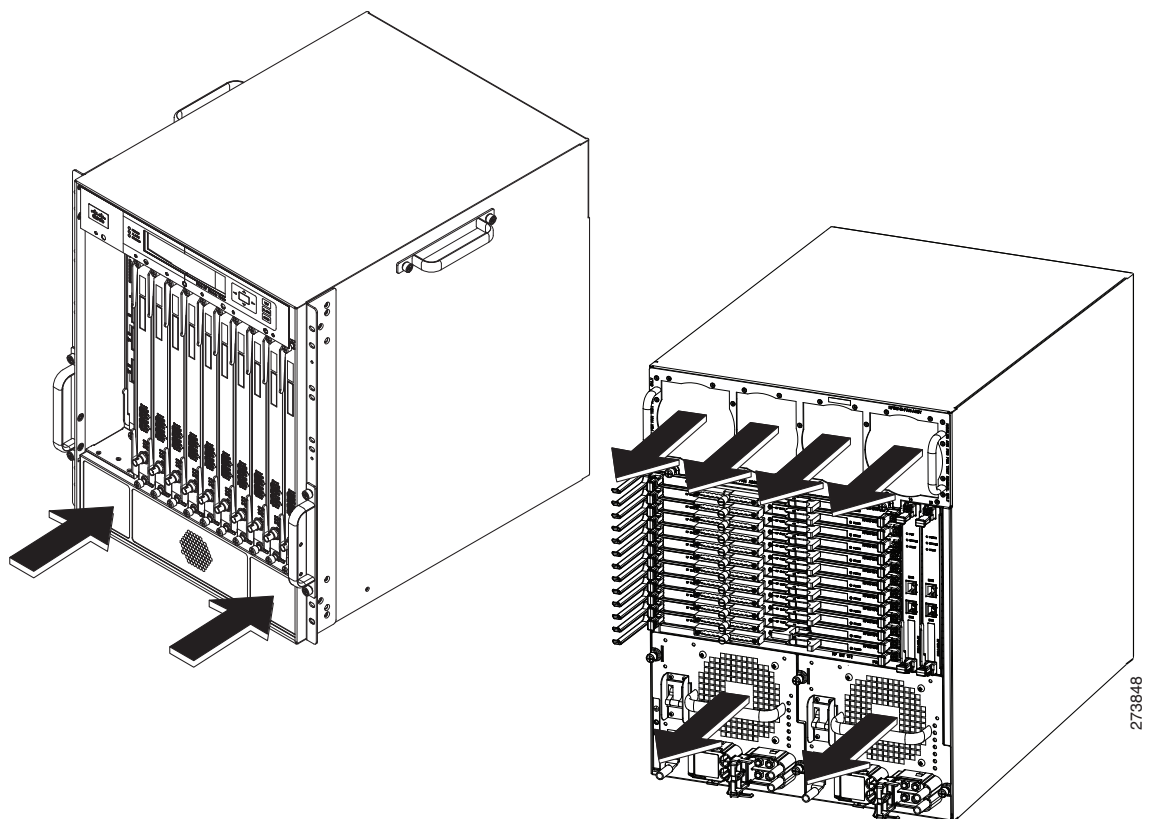
The Cisco RFGW-10 UEQAM system uses a modular fan assembly to dissipate heat from the system and control the temperature of the chassis system components (except the DC PEM, which contains its own internal fan). The fan assembly is a multi-fan design that pulls ambient air from the lower front of the chassis and exhausts air out of the rear top of the chassis. The fan assembly provides individual fan control and failure monitoring, multiple thermistors to monitor exhaust air and a wide range of speed control parameters based on the system and the environmental conditions. Inlet air monitoring is communicated to the fan tray via the system software from the sensors on each of the RF line cards.

The fan tray module provides the following features:

- Online insertion and removal OIR support
- Failure monitoring of individual fans
- Backup temperature monitoring to control individual fan rotation per minute (RPM)
- Usage counter based on hours of operation (CLI-based)
- Front panel LED for alarm status indication
- Control and power circuit failure alarms
- On board multi-level fan speed control based on system temperature

The fan assembly draws air into the chassis and directs it across the internal system components. The heated air exhausts out of the rear of the chassis as shown in [Figure 1-4](#).

Figure 1-4 Cisco RFGW-10 Airflow



The fan tray has four speed levels based on the operating control modes for the system. After power on, the fan speed is set according to the Supervisor provided ambient average air temperature and the configured speed control mode in the system configuration. The default control mode setting configures the fans at maximum speed. The speed of the fans regulate to a slower speed when the fan controller stabilizes to the ambient temperature and chassis temperature. After startup, it may take up to 30 seconds for the fans to stabilize at the requested RPM.

[Figure 1-5](#) and [Figure 1-6](#) show the fan assembly module. The fan tray has a single LED indicator (FAN OK) located in the center of the module. The FAN OK LED status indicators are defined in [Table 1-2](#):

Table 1-2 Fan Assembly LED

LED Color	Status	Description
Green	System OK	System is functioning normally, all fans are operating.
Amber	Failure (Any Type of Failure)	A single fan has failed, system triggers alarms, but the fan assembly is still able to cool the chassis. Repair or replace the fan assembly as soon as possible.

Figure 1-5 Cisco RFGW-10 Fan Assembly Faceplate

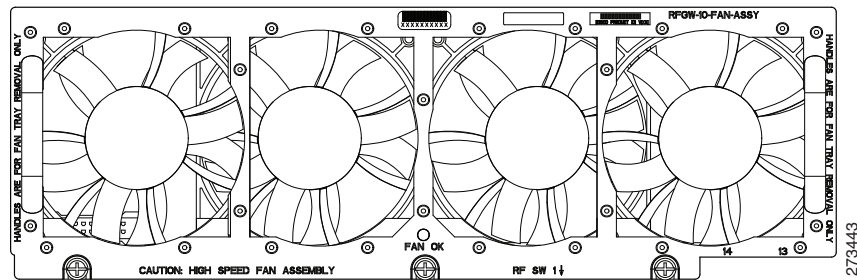
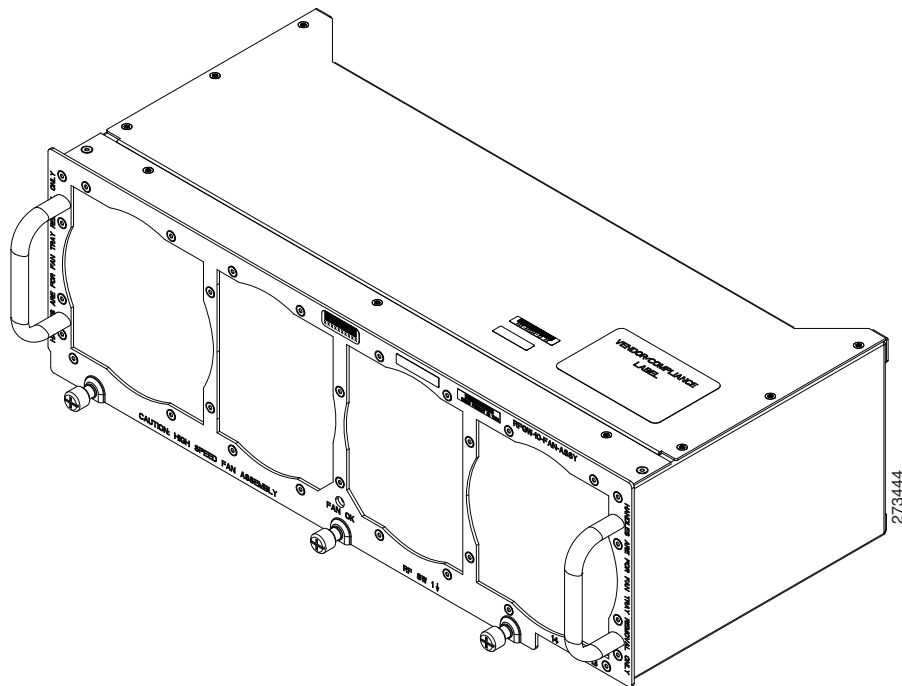


Figure 1-6 Cisco RFGW-10 Fan Assembly



DC PEMs

The Cisco RFGW-10 system is powered by redundant DC PEMs. An individual PEM is capable of providing 4536 watts of total output. The redundant modules work as a 1:1 redundancy configuration and support OIR (hot swapping). These modules do not support current sharing as they are non-isolated PEMs, which are diode OR'd into two separate load zones.

Each PEM includes two 60A input lines that operate between –40VDC and –60VDC input voltages. Proper configuration and operation requires that both DC inputs are properly wired. The PEM also includes an earth ground connection (this is not power return) for grounding the chassis.

**Note**

Each DC PEM has an earth ground connection and two DC power input connections (Input 1 and Input 2). Both external DC inputs (Input 1 and Input 2) must be connected as shown in [Figure 1-7](#). Input 1 and Input 2 are individual power inputs. Both power inputs on the PEM must be wired to external power for the Cisco RFGW-10 UEQAM to operate properly. If both inputs are not connected to external power, the Cisco RFGW-10 UEQAM will not power on.

DC PEM features:

- Closed frame, NEBS-compliant module design
- Front-to-back airflow (exhaust air exits out of the rear of the chassis)
- Power input range: –48VDC to –60VDC
- 4536W power capacity
- Supports OIR (hot swap)
- Supports 1:1 redundancy (system can run with a single PEM)
- CLI interface support for status and configuration
- Remote shutdown feature
- Front panel LED status and alarm indicators

**Note**

When both the DC PEMs are installed, both need to operate with the breaker switches and the OUTPUT OK LED on. If one PEM is not operational, it is recommended that the PEM either be removed from the system or the power input cables be removed to limit the power supply Conductive Emissions (FCC conductive Emission Requirements).

Figure 1-7 shows the DC PEM faceplate.

Figure 1-7 DC PEM Faceplate

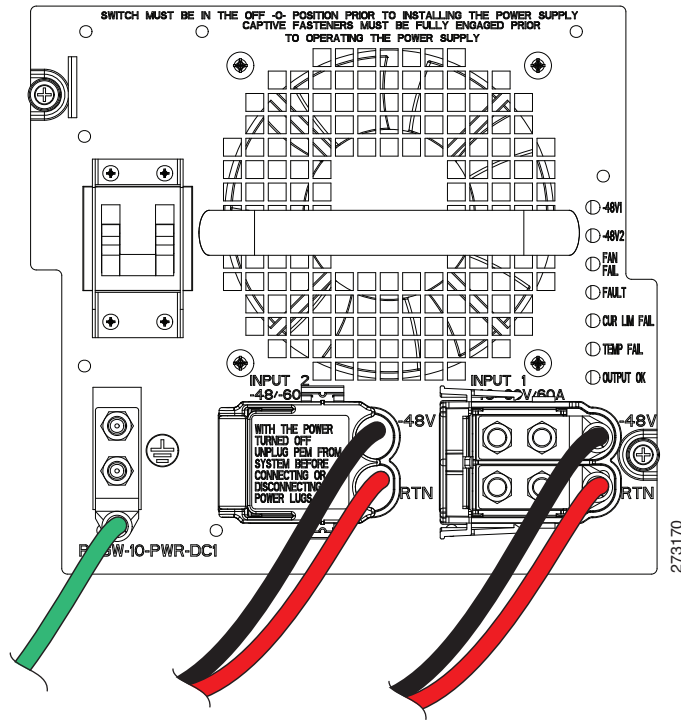


Table 1-3 DC PEM LEDs


LED	Status	Description
-48V1	Green	Power input is wired correctly and receiving proper DC power input.
	Red	Fault with power input. Typically this means that the power input is wired incorrectly with reverse polarity. Sometimes it also indicates a failure on the power input.
	Blank	External power source is not providing power correctly (typically no power is provided).
-48V2	Green	Power input is wired correctly and receiving proper DC power input.
	Red	Fault with power input. Typically this means that the power input is wired incorrectly with reverse polarity. Sometimes it also indicates a failure on the power input.
	Blank	External power source is not providing power correctly (typically no power is provided).
FAN FAIL	Blank	Normal Operation.
	Red	Alarm Condition. Fan operation is not normal.
Fault	Blank	Normal Operation.
	Red	Alarm Condition. System Fault - General fault indications. Power supply is not operating normally.
CUR LIM FAIL	Blank	Normal Operation.
	Red	Alarm Condition. System is experiencing an over current or over power condition (exceeding 60A on inputs).
TEMP FAIL	Blank	DC PEM is operating within functional temperature range.
	Red	Alarm Condition. DC PEM is experiencing an over temperature condition.
OUTPUT OK	Green	All outputs from the PEM to the system are within normal operating ranges.
	Red	Alarm Condition. Indicates that one of the system voltages from the DC PEM is out of range.

Table 1-4 DC PEM Wiring Definitions

Connector	Wiring Point	Description
Input 1	-48V	<ul style="list-style-type: none"> Negative DC input from external battery source Input Voltage Range: -48VDC to -60VDC (nominal), -40VDC to -60VDC (full range) Wiring: #2 Gauge, #4 Gauge Must use Right Angle Power LUG
Input 1	RTN	<ul style="list-style-type: none"> Battery Return for DC input 1 Input Voltage Range: -48VDC to -60VDC (nominal), -40VDC to -60VDC (full range) Wiring #2 Gauge, #4 Gauge Must Use Right Angle Power LUG
Input 2	-48V	<ul style="list-style-type: none"> Negative DC input from external battery source Input Voltage Range: -48VDC to -60VDC (nominal), -40VDC to -60VDC (full range) Wiring: #2 Gauge, #4 Gauge Must use Right Angle Power LUG
Input 2	RTN	<ul style="list-style-type: none"> Battery Return for DC input 1 Input Voltage Range: -48VDC to -60VDC (nominal), -40VDC to -60VDC (full range) Wiring #2 Gauge, #4 Gauge Must Use Right Angle Power LUG
GND	GND	<ul style="list-style-type: none"> Earth Ground Connection for PEM and Chassis Wiring: #2 Gauge, #4 Gauge Must use Right Angle Power LUG

Table 1-5 lists the DC power specifications.

Table 1-5 DC Power Specifications

Specifications	Requirements
Power Input Range	<p>Input voltage: –48 VDC or –60 VDC (nominal), range –40 to –60 VDC</p> <p>Recommended DC service: Four 60A services @ nominal –48 VDC or –60 VDC (two 60A services per PDU)</p> <p>Required Lugs: 90° angled industry standard 2-hole compression lugs with holes on 5/8-inch centers (for example, for AWG no. 4 wire: for example Panduit LCD4-14AF-L or equivalent).</p> <p> Caution The input wire gauge should be selected by certified electricians based on the local electrical code.</p>
Power Consumption	Maximum system power is limited to 4536 watts (15,474.06 Btu/hour)
Thermal Requirements	Maximum Ambient Temperature must be less than 122°F (50°C)
Power Redundancy	Two DC PDUs and two DC PEMs—2N redundancy
Power Supply Ground Lug	Industry standard 2-hole compression lug with holes on 5/8- inch centers (for example, Panduit part number LCD4-14AF-L, or equivalent)

Front Panel Display

Integrated with the Cisco RFGW-10 chassis is the Front Panel Display (FPD) and Push Button Select module. The purpose of the module is to provide real time information of the chassis configuration, IOS images, alarm status and management, and general system auditing. The LCD is field upgradeable, but not hot-swappable.

Figure 1-8 shows the Cisco RFGW-10 front panel display.

Figure 1-8 Cisco RFGW-10 Front Panel Display



The FPD is a 40 character x 4 line LCD module. The push button display and status LEDs are integrated as part of the chassis front faceplate. The push button display provides the menu selection and a screen scrolling mechanism to provide navigation capabilities. The FPD navigation features are not enabled in this release of the system.

Table 1-6 Front Panel Display LEDs

LED	Color/Status	Description
POWER	Blank	Power is not on
	Green	Power is on
ALARM	Blank	No system alarms reported
	Orange	System alarms are reported. Refer to the CLI and system logs for the specific alarms.
STATUS	Green	Future LED. Is Green when the system is powered on normally.

**Note**

The FPD features depend on the release of the Cisco IOS software running on the Cisco RFGW-10. The initial release of the IOS software for the Cisco RFGW-10 will include the basic FPD features, Hostname, IP Address, and IOS Version, and Customer Configured Description Field. Please refer to the release notes for the Cisco IOS release running on the platform.

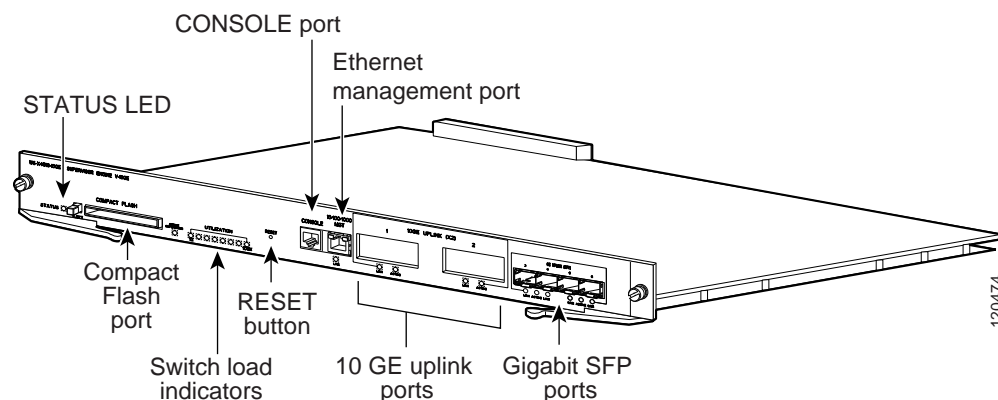
Supervisor Engines

This section describes the following supervisor engines for the Cisco RFGW-10:

- [Cisco Supervisor Engine V-10GE, page 1-15](#)
- [Cisco RFGW 10 Supervisor Engine 7-E, page 1-17](#)

Cisco Supervisor Engine V-10GE

Figure 1-9 Supervisor Engine V-10GE for the DS-48 Line Card

**Note**

The Cisco Supervisor Engine V-10GE does not support the Cisco RFGW-10 DS-384 line card.

Supervisor Engine Components

The following connectors, LEDs, and buttons are located on the front panel of the supervisor engine:

- The STATUS LED, which indicates the operating state of the module
- Two Gigabit uplink ports
- Four SFP Gigabit uplinks ports
- Eight utilization indicator LEDs, which provide an approximation of the current traffic across the backplane
- A console port (RJ-45)
- An Ethernet management port (RJ-45)
- A link status LED, which provides status for the management port
- The Reset button (recessed), which allows you to reset the system
- The Compact Flash port and eject button

Supervisor Engine LEDs

Table 1-7 describes the meaning of the Supervisor Engine LEDs.

Table 1-7 Supervisor Engine LEDs

LED	Status	Meaning
STATUS	Green	All diagnostic tests passed.
	Red	A test failed.
	Orange	System boot or diagnostic test is in progress.
	Off	Supervisor is disabled.
UTILIZATION	Green 1-100%	If the switch is operational, this display indicates the current traffic load over the backplane (as an approximate percentage). Each LED lit green indicates approximately 12.5% of the load.
LINK	Green	The link is operational.
	Orange	The link is disabled by user.
	Flashing orange	The power-on self-test indicates a faulty port.
	Off	No signal is detected or there is a link configuration failure.
Active	Green	The port is active.
	Off	The port is not active.

Ethernet Management Port

The supervisor engine has a 10/100 BASE-T Ethernet management port. The Supervisor engine uses an RJ-45 connector on the front panel with a link status LED.

**Note**

To meet the electromagnetic interference (EMI) requirements, special UTP cables (with ferrites) should be used for SUP Console and Auxiliary ports.

TCP/IP-based management services available through inband access also are provided through this port (Telnet and SNMP). This management port also supports image download.

**Note**

The 10/100 BASE-T Ethernet management ports are for network management only. These ports do not support network switching.

Supervisor Memory

The Cisco RFGW-10 Supervisor provides 512-MB SODIMM SDRAM, 64-MB flash memory, and 512-KB NVRAM.

Cisco RFGW 10 Supervisor Engine 7-E

Starting with Cisco IOS-XE Release 3.2.0SQ, the Cisco RFGW-10 supports a new supervisor engine for the Cisco RFGW-10 DS-384 line card.

**Note**

The Cisco Supervisor Engine 7-E also supports the DS-48 line card.

[Figure 1-10](#) and [Figure 1-11](#) show the faceplate and front view of the Supervisor Engine 7-E with the major features identified.

Figure 1-10 Faceplate - Cisco RF Gateway 10 Supervisor Engine 7-E for the Cisco RFGW-10 DS-384 Line Card

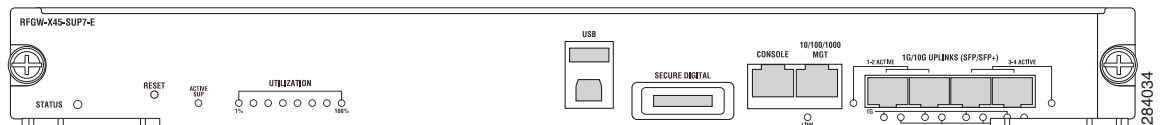
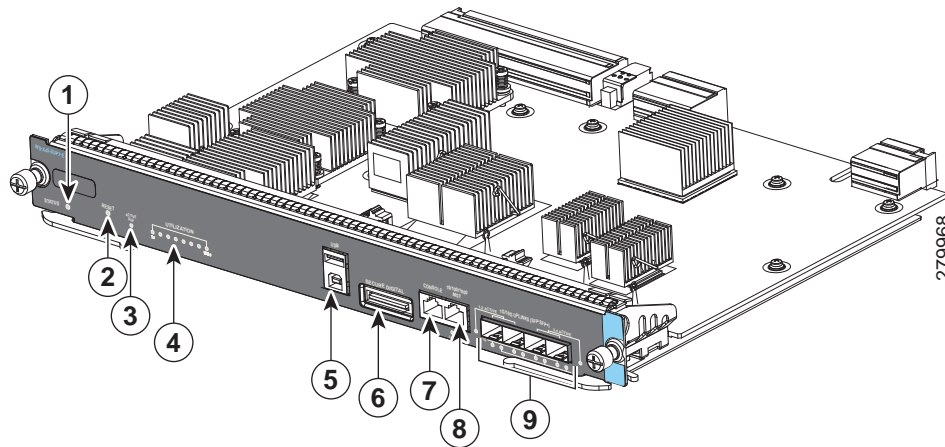


Figure 1-11 Cisco RFGW Supervisor Engine 7-E



1	STATUS LED	4	UTILIZATION LEDs	7	CONSOLE port (RJ-45 connector)
2	RESET switch (recessed)	5	USB ports	8	10/100/1000 MGT port (RJ-45 connector)
3	ACTIVE SUP (active supervisor engine) LED	6	SECURE DIGITAL slot	9	1G/10G UPLINKS (SFP/SFP+) ports

Features of the Cisco RFGW-10 Supervisor Engine 7-E

Table 1-8 Cisco RFGW-10 Supervisor Engine 7-E Features

Feature	Description
Bandwidth per slot	48-Gbps
Memory	2-GB (upgrade to 4-GB)
Front panel features	
STATUS LED	The status LED indicates the current health of the supervisor engine and the current software state. See Table 1-9 .
RESET switch	The RESET switch is used to reset and restart the switch. Note Use a paper clip or other small, pointed object to press the RESET switch.
ACTIVE SUP LED	The active supervisor engine LED indicates whether the supervisor engine is active or in standby mode in redundant supervisor engine configurations. See Table 1-9 .
UTILIZATION LEDs	Eight LEDs indicate (as an approximate percentage) the current traffic load over the backplane. See Table 1-9 .
USB connectors	Two USB 2.0 ports are provided. Port 1 operates in device mode (upstream) and port 2 in host mode (downstream). Port 1 has a standard Type B USB connector and can be used as a USB console. Port 2 has a USB type A connector and a standard USB 2.0 device like a flash memory device can plug into this connector.
SECURE DIGITAL slot	A standard Secure Data (SD) memory card interface is provided on the front panel

Feature	Description
CONSOLE port	This is a 10/100/1000 port that uses an RJ-45 connector. The console port allows you access the switch either locally (with a console terminal) has an RJ-45 connector. The console port allows you to perform the following functions: <ul style="list-style-type: none"> • Configure the switch from the CLI • Monitor network statistics and errors • Configure SNMP agent parameters
10/100/1000 MGT port	The Ethernet management port is a Layer 3 host port to which you can connect a PC. You can use the Ethernet management port instead of the console port for network management. Note When connecting a PC to the Ethernet management port, you must assign an IP address.
LINK LED	The 10/100/1000 MGT port has a link LED associated with it. See Table 1-9 .
1G/10G UPLINKS (SFP/SFP+) ports	The Supervisor Engine 7-E has four 1-G or 10-G ports that use either SFP transceivers or SFP+ transceivers.
Uplink port LEDs	Each of the four uplink ports has two LEDs associated with it. One LED displays port status when a 1-GB SFP transceiver is installed in the port socket. The second LED displays uplink port status when a 10-GB SFP+ transceiver is installed in the port socket. See Table 1-9 .

Front Panel LED

Table 1-9 Cisco RFGW-10 Supervisor Engine 7-E Front Panel LEDs

LED	Color and Meaning
STATUS	The STATUS LED indicates the status of the supervisor engine. <ul style="list-style-type: none"> • Green—All diagnostic tests have passed • Orange—System boot or a diagnostic test is in progress. • Red—A diagnostic test failed. • Off—The supervisor engine is disabled or is not powered up.
ACTIVE SUP	Indicates whether the supervisor engine is active or standby. <ul style="list-style-type: none"> • Green—Supervisor engine is active (in redundant supervisor engine configurations) • Off—Supervisor engine is in standby mode (in redundant supervisor engine configurations)
UTILIZATION	When the switch is operational, the eight utilization LEDs indicate the current traffic load over the backplane as an approximate percentage value. Each LED lit green indicates approximately 12.5 percent of load.

Table 1-9 Cisco RFGW-10 Supervisor Engine 7-E Front Panel LEDs (continued)

LED	Color and Meaning
MGT port	Indicates the status of the 10/100/1000BASE-T Ethernet management port <ul style="list-style-type: none"> • Green—The link is operational. • Orange—The link is disabled by user. • Flashing orange—The power-on self-test indicates a faulty port. • Off—No signal is detected or there is a link configuration failure.
Uplink link	Indicates the status of the uplink port <ul style="list-style-type: none"> • Green—The link is operational. • Orange—The link is disabled by user. • Flashing orange—The power-on self-test indicates a faulty port. • Off—No signal is detected or there is a link configuration failure.

Physical and Environmental Specifications

Table 1-10 Cisco RFGW-10 Supervisor Engine 7-E Physical and Environmental Specifications

Item	Specification
Dimensions (H x W x D)	1.75" x 14.5" x 11"
Weight	5.5 lbs
Power requirement	302 W
Environmental	
Operating temperature	<ul style="list-style-type: none"> • Certified for operation: 32° to 104°F (0° to 40°C) • Designed and tested for operation: 32° to 130°F (0° to 55°C)
Humidity (RH) ambient (non-condensing)	10 to 90%
Operating altitude	<ul style="list-style-type: none"> • Certified for operation: 0 to 6500 ft (0 to 2000 m) • Designed and tested for operation: -200 to 10,000 ft (-60 to 3000 m)
Operating temperature	<ul style="list-style-type: none"> • Certified for operation: 32° to 104°F (0° to 40°C) • Designed and tested for operation: 32° to 130°F (0° to 55°C)

Cisco RFGW-10 DS-48 Line Card

The Cisco RFGW-10 DS-48 line card is a QAM modulator and upconverter product designed to support DOCSIS downstream data traffic (DEPI D-MPT) and video applications (VoD, SDV, and broadcast video). The DS-48 card is similar to the traditional QAM solutions where the card receives encapsulated data, de-packetizes/re-formats the packets, maps them to the output QAM channel, and performs QAM

modulation and frequency upconversion. From a high level, the DS-48 line card receives Video and DOCSIS data encapsulated over Ethernet and outputs analog QAM data to the subscriber devices (STB, DOCSIS modems).

As a DOCSIS engine, the DS-48 line card supports DEPI D-MPT mode (future SW releases may support PSP mode). DEPI is based on the L2TPv3 protocol, which includes a data plane and a control plane. DEPI data plane traffic is terminated at the line card. The Cisco RFGW-10 Supervisor terminates DEPI control and communicates the control to each line card in the system via the chassis IPC infrastructure. DOCSIS timing information (10.24MHz synchronous DTI clock) is received by the line card from the system TCC cards.

As a video engine, the DS-48 terminates video data path traffic forwarded from the Supervisor Engine (video control plane traffic is terminated and processed by the system Supervisor). The DS-48 processing path classifies video packets, performs inter QAM processing, bitrate scheduling, program muxing/scheduling, PID remapping, PCR re-stamping, and CC re-stamping.

A critical feature for the DS-48 line card is redundancy and high availability support. The line cards are designed to detect and react to a wide range of faults and failures and respond with sub-second failover to a dedicated protect card.

The DS-48 line card is designed to support a wide range of line card health conditions and initiate failover events if considered catastrophic:

- QAM/upconverter HW failure. The line card monitors both the digital and RF data integrity. The modules also provide a comprehensive alarm structure to the system CPU, which allows constant monitoring of the UPX.
- Environmental alarms (temperature, voltage, frequency).
- Software kernel failures.
- Software module failure.
- DTI Clock/Timing failures (both internal and external).
- SFP failures.

The DS-48 line card has 12 physical RF ports, which support up to four QAMs per port. The number of QAM outputs is configurable on a per port basis (meaning an individual port can support 1, 2, or 4 QAMs as well as muting of individual QAMs within a QAM group). In stacked QAM mode, the QAMs are stacked contiguously over a 24-MHz or 32-MHz band. The line card supports a downstream channel frequency range of 88 MHz to 870 MHz.

The front panel includes two 1xGE ports and a single DVB-ASI interface (covers all video output streams). The front panel connectors support both copper and fiber SFP modules. The front panel GE ports are not processed directly by the line card, these are independent of the line card and route directly to the Supervisor switch fabric. These ports do not become out of service if the line card crashes and a failover to the redundant card occurs.

DS-48 Line Card Components

The following connectors and LEDs are located on the front panel of the DS-48 line card:

- STATUS LED that indicates the operating state of the line card
- ALARM LED that indicates the general health of the line card
- TRAFFIC LED that indicates whether the card is a primary (working card) or a protect card
- LINK LED that indicates whether the link is operational
- DVB-ASI BNC Coax Interface

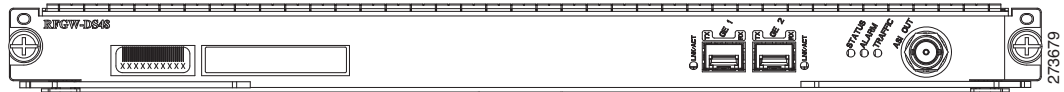
- Two SFP Gigabit uplink ports

Table 1-11 DS-48 Line Card LEDs

LED	Color/Status	Description
STATUS	Green	Line card is powered correctly and has initialized correctly
	Off	Line card is not initialized correctly, not booted up
ALARM	Blank	Normal operation
	Yellow	Minor line card error
	Red	Major line card error
TRAFFIC	Green	Line card is active and traffic is processed by the card
	Blue	Slot [11:12]: Card is configured as backup card
	Red	Slots[3:10]: Card has failed over to protect slot
LINK	Green	The Link is operational
	Blank	The link is not operational

Figure 1-12 shows the DS-48 faceplate.

Figure 1-12 DS-48 Line Card Faceplate



Cisco RFGW-10 DS-384 Line Card

For information about the Cisco RFGW-10 DS-384 line card, see [Cisco RF Gateway 10 Downstream 384 Line Card Hardware Installation Guide](#).

TCC/DTI Card

The Cisco RFGW-10 UEQAM supports two Timing, Communication, and Control (TCC) slots. The TCC card acts as a secondary processor that controls the overall system clock generation and distribution, DOCSIS timestamp synchronization, and system control of the Front Panel Display (FPD) and the RF Switch cards.

The TCC card's most critical function is distribution of the system clocking, in particular the DTI interface. The TCC card is a DTI client interface. It supports dual DTI external input allowing DTI server redundancy. Based on the DTI input information, the TCC card generates DOCSIS 10.24-MHz clock and timestamp information to every line card in the chassis. All clocks and DOCSIS information are redundant. When there is no external DTI clock, the TCC provides an internal DOCSIS DTI clock and time stamp reference.

When two TCC cards are installed, they are configured as active and backup (redundant). If the TCC card in the first slot is working at system power-up, it automatically becomes the active card and the TCC card in the second slot becomes the backup card (typically Slot 13 boots as the primary TCC and Slot 14 as the secondary, but this is not mandatory).

In terms of the overall system high availability, the TCC cards work autonomously from the centralized control mechanisms. Redundant TCC cards monitor each other's priority information so that when the active card fails, the active card role is transferred to the redundant backup card without loss of data.

The following is a summary of the TCC card's functions and features:

- Generates and distributes 10.24 MHz clock references and 32-bit timestamp references to every cable interface line card
- Drives the LCD module used to display the system configuration and status information
- Proxy control mechanism (via supervisor cards) for the RF Switch Cards
- Front Panel LEDs providing Status and Alarm Indicators
- Provides two RJ-45 ports supporting redundant DTI server sources

Table 1-12 TCC Card LEDs

LED	Color/Status	Description
POWER	Green	Power is being supplied to the TCC card.
	Off	Power off
STATUS	Yellow	Indicates that the CPU is in the bootup process, self-test, or downloading code.
	Green	Indicates that the CPU has successfully completed the boot, self-test, and code download process and the TCC card is the Active card.
	Blinking green	Indicates that the CPU has successfully completed the boot, self-test, and code download process. Blinking green means the TCC card is the backup card.
MAINTENANCE	Off	Indicates normal off. No maintenance action is required.
	Yellow	Indicates that the maintenance operation is required, and the TCC card can be hot-swapped.
DTI 1 ACT	Yellow	Indicates that the DTI server is connected, however the DTI lock and communication is not established.
	Off	When DTI ACT is Off and the DTI Link is Green, it indicates normal DTI connection. When DTI ACT is Off and the DTI LINK is Off, it indicates that the DTI interface is not linked with the Server.
DTI 1 LINK	Green	Indicates that the DTI Client has established connection with the server and the frequency is locked.
	Off	When DTI ACT is Off and the DTI Link is Green, it indicates normal DTI connection. When DTI ACT is Off and the DTI LINK is Off, it indicates that the DTI interface is not linked with the server.
DTI 2 ACT	Yellow	Indicates that the DTI Server is connected, however DTI lock and communication is not established.
	Off	Indicates that the DTI Server is not recognized or not connected.
DTI 2 LINK	Green	Indicates that the DTI Client has established connection with the server and the frequency is locked.
	Off	Indicates that the DTI Server has not locked with the DTI Client.

**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 indicate 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.

Figure 1-13 and Figure 1-14 show the TCC/DTI Card.

Figure 1-13 TCC Card Faceplate

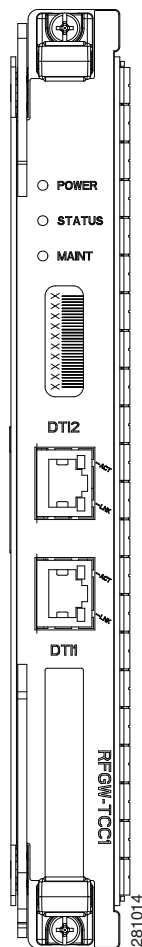
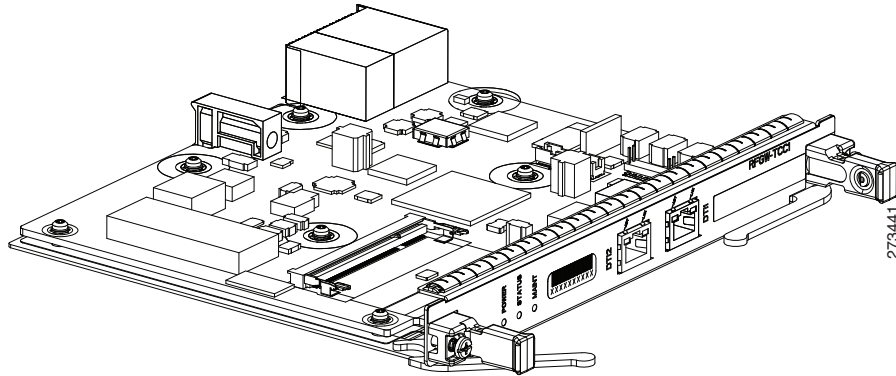


Figure 1-14 TCC/DTI Card



RF Switch Card

The RF Switch provides RF data path redundancy at both the line card (slot) level and the RF port level for bi-directional DOCSIS traffic upto 1.2 GHz. Additionally, the RF Switch cards are the coaxial cable termination point for the Cisco RFGW-10.

Functionally the RF Switch card physically switches out a failed line card (port by port) at the RF data path level. The card is capable of supporting (two) simultaneous RF line card failures. It is designed to support dual N+1 redundancy groups (where N is a group of RF line cards associated with a single “protect” card).

There are 12 RF Switch cards per chassis providing 120 RF ports for the system (Note: the chassis MUST include all 12 RF Switch cards for proper operation). Each Switch Card supports a single Cisco UCH2 connector header; the UCH2 supports 10 MCX coaxial connections per card. The RF Switch card is physically separate from the RF line cards slots allowing insertion or removal of the RF line cards without disruption of the cable plant wiring.

The RF Switch Card is the central hardware component for chassis-level HA features. The card can be configured and controlled via the system level CLI functionality. The RF Switch card is a hardware and firmware based module (no operating software) that can be field upgraded via the chassis CLI.

The RF Switch Card faceplate includes a single LED, which provides very high level status for power and functionality. The LED does not indicate a line card failover.

Figure 1-15 and Figure 1-16 show the RF Switch Card.

Figure 1-15 RF Switch Card Faceplate

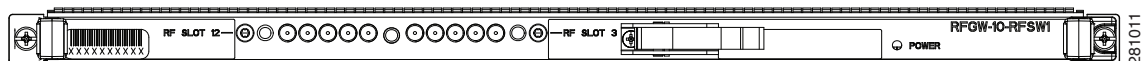
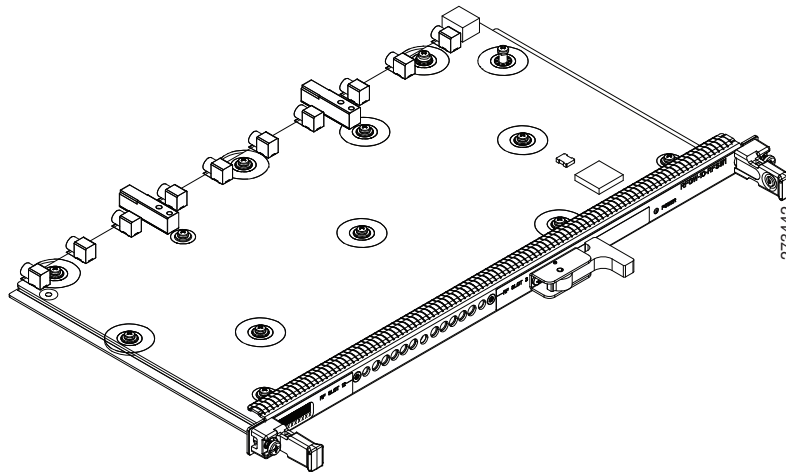


Figure 1-16 RF Switch Card



The RF Switch Card supports the following features:

- 10 RF bi-directional RF ports per RF Switch card
 - System support for 12 RF Switch cards, 120 RF Ports per chassis
 - Wire once interface: Coax cables are independent of the RF card insertion and removal
- OIR (Hot Swap) and field upgradeability
- Supports SW field upgrades
- Exceeds DOCSIS DRFI compliance requirements over 5 MHz to 1.2 GHz frequency range
- No active gain in any switch path
- Support for Cisco UCH2 Dense (MCX) connector
- Upto two flexible redundancy groups, each capable of N:1
- LED to indicate RF Switch's active or fail mode
- CLI support for configuring and monitoring the status information

Table 1-13 Status LEDs

LED	Color/Status	Description
POWER	Blank	RF Switch is not powered or Severe firmware corruption
	Green	Normal operating conditions
	Blinking Green	Severe error condition (possibly power out of specification or firmware corruption)

Supported External AC-Input Power Shelf

The AC-input power shelf converts AC power from an external AC power supply source into DC power that is suitable for powering on the Cisco RFGW-10.

The Lineage AC-DC power shelf is supported on the Cisco RFGW-10.

Table 1-14 lists the Lineage power shelf specifications and the configurations supported on the Cisco RFGW-10.

Table 1-14 Lineage Shelf Configurations Supported on Cisco RFGW-10

Component	Configuration 1	Configuration 2
No. of Lineage Shelves (Part Number J85480S1 L21) ¹	1	2
Maximum Output Power	11 KW	16 KW
Rectifiers Modules	4 CP2725TEZ	8 CP2725TEZ or CP2000AC54
Power Output for Rectifiers	2725 W (maximum)	1200 W (maximum)
DC Power Output	-54 VDC	-54 VDC
AC Power Output	200-240 VAC	100-120 VAC
Operating Temperature	-40 C to 45 C	-5 C to 45 C
AC Power Cables	240 VAC AC power—4	120 VAC AC power—8 ²
DC Power Cables	Amphenol Y cables <ul style="list-style-type: none"> • Black—2 • Red—2 	Elmech straight cables <ul style="list-style-type: none"> • Black—4 • Red—4

1. For more information on ordering the Lineage kit, visit www.arrow.com
2. The AC power cables supplied may vary with the country where the equipment is deployed.

For information on installation, power shelf safety features, safety warnings, and troubleshooting the Lineage power shelf, see the product documentation available at <http://www.lineagepower.com/>.

Lineage AC-DC Power Shelf

The external Lineage AC-DC power shelf (part number J85480S1 L21) with AC module (CP2725TEZ or CP2000AC54PE) is one-rack unit high (1.75 inch), and can be mounted on a standard 19-inch 4-post equipment rack or telco-type rack. It is recommended that the Lineage power shelf is installed such that the power connections face inside of the rack when viewed from the front. This allows the DC output terminals of the external AC-input power shelf to be on the same side as the DC-input terminals of the Cisco RFGW-10 chassis.

The Lineage AC-DC power shelf has two DC power sources, four AC-input power supply sources, and J1 and J2 Jumper connectors. The J1 connector is used to connect a control interface cable and J2 connector is used for a shelf-to-shelf connection.

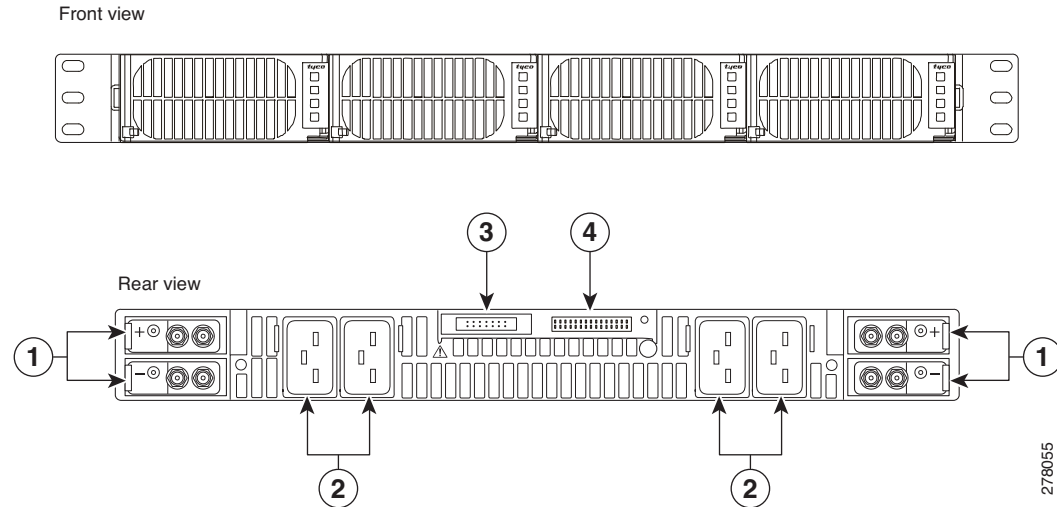


Note

Jumpers must be removed prior to inserting a connector into the J1 housing.

Each AC-input power supply module is automatically powered on when it is plugged into the wall socket. (See [Figure 1-17](#)).

Figure 1-17 Lineage AC-DC Power Shelf - Front and Rear View



1	DC power source terminal blocks	3	J2 connector
2	AC-input power connectors	4	J1 connector

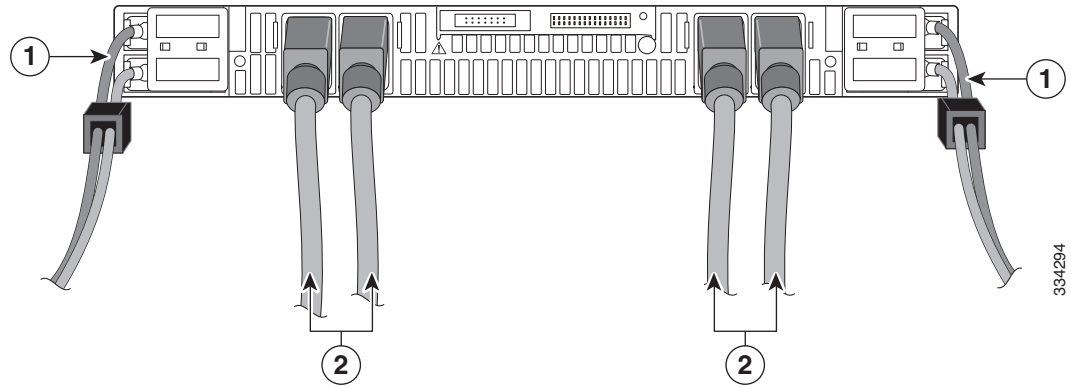
All cable connections for AC-input power, DC-output power, and status signals are made from the rear of the power shelf. Each AC power supply module has an individual AC facility cord attachment. All four AC-input cords must be attached to the facility for all four AC power modules to function. The DC-interconnect cables provide DC-output power to the DC PEM modules on the Cisco RFGW-10. (See [Figure 1-18](#)).



Note

The AC-input and DC-output power cables are supplied along with the Lineage kit. It is recommended that you use these cables for cabling the shelf to the Cisco RFGW-10.

Figure 1-18 Rear View of the Lineage AC-DC Power Shelf with Cables



1	DC-output power supply cables	2	AC-input power supply cables
----------	-------------------------------	----------	------------------------------

To meet compliance standards, use the DC power cables (3 m cable supplied along with the Lineage power shelf) while cabling the Lineage AC-DC power shelf to the Cisco RFGW-10.

For information on connecting the Lineage power shelf see, [Connecting the Lineage Power Shelf to the Cisco RFGW-10, page 3-28](#).



Preparing Your Site for Installation

Before you install the Cisco RFGW-10 UEQAM, consider:

- The power and cabling requirements that must be in place at your installation site
- The equipment required to install the router
- The environmental conditions your installation site must meet to maintain normal operation

This chapter contains important safety information you should know before working with the Cisco RFGW-10 UEQAM and guides you through the process of preparing your site for router installation.



Note

Do not unpack the system until you are ready to install it. Keep the chassis in the shipping container to prevent accidental damage until you determine an installation site. Use the appropriate unpacking documentation included with the system.



Warning

Read the installation instructions before connecting the system to the power source. Statement 1004



Warning

Only trained and qualified personnel should be allowed to install, replace, or service this equipment. Statement 1030



Warning

Ultimate disposal of this product should be handled according to all national laws and regulations. Statement 1040



Warning

Class 1 laser product. Statement 1008

This chapter contains the following sections:

- [Safety Recommendations](#), page 2-2
- [Compliance Requirements](#), page 2-3
- [Cautions and Regulatory Compliance Statements for NEBS](#), page 2-3
- [Standard Warning Statements](#), page 2-4
- [Site Planning](#), page 2-7

- [Preventing Electrostatic Discharge Damage, page 2-15](#)
- [Electrical Safety, page 2-15](#)
- [Receiving a Cisco RFGW-10 UEQAM, page 2-17](#)
- [Chassis-Lifting Guidelines, page 2-17](#)
- [Tools and Equipment, page 2-19](#)
- [Checking the Shipping Container Contents, page 2-20](#)
- [Cisco RFGW-10 UEQAM Installation Checklist, page 2-21](#)

Safety Recommendations


The following guidelines will help to ensure your own safety and protect your Cisco equipment. This list does not cover all potentially hazardous situations, so be alert.

- Cisco safety policy is that all of its routers must conform to the requirements of IEC 60950, with appropriate national deviations, as a minimum. In addition, Cisco routers must also meet the requirements of any other normative documents (for example, standards, technical specifications, laws or regulations).
- Review the safety warnings listed in the Regulatory Compliance and Safety Information Guide that accompanied your Cisco RFGW-10 UEQAM before installing, configuring, or maintaining the router.
- Never attempt to lift an object that might be too heavy for you to lift by yourself.
- Always turn all the DC PEMs off and disconnect all power cables before opening the chassis.
- Always disconnect the power cables before installing or removing a chassis.
- Keep the chassis area clear and dust free during and after installation.
- Keep the tools and chassis components away from walk areas.
- Do not wear loose clothing, jewelry (including rings and chains), or other items that could get caught in the chassis. Fasten your tie or scarf and sleeves.
- The Cisco RFGW-10 UEQAM operate safely when it is used in accordance with its marked electrical ratings and product usage instructions.

Compliance Requirements

This section includes Safety Compliance and Network Equipment Building Systems (NEBS) standards. The Cisco RFGW-10 UEQAM is in compliance with national and international standards as described in [Table 2-1](#).

Table 2-1 NEBS Compliance Requirements


Safety Compliance and NEBS Requirements	
Specification	Description
Safety	IEC 60950-1 First 2001 EN 60950-1: 2001 +A11 CAN/CSA-C22.2 No. 60950-1-03 1st. / UL 60950-1 First.
Telcordia NEBS GR-1089-Core Statement	 Caution To comply with the Telcordia GR-1089 NEBS standard for electromagnetic compatibility and safety, for Ethernet RJ-45 ports, use only shielded Ethernet cables that are grounded on both ends. In a NEBS installation, all Ethernet ports are limited to intrabuilding wiring.
	GR-1089-CORE GR-63-CORE


NEBS Level 3 Compliance

The Cisco RFGW-10 UEQAM is designed to meet Network Equipment Building System (NEBS) Level 3 requirements per GR-1089-CORE and GR-63-CORE.

Cautions and Regulatory Compliance Statements for NEBS

This section lists the cautions, regulatory compliance statements, and requirements for the Network Equipment-Building System (NEBS) certification from the Telcordia Electromagnetic Compatibility and Electrical Safety – Generic Criteria for Network Telecommunications Equipment (A Module of LSSGR, FR-64; TSGR, FR-440; and NEBSFR, FR-2063) Telcordia Technologies Generic Requirements, GR-1089-CORE, Issue 4, June 2006.

 **Caution** Wear an ESD protective wrist-strap on your wrist and attach the other end to a bare metal grounded surface to prevent ESD.

 **Caution** To comply with the Telcordia GR-1089 NEBS standard for electromagnetic compatibility and safety, for Ethernet RJ-45 ports, use only shielded Ethernet cables that are grounded on both ends. In a NEBS installation, all Ethernet ports are limited to intrabuilding wiring.

**Caution**

The intrabuilding ports of the equipment or subassembly is only suitable for connection to intrabuilding or unexposed wiring or cabling. The intrabuilding ports of the equipment or subassembly **MUST NOT** be metallically connected to interfaces that connect to the OSP or its wiring. These interfaces are designed for use only as intrabuilding interfaces (Type 2 or Type 4 ports as described in GR-1089-CORE, Issue 4), and require isolation from the exposed OSP cabling. The addition of primary protectors is not sufficient protection in order to connect these interfaces metallically to OSP wiring.

- This product is designed for a common bonding network (CBN) installation.
- This product can be installed in a network telecommunication facility or location where the NEC applies.
- An electrical conducting path shall exist between the product chassis and the metal surface of the enclosure or rack in which it is mounted or to a grounding conductor. Electrical continuity shall be provided by using thread-forming type mounting screws that remove any paint or nonconducting coatings and establish a metal-to-metal contact. Any paint or other nonconducting coatings shall be removed on the surfaces between the mounting hardware and the enclosure or rack. The surfaces shall be cleaned and an antioxidant applied before installation.
- The grounding architecture of this product is DC-isolated (DC-I).
- DC-powered products have a nominal operating DC voltage of 48 VDC. Minimal steady state DC operating voltage is 40 VDC. Reference Table 1, American National Standards Institute (ANSI) T1.315.

**Note**

The English warnings in this document are followed by a statement number. To see the translations of a warning into other languages, look up its statement number in the *Regulatory Compliance and Safety Information for the Cisco RF Gateway 10* document.

Standard Warning Statements

This section describes the warning definition and then lists core safety warnings grouped by topic.

**Warning**











This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device.

Note: SAVE THESE INSTRUCTIONS
Statement 1071

General Safety Warnings

**Warning**

Read the installation instructions before you connect the system to its power source. Statement 1004

-  **Warning** **Ultimate disposal of this product should be handled according to all national laws and regulations.** Statement 1040
-  **Warning** **Installation of the equipment must comply with local and national electrical codes.** Statement 1074
-  **Warning** **To comply with FCC Part 15 regulations- special UTP cables with ferrite have to be used to connect Ethernet and Console ports on Supervisor card.**
-  **Warning** **Power cable and AC adapter - When installing the product, please use the provided or designated connection cables/power cables/AC adaptors. Using any other cables or adapters could cause a malfunction or a fire. Electrical Appliance and Material Safety Law prohibits the use of certified cables (that have the 'UL' shown on the code) for any other electrical devices than products designated by Cisco. The use of cables that are certified by Electrical Appliance and Material Safety Law (that have 'PSE' shown on the code) is not limited to Cisco-designated products.** Statement 371
-  **Warning** **Only trained and qualified personnel should be allowed to install or replace this equipment** Statement 1030
-  **Warning** **This product relies on the building's installation for short-circuit (overcurrent) protection. Ensure that the protective device is rated not greater than: DC PEM for RFGW-10 : 60A U.S. maximum.** Statement 1005
-  **Warning** **This product requires short-circuit (overcurrent) protection to be provided as part of the building installation. Install only in accordance with national and local wiring regulations.** Statement 1045
-  **Warning** **This unit may have more than one power supply connection. All connections must be removed to de-energize the unit.** Statement 1028
-  **Warning** **Hazardous voltage or energy may be present on the DC power terminals. Always replace cover when terminals are not in service. Be sure un-insulated conductors are not accessible when cover is in place.** Statement 1075
-  **Warning** **Use copper conductors only.** Statement 1025

**Warning**

This equipment must be grounded. Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available. Statement 1024

**Warning**

Hazardous voltage or energy is present on the backplane when the system is operating. Use caution when servicing. Statement 1034

**Warning**

Class 1 laser product. Statement 1008

**Warning**

Class 1 LED product. Statement 1027

**Warning**

Laser radiation is present when the system is open. Statement 1009

**Warning**

Do not stare into the laser beam. Statement 1010

**Warning**

Class I(CDRH) and Class 1M (IEC) laser products. Statement 1055

**Warning**

Invisible laser radiation may be emitted from the end of the unterminated fiber cable or connector. Do not view directly with optical instruments. Viewing the laser output with certain optical instruments (for example, eye loupes, magnifiers, and microscopes) within a distance of 100 mm may pose an eye hazard. Statement 1056

**Warning**

To prevent personal injury or damage to the chassis, never attempt to lift or tilt the chassis using the handles on modules (such as power supplies, fans, or cards); these types of handles are not designed to support the weight of the unit. Statement 1032

**Warning**

To prevent the system from overheating, do not operate it in an area that exceeds the maximum recommended ambient temperature of: 40 degrees C. Statement 1047

**Warning**

This equipment must be externally grounded using a customer-supplied ground wire before power is applied. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available. Statement 366

**Warning**

Blank faceplates and cover panels serve three important functions: they prevent exposure to hazardous voltages and currents inside the chassis; they contain electromagnetic interference (EMI) that might disrupt other equipment; and they direct the flow of cooling air through the chassis. Do not operate the system unless all cards, faceplates, front covers, and rear covers are in place. Statement 1029

Site Planning

This section contains site planning information, and will help you plan for the installation of the Cisco RF Gateway 10 UEQAM. It contains the following sections:

- [General Precautions, page 2-7](#)
- [Site Selection Guidelines, page 2-7](#)
- [Floor Loading Considerations, page 2-9](#)
- [Site Power Guidelines, page 2-9](#)
- [Site Cabling Guidelines, page 2-10](#)
- [Rack-Mounting and Location Guidelines, page 2-12](#)
- [Site Planning Checklist, page 2-14](#)

General Precautions

Observe the following general precautions when using and working with your Cisco RFGW-10 UEQAM system.

- Keep your system components away from radiators and heat sources and do not block cooling vents.
- Do not spill food or liquids on your system components and never operate the product in a wet environment.
- Do not push any objects into the openings of your system components. Doing so can cause fire or electric shock by shorting out interior components.
- Position system cables and power supply cables carefully. Route system cables and the power supply cable and plug so that they cannot be stepped on or tripped over. Be sure that nothing else rests on your system component cables or power cable.
- Do not modify power cables or plugs. Consult a licensed electrician or your power company for site modifications. Always follow your local and national wiring rules.

**Caution**

If you turn off your system, wait at least 30 seconds before turning it on again to avoid system component damage.

Site Selection Guidelines

The Cisco RFGW-10 UEQAM require specific environmental operating conditions. Temperature, humidity, altitude, and vibration can affect the performance and reliability of the router. The following sections provide specific information to help you plan for the proper operating environment.

The Cisco RFGW-10 UEQAM are designed to meet the industry EMC, safety, and environmental standards described in the *Regulatory Safety and Compliance Information for the Cisco RF Gateway 10* document.

Site Environmental Requirements

Environmental monitoring in the Cisco RFGW-10 UEQAM protects the system and components from damage caused by excessive voltage and temperature conditions. To ensure normal operation and avoid unnecessary maintenance, plan and prepare your site configuration *before* installation. After installation, make sure the site maintains the environmental characteristics as shown in [Table 2-2](#).

Table 2-2 Cisco RFGW-10 UEQAM Environmental Tolerances

Environmental Characteristic	Minimum	Maximum
Steady State Operating	32°F (0°C)	104°F (40°C) at 10,000 feet
Storage	-4°F (-20°C)	158°F (70°C)
Humidity operating (noncondensing)	5%	90%
Humidity nonoperating (noncondensing)	5%	95%
Altitude operating: over allowable temperature range 32°F to 122°F (0 to 50°C)	-200 feet	6,000 feet
Altitude operating: over allowable temperature range 32°F to 104°F (0 to 40°C)	-200 feet	10,000 feet
Altitude, nonoperating: over allowable temperature range	-200 feet	30,000 feet

Physical Characteristics

Be familiar with the physical characteristics of the Cisco RFGW-10 UEQAM to assist you in placing the system in the proper location.

[Table 2-3](#) shows the weight and dimensions of the Cisco RFGW-10 UEQAM.

Table 2-3 Physical Characteristics of Cisco RFGW-10 UEQAM

Characteristic	Cisco RFGW-10 UEQAM
Height	22.75 in. (57.785 cm)
Width	17.48 in. (44.4 cm) with rack-mounts
Depth	Overall depth including card handles, UCH2 cable holders, power supply handles: 24.93 in. (63.32 cm) Depth from the front rack-mount bracket including card handles, UCH2 cable holders, power supply handles: 24.13 in. (61.29 cm) Depth from the front rack-mount bracket including rear RF cable-management bracket: 26 in. (66 cm)
Weight of fully configured chassis	275 lbs (125 kg) (with 10 DS-48 line cards and two DC PEMs)

The following list describes additional Cisco RFGW-10 chassis characteristics:

- Chassis height meets EIA-310 rack spacing 13RU, universal rack-mount
- Chassis width meets EIA-310 19-inch wide with rack brackets
- Rear RF cable-management bracket for Cisco RFGW-10 UEQAM can hold 24 five coaxial conductor bundled cables routed to the side of the chassis.
- Optionally the chassis can be racked mid-mounted.

Floor Loading Considerations

Ensure that the floor under the rack supporting the Cisco RFGW-10 UEQAM is capable of supporting the combined weight of the rack and all other installed equipment.

To assess the weight of the fully configured Cisco RFGW-10 UEQAM respectively, refer to [Table 2-3](#).

For additional information about floor loading requirements, consult the document *GR-63-CORE, Network Equipment Building System (NEBS) Requirements: Physical Protection*.

Site Power Guidelines

The Cisco RFGW-10 UEQAM has specific power and electrical wiring requirements. Adhering to these requirements ensures reliable operation of the system. Follow these precautions and recommendations when planning your site the Cisco RFGW-10 UEQAM:

- The redundant power option provides a second, identical power supply to ensure that power to the chassis continues uninterrupted if one power supply fails or input power on one line fails.
- In systems configured with the redundant power option, connect each of the two DC PEMs to a separate input power source. If you fail to do this, your system might be susceptible to total power failure due to a fault in the external wiring or a tripped circuit breaker.
- To prevent a loss of input power, be sure the total maximum load on each circuit supplying the DC PEM is within the current ratings of the wiring and breakers.
- Check the power at your site before installation and periodically after installation to ensure that you are receiving clean power. Install a power conditioner if necessary.
- Provide proper grounding to avoid personal injury and damage to the equipment due to lightning striking power lines or due to power surges. The chassis ground must be attached to a central office or other interior ground system.
- The Cisco RFGW-10 should be connected to the DC main supplies, which are earthed within the same building.



Caution

This product requires short-circuit (overcurrent) protection, to be provided as part of the building installation. Install only in accordance with national and local wiring regulations.



Note

The Cisco RFGW-10 UEQAM installation must comply with all applicable codes and is approved for use with copper conductors only. The ground bond fastening hardware should be of compatible material and preclude loosening, deterioration, and electrochemical corrosion of hardware and joined material. Attachment of the chassis ground to a central office or other interior ground system must be made with an AWG #6 gauge wire, copper ground conductor at a minimum.

Electrical Circuit Requirements

Each Cisco RFGW-10 UEQAM requires a dedicated electrical circuit. If you equip it with dual power feeds, provide a separate circuit for each DC PEM to avoid compromising the power redundancy feature.

The Cisco RFGW-10 UEQAM can be powered by a DC source. Ensure that the equipment grounding is present and observe power strip ratings. Make sure that the total ampere rating of all products plugged into the power strip does not exceed 80% of the rating.

Table 2-4 contains specifications for DC powered systems for all Cisco RFGW-10 UEQAM.

Table 2-4 Cisco RFGW-10 UEQAM DC Powered System Input Requirements

Cisco RFGW-10 UEQAM DC PEM	System Input Rating (Amps)	Circuit Breaker Amps		AWG # Wire	
		Minimum	Maximum	Minimum	Maximum
Cisco RFGW-10	60	Always 60		AWG #4 to # 2 wire	

Table 2-5 lists the DC PEM rating requirements for Cisco RFGW-10 UEQAM.

Table 2-5 DC PEM Rating Specifications for the Cisco RFGW-10 UEQAM

Description	Specification
Power supply declared ratings	DC = -48 VDC

Site Cabling Guidelines

This section contains guidelines for wiring and cabling at your site. When preparing your site for network connections to the Cisco RFGW-10 UEQAM, consider the type of cable required for each component, and the cable limitations. Consider the distance limitations for signaling, EMI, and connector compatibility. Possible cable types are fiber, thick or thin coaxial, foil twisted-pair, or unshielded twisted-pair cabling.

Also consider any additional interface equipment you need, such as transceivers, hubs, switches, modems, channel service units (CSU), or data service units (DSU).

Before you install the Cisco RFGW-10 UEQAM, have all additional external equipment and cables on hand. For ordering information, contact a customer service representative.

The extent of your network and the distances between network interface connections depend in part on the following factors:

- Signal type
- Signal speed
- Transmission medium

The distance and rate limits referenced in the following sections are the IEEE-recommended maximum speeds and distances for signaling purposes. Use this information as a guideline in planning your network connections *prior to* installing the Cisco RFGW-10 UEQAM.

If wires exceed recommended distances, or if wires pass between buildings, give special consideration to the effect of a lightning strike in your vicinity. The electromagnetic pulse caused by lightning or other high-energy phenomena can easily couple enough energy into unshielded conductors to destroy electronic devices. If you have had problems of this sort in the past, you may want to consult experts in electrical surge suppression and shielding.

Asynchronous Terminal Connections

The Supervisor provides a console port to connect a terminal or computer for local console access. The Supervisor also provides an auxiliary port to connect to a modem for remote dial-in console access.

Both ports have RJ-45 connectors, support RS-232 asynchronous data, and have distance recommendations specified in the IEEE RS-232 standard.

Interference Considerations

When wires are run for any significant distance, there is a risk that stray signals will be induced on the wires as interference. If interference signals are strong, they can cause data errors or damage to the equipment.

The following sections describe sources of interference and how to minimize its effects on the Cisco RFGW-10 UEQAM system.

Electromagnetic Interference

All equipment powered by AC current can propagate electrical energy that can cause electromagnetic interference (EMI) and possibly affect the operation of other equipment. The typical sources of EMI are equipment power cords and power service cables from electric utility companies.

Strong EMI can destroy the signal drivers and receivers in the Cisco RFGW-10 UEQAM and even create an electrical hazard by causing power surges through power lines into installed equipment. These problems are rare, but could be catastrophic.

To resolve these problems, you need specialized knowledge and equipment, which could consume substantial time and money. However, you should ensure that you have a properly grounded and shielded electrical environment, paying special attention to the need for electrical surge suppression.

[Table 2-6](#) lists electrode magnetic compliance standards for the Cisco RFGW-10 UEQAM.

Table 2-6 EMC Standards

EMC Standards	FCC 47 CFR Part 15 Class A VCCI Class A AS/NSZ Class A ICES-003 Class A EN55022/CISPR 22 Information Technology Equipment (Emissions) EN55024/CISPR 24 Information Technology Equipment (Immunity) EN300 386 Telecommunications Network Equipment (EMC) EN50082-1/EN61000-6-1 Generic Immunity Standard
CE marking	UL60950-1 CSA C22.2 No. 60950-1-03

EN 60950-1
IEC 60950-1
AS/NZS 60950.1

Radio Frequency Interference

When electromagnetic fields act over a long distance, radio frequency interference (RFI) can be propagated. Building wiring can often act as an antenna, receiving the RFI signals and creating more EMI on the wiring.

If you use twisted-pair cable in your plant wiring with a good distribution of grounding conductors, the plant wiring is unlikely to emit radio interference. If you exceed the recommended distances, use a high-quality twisted-pair cable with one ground conductor for each data signal.

Lightning and AC Power Fault Interference

If signal wires exceed recommended cabling distances, or if signal wires pass between buildings, you should consider the effect that a lightning strike in your vicinity might have on the Cisco RFGW-10 UEQAM.

The electromagnetic pulse (EMP) generated by lightning or other high-energy phenomena can couple enough energy into unshielded conductors to damage or destroy electronic equipment. If you have previously experienced such problems, you should consult with RFI/EMI experts to ensure that you have adequate electrical surge suppression and shielding of signal cables in your Cisco RFGW-10 UEQAM operating environment.

Rack-Mounting and Location Guidelines

The Cisco RFGW-10 UEQAM is designed for standalone, two-post 19-inch rack-mount, four-post 19-inch rack-mount and closed cabinet systems with front and rear doors.

The sections that follow describe criteria for selecting a rack to mount the Cisco RFGW-10 UEQAM, guidelines for placing the rack for reliable operation, and safety precautions to take to prevent bodily injury when mounting a Cisco RFGW-10 UEQAM system in a rack.

Precautions for Rack-Mounting

The following rack-mount guidelines are provided to ensure your safety:

- Do not move large racks by yourself. Due to the height and weight of a rack, a minimum of two people are required to accomplish this task.
- Ensure that the rack is level and stable before extending a component from the rack.
- Ensure that proper airflow is provided to components in the rack.
- Do not step or stand on any component or system when servicing other systems or components in a rack.
- When mounting the Cisco RFGW-10 UEQAM in a partially filled rack, load the rack from the bottom to the top with the heaviest component at the bottom of the rack.
- If the rack is provided with stabilizing devices, then install the stabilizers before mounting or servicing the unit in the rack.

Rack Selection Guidelines

The Cisco RFGW-10 UEQAM can be mounted in most two-post or four-post, 19-inch equipment racks that comply with the Electronics Industries Association (EIA) standard for equipment racks (EIA-310-D 19-inch). The rack must have at least two posts with mounting flanges to mount the chassis.

**Caution**

When mounting a chassis in any type of rack equipment, make certain the inlet air to the chassis does not exceed 104°F (40°C).

The distance between the center lines of the mounting holes on the two mounting posts must be 18.31 inches \pm 0.06 inch (46.50 cm \pm 0.15 cm). The rack-mounting hardware included with the chassis is suitable for most 19-inch equipment racks.

We recommend that you mount the Cisco RFGW-10 UEQAM in an equipment rack that includes the necessary rack-mounting hardware, which is suitable for most 19-inch equipment racks.

Consider installing the Cisco RFGW-10 UEQAM in a rack with the following features:

- NEBS-compliant, 19-inch (48.3 cm) wide rack.
- EIA or ETSI hole patterns in the mounting rails. Required mounting hardware is shipped with the Cisco RFGW-10 UEQAM. If the rack that you plan to install the system in has metric-threaded rails, you must provide your own metric mounting hardware.
- Perforated top and open bottom for ventilation to prevent overheating.
- Leveling feet for stability.

Equipment Rack Guidelines

The placement of the rack can affect personnel safety, system maintenance, and the system ability to operate within the environmental characteristics described in [Table 2-2](#). Choose a proper location for the Cisco RFGW-10 UEQAM by following the guidelines below.

Locating for Safety

If the Cisco RFGW-10 UEQAM is the heaviest or the only piece of equipment in the rack, consider installing it at or near the bottom to ensure that the rack center of gravity is as low as possible.

For additional information about the proper placement of electronic equipment, consult the document *GR-63-CORE, Network Equipment Building System (NEBS) Requirements: Physical Protection*.

Locating for Easy Maintenance

Keep at least 3 feet of clear space in front and behind the rack. This space ensures that you can remove the Cisco RFGW-10 UEQAM components and perform routine maintenance and upgrades easily.

Avoid installing the Cisco RFGW-10 UEQAM in a congested rack and consider how the routing of cables from other pieces of equipment in the same rack could affect access to the routers cards.

The front and back of the chassis must remain unobstructed to ensure adequate airflow and prevent overheating inside the chassis.

Allow the following clearances for normal system maintenance:

- At the back of the chassis for maintenance—To 4 ft (91.44 cm to 121.92 cm)
- At the back of the chassis for airflow obstructions—At least 4 inches (7.6 cm)
- In the front of the chassis for maintenance—3 to 4 ft (91.44 cm to 121.92 cm)
- In the front of the chassis for airflow obstructions—At least 4 inches (7.6 cm)

To avoid problems during installation and ongoing operation, follow these general precautions when you plan the equipment locations and connections:

- Use the **show environment all** command regularly to check the internal system status. The environmental monitor continually checks the interior chassis environment; it provides warnings for high temperature and creates reports on any occurrences. If warning messages are displayed, take immediate action to identify the cause and correct the problem.
- Keep the Cisco RFGW-10 UEQAM off of the floor and out of areas that collect dust.
- Follow ESD prevention procedures to avoid damage to equipment. Damage from static discharge can cause immediate or intermittent equipment failure.

Locating for Proper Airflow

Ensure the location of the Cisco RFGW-10 UEQAM has enough airflow to keep the system operating within the environmental characteristics and the air temperature is sufficient to compensate for the heat dissipated by the system.

Avoid locating the Cisco RFGW-10 UEQAM in a location in which the chassis air intake vents could draw in the exhaust air from adjacent equipment. Consider how the air flows through the Cisco RFGW-10 UEQAM. The Cisco RFGW-10 UEQAM airflow direction is front to back with ambient air drawn in from the venting located on the chassis front sides.

Site Planning Checklist

Table 2-7 is provided to help you perform and account for all the site planning tasks.

Table 2-7 Site Planning Checklist

Site Planning Requirements	Yes/No
The site meets the environmental requirements.	
The site air conditioning system can compensate for the heat dissipation of the Cisco RFGW-10 UEQAM.	
The floor space that the Cisco RFGW-10 UEQAM occupy can support the weight of the system.	
Electrical service to the site complies with the requirements.	
The electrical circuit servicing the Cisco RFGW-10 UEQAM complies with the requirements.	
Consideration has been given to the console port wiring, and limitations of the cabling involved, according to TIA/EIA-232F.	
The Cisco RFGW-10 UEQAM Ethernet cabling distances are within limitations.	
The equipment rack in which you plan to install the Cisco RFGW-10 UEQAM chassis complies with requirements.	
Careful consideration has be given to safety, ease of maintenance, and proper airflow in selecting the location of the rack.	

Preventing Electrostatic Discharge Damage

Electrostatic discharge (ESD) damage, occurs when electronic cards or components are improperly handled and can result in complete or intermittent failures. The Supervisors, and all line cards consist of a printed circuit card that is 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. Handle the carriers by the edges only; never touch the cards or connector pins.

**Caution**

Always tighten the captive installation screws on all system components when you are installing them. These screws prevent accidental removal of the module, provide proper grounding for the system, and help to ensure that the bus connectors are properly seated in the backplane. Captive screws should be torqued to 6-8 in-lbs to ensure proper grounding and mechanical support. Never use cordless or corded drills to tighten screws, power screwdrivers and hand tools are acceptable.

Static electricity can harm delicate components inside your system. To prevent static damage, discharge static electricity from your body before you touch any of your system components, such as an microprocessor. As you continue to work on your system, periodically touch an unpainted metal surface on the computer chassis.

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 the ESD plug at the bottom of the chassis below the power entry modules (see [Figure 3-13](#), and [Figure 3-14](#)).
- Handle line cards by the faceplates and carrier edges only; avoid touching the card components or any connector pins.
- When removing a card, place the removed module component-side-up 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 clothing. The wrist-strap protects the card from ESD voltages on the body only; ESD voltages on clothing can still cause damage.
- When transporting a sensitive component, first place it an antistatic container or packaging.
- Handle all sensitive components in a static-safe area. If possible, use antistatic floor pads and workbench pads.

**Caution**

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

Electrical Safety

All system components are hot-swappable. They are designed to be removed and replaced while the system is operating without presenting an electrical hazard or damage to the system.

Follow these basic guidelines when you are working with any electrical equipment:

- Before beginning any procedures requiring access to the chassis interior, locate the emergency power-off switch for the room in which you are working.
- Disconnect all power and external cables before installing or removing a chassis.
- Do not work alone when potentially hazardous conditions exist.
- Never assume that power has been disconnected from a circuit; always check.
- Do not perform any action that creates a potential hazard to people or makes the equipment unsafe. Never install equipment that appears damaged.
- Carefully examine your work area for possible hazards such as moist floors, ungrounded power extension cables, and missing safety grounds.

In addition, use the guidelines that follow when working with any equipment that is disconnected from a power source but is still connected to telephone wiring or other network cabling.

- Never install telephone wiring during a lightning storm.
- Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
- Never touch un-insulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
- Use caution when installing or modifying telephone lines.



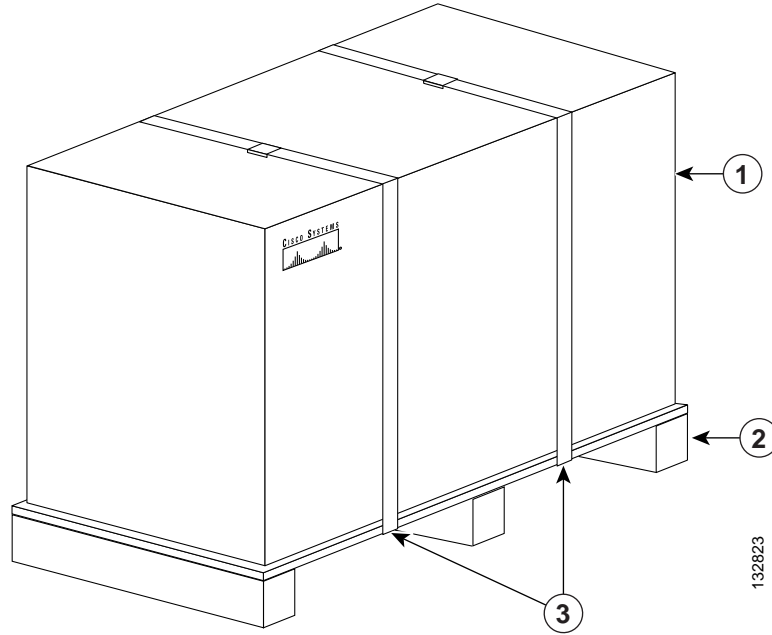
Warning

Do not work on the system or connect or disconnect cables during periods of lightning activity.
Statement 1001

Receiving a Cisco RFGW-10 UEQAM

Each Cisco RFGW-10 UEQAM chassis is shipped in a container that is strapped to a pallet as illustrated in Figure 2-1.

Figure 2-1 Cisco RFGW-10 UEQAM Packaged for Shipping



1	Outside carton	3	Packing straps
2	Pallet		



Note

We recommend that you have at least two people available to help with the installation and ensure safe lifting.

Chassis-Lifting Guidelines

The fully configured system weighs approximately 275 pounds. The chassis is not intended to be moved frequently. Before you install the system, ensure that your site is properly prepared so you can avoid moving the chassis later to accommodate power sources and network connections.



Caution

You must use a hydraulic lift or forklift to move a fully populated chassis to prevent injury or damage to the chassis.

Two or more people are required to lift the chassis. Each time you lift the chassis or any heavy object, follow these guidelines:

- Do not remove installed components from the chassis until you are ready to install it into a rack.
- When ready to install the Cisco RFGW-10 UEQAM into a rack it is recommended to remove all components except the fan tray, two TCC cards, and the 12 RF Switch cards. In this configuration the chassis weighs 139 lbs (63.2 kg).
- Always disconnect all external cables before lifting or moving the chassis.
- Never attempt to lift the chassis by yourself. Because of the size and weight of the chassis, use at least two people to safely lift and move it without causing injury or damaging the equipment.
- Ensure that your footing is solid, and balance the weight of the chassis between your feet.
- Lift the chassis slowly; never move suddenly or twist your body as you lift.
- Keep your back straight and lift with your legs, not your back. If you must bend down to lift the chassis, bend at the knees, not at the waist, to reduce the strain on your back muscles.

**Note**

To unpack the Cisco RFGW-10 UEQAM, it is recommended that the chassis installation handles be installed to help facilitate lifting of the chassis off the palette.

**Note**

When moving a fully loaded Cisco RFGW-10 UEQAM chassis, it is recommended that a hand lift and a hydraulic lift or forklift be used.

**Note**

To install a Cisco RFGW-10 UEQAM in a rack, see the [“Installing the Cisco RFGW-10 UEQAM in a Rack”](#) section on page 3-12 for rack installation guidelines.

Step 1 Each person should stand on either side of the chassis and place one hand under the air intake at the bottom front of the chassis.

Step 2 With the other hand, grasp the top rear of the chassis under the air exhaust and carefully lift the chassis.

Tools and Equipment

The tools and equipment listed below are recommended as the minimum necessary to install the Cisco RFGW-10 UEQAM. You may need additional tools and equipment to install associated equipment and cables. You may also require test equipment to check electronic and optical signal levels, power levels, and communications links.

- ¼-inch flat-head screwdriver (for UCH2 cable holder installation onto the RF Switch Cards)
- 3/16-inch flat blade screwdriver
- Number 2 Phillips screwdrivers to tighten the captive installation screws on most systems
- Antistatic mat, bags, or antistatic foam for you to remove modules
- 10-mm socket wrench for tightening DC power and ground connection nuts
- 4 AWG (21mm²) wire for DC power and ground connections (customer provided)
- 6 AWG (13mm²) wire for NEBS Chassis ground connection (customer provided)
- Wire stripper and crimping tool for preparing the DC power and ground connections (the accessory kit comes with specific 4 AWG and 6 AWG 90-degree ground lugs)
- Heat shrink tubing or electrical insulation for exposed DC power and ground crimp joints
- 12 universal cable holders UCH2 (supplied in the accessory kit) <does this require a change?>
- T-10 TORX driver tool
- Tape measure (optional)
- Level (optional)
- MCX terminated cable bundle (optional)
- Rack-mount kit (provided in the accessory kit)
- Ten #4 AWG wire, 90 degree, dual ring lugs, 0.63 spacing for M6 studs (reference Panduit LCD4-14AF-L, provided in the accessory kit for DC PEM power and ground connections)
- One #6 AWG wire, 90 degree, dual ring lugs, 0.63 spacing for M5 studs (reference Panduit LCD6-10AF-L, provided in the accessory kit for NEBS chassis ground connection)
- Two M5 pan-head Phillips screws (provided in the accessory kit for NEBS chassis ground connection)
- Eight rack-mounting screws (customer provided)
- Connectors and wire for the DC circuit or circuits
- Cables—75-ohm quad-shielded precision miniature video cable, bonded foil 1855 type (reference YR50386 and YR52310)
- Wrist-strap or other grounding device

Unpacking and Verifying Shipping Contents

When you receive your chassis, perform the following steps and use the shipping contents checklist from the next section:

-
- Step 1** Inspect the box for any shipping damage. (If there is damage contact your service representative).
 - Step 2** Unpack the Cisco RFGW-10 UEQAM.

- Step 3** Perform a visual inspection of the chassis.
 - Step 4** After you have unpacked the system verify that you have received all of the required components. Using the packing list as a guide, take the following steps to check the contents of the Cisco RFGW-10 UEQAM shipping container:
 - Step 5** Check the contents of the boxes containing accessory items. Verify that you have received all equipment listed in your order.
 - Step 6** Check that all Cisco RFGW-10 UEQAM components and DC PEM you ordered are installed in the chassis. Ensure that the configuration matches the packing list.
-

Checking the Shipping Container Contents

Use the components list to check the contents of the Cisco RFGW-10 UEQAM shipping container. (See [Table 2-8](#).) Do not discard the shipping container. You need the container if you move or ship the Cisco RFGW-10 UEQAM in the future.

Table 2-8 Cisco RFGW-10 UEQAM Shipping Container Contents List

Component	Description	Received
Chassis	Cisco RFGW-10 UEQAM chassis configured with fan tray, 12 RFGW-10-RFSW1 cards, two RFGW-TCC1 cards, dual DC PEM.	
Components	Check that the proper number and type of cards are installed for the Supervisor Slots, and Universal RF slots. All other empty slots should be filled with blank panels.	
Accessories Kit	2 Front chassis rack-mount brackets that you will attach to the chassis with the respective screws	
	Two sets of screws, one set for: <ul style="list-style-type: none"> • 2 M5 pan head screws for NEBS chassis ground connection. • 12 M5 undercut flat-head screws for rack-mount bracket attachment to the chassis. 	
	1 RF cable-management bracket	
	4 Chassis installation handle assemblies	
	2 Chassis rack installation brackets	
	10 #4 AWG wire lugs, dual hole, 90 degree	
	1 #6 AWG wire lug, dual hole, 90 degree	
	12 UCH2 cable holders for coaxial termination fixing to the RF switch cards	
	4 Ferrite clips for the Supervisor console and management cables for EMI suppression	
	1 RJ45 to Dsub adaptor	
	2 MCX to F adaptors	
ESD, Wrist-strap (disposable)	1 disposable wrist-strap	
Documentation	<i>Regulatory Safety and Compliance Information for the Cisco RF Gateway 10</i>	

**Note**

Most Cisco documentation is online or on the Cisco Documentation DVD. Documentation that ships with your Cisco RFGW-10 UEQAM includes the Cisco RF Gateway 10 Documentation Flyer, *Cisco RF Gateway 10 Quick Start Guide* and the *Regulatory Compliance and Safety Information for the Cisco RF Gateway 10*. See also the “[Related Documentation](#)” section on page -4.

Cisco RFGW-10 UEQAM Installation Checklist

To assist you with your installation and to provide a historical record of what was done by whom, photocopy the Cisco RFGW-10 UEQAM Installation Checklist (see [Table 2-9](#)). Use this to indicate when each procedure or verification is completed. When the checklist is completed, place it in your site log along with the other records for your new router.

Table 2-9 Cisco RFGW-10 UEQAM Installation Checklist

Task	Verified By	Date
Date chassis received		
Chassis and all accessories unpacked		
Types and numbers of interfaces verified		
Safety recommendations and guidelines reviewed		
Installation Checklist copied		
Site log established and background information entered		
Site power voltages verified		
Site environmental specifications verified		
Required passwords, IP addresses, device names, and so on, available		
Required tools available		
Network connection equipment available		
Cisco RFGW-10 UEQAM Chassis installed into a rack and all interfaces re-installed		
Rear RF Cable-management bracket installed (optional but recommended to be installed after rack-mounting)		
DC power cable(s) connected to DC source(s) and RFGW-10		
Network interface cables and devices connected		
System power turned on		
System boot complete (STATUS LED is on)		
Correct hardware configuration displayed after system banner appears		
Site grounding meets agency/code requirements		
Ground cables are connected to Cisco RFGW-10 before connecting power		



Cisco RFGW-10 UEQAM Installation

This chapter describes the Cisco RFGW-10 Universal Edge QAM (UEQAM) and provides the procedures for installing the Cisco RFGW-10 UEQAM in the equipment racks. It also describes how to connect the interfaces and power cables.

This chapter contains the following sections:

- [Cisco RFGW-10 UEQAM Description, page 3-1](#)
- [Installation Methods, page 3-4](#)
- [General Rack Installation Guidelines, page 3-4](#)
- [Rack-Mounting a Cisco RFGW-10 UEQAM, page 3-5](#)
- [Installing the Chassis Installation Brackets, page 3-6](#)
- [Installing the Chassis Installation Handles, page 3-7](#)
- [Attaching the Chassis Rack-Mount Brackets, page 3-9](#)
- [Installing the Cisco RFGW-10 UEQAM in a Rack, page 3-12](#)
- [Attaching a Chassis Ground Connection, page 3-18](#)
- [Attaching the Cable-Management Bracket, page 3-20](#)
- [Connecting Power to Cisco RFGW-10 UEQAM, page 3-21](#)
- [Connecting the Lineage Power Shelf to the Cisco RFGW-10, page 3-28](#)

Cisco RFGW-10 UEQAM Description

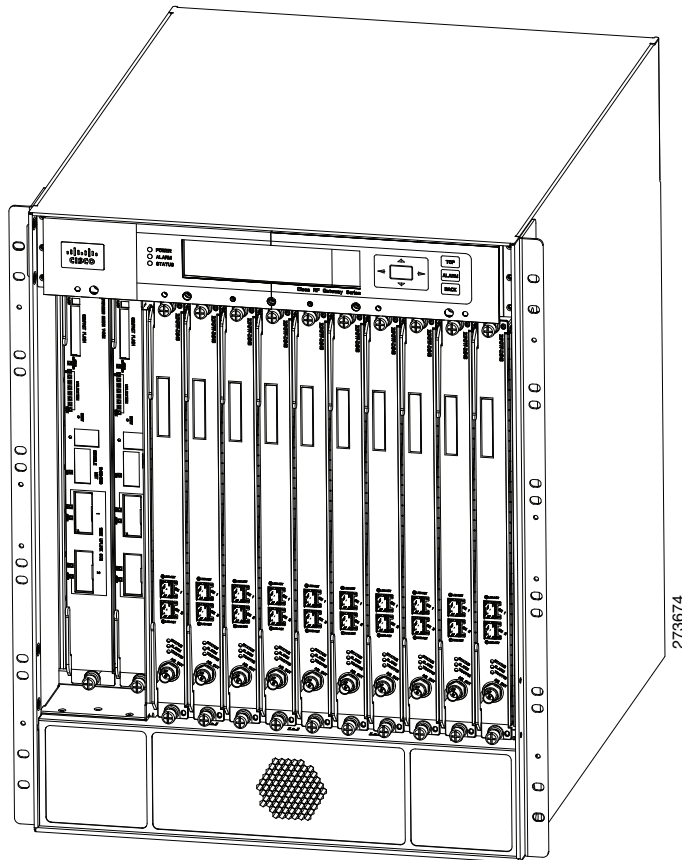
The Cisco RFGW-10 UEQAM supports multiple card modules. It is designed with a single midplane with modules connecting on both sides of the midplane. It supports:

- 2 TCC cards
- 12 RF switch card slots
- 10 Cisco RFGW-10 Universal RF Cards
- 2 Cisco RFGW-10 UEQAM Series Supervisors
- Dual (redundant) DC PEM
- 1 fan tray module
- 1 front panel display

Front View

Figure 3-1 shows the Cisco RFGW-10 UEQAM with the modules installed.

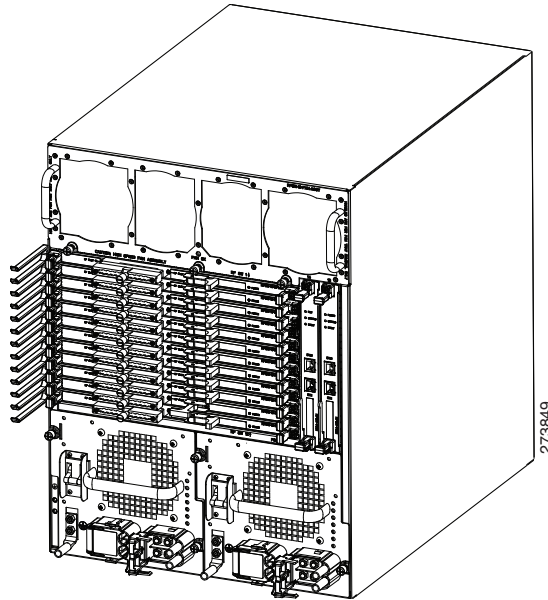
Figure 3-1 Cisco RFGW-10 UEQAM—Front View



Rear View

Figure 3-2 shows the rear of the Cisco RFGW-10 UEQAM with DC PEM installed.

Figure 3-2 Cisco RFGW-10 UEQAM—Rear View



The internal fans draw cooling air into the chassis and across internal components to maintain an acceptable operating temperature (see Figure 3-2). The fans are located at the rear of the chassis in the fan tray module and power supply modules. A two-hole grounding lug is located on the rear left bottom side of the chassis. Two DC PEMs are accessed from the rear of the router.



Note

You have already unpacked your chassis and read all the site requirements for your new equipment. Proceed with the installation.



Warning

Before you install, operate, or service the system, read the Regulatory Compliance and Safety Information for the Cisco RF Gateway 10 publication. This document provides important safety information you should know before working with the system. Statement 200



Warning

This unit is intended for installation in restricted access areas. A restricted access area can be accessed only through the use of a special tool, lock and key, or other means of security. Statement 1017



Warning

Only trained and qualified personnel should be allowed to install, replace, or service this equipment. Statement 1030

**Warning**

To prevent personal injury or damage to the chassis, never attempt to lift or tilt the chassis using the handles on modules (such as power supplies, fans, or cards); these types of handles are not designed to support the weight of the unit. Statement 1032

Installation Methods

Rack-mounting is the preferred method of installation for the Cisco RFGW-10 UEQAM. You can mount the chassis:

- Front mount or mid mount
- In a 19-inch wide (standard), four-post equipment rack or two-post, using the rack-mount brackets in the accessory kit

**Note**

The Cisco RFGW-10 UEQAM usually ships fully loaded. It is recommended that you remove the components from the chassis to make the chassis lighter for your rack installation. It is recommended to remove the two DC PEMs, the two Supervisor Cards, and the 10 Universal RF Line Cards.

**Caution**

Before you proceed, read the instructions in the [“Chassis-Lifting Guidelines” section on page 2-17](#).

General Rack Installation Guidelines

When planning your rack installation, consider the following guidelines:

- The Cisco RFGW-10 UEQAM requires a minimum of 13 rack units (22.75 inches or 57.785 cm) of vertical rack space. Measure the proposed rack location before mounting the chassis in the rack.
- Before using a particular rack, check for obstructions (such as a power strip) that could impair rack-mount installation. If a power strip does impair a rack-mount installation, remove the power strip before installing the chassis, and then replace it after the chassis is installed.
- Allow sufficient clearance around the rack for maintenance. If the rack is mobile, you can push it back near a wall or cabinet for normal operation and pull it out for maintenance (installing or moving cards, connecting cables, or replacing or upgrading components). Otherwise, allow 36 inches (91.44 cm) of access to remove field-replaceable units.
- Maintain a minimum clearance of 4 inches (10.16 cm) on the front and the rear of the chassis for the cooling air inlet and exhaust ports, respectively. Avoid placing the chassis in an overly congested rack or directly next to another equipment rack; otherwise, the heated exhaust air from the other equipment can enter the inlet air vents and cause a high temperature condition inside the router.

**Caution**

To prevent chassis overheating, never install a Cisco RFGW-10 UEQAM in an enclosed room that is not properly ventilated or air conditioned.

- Always install the heavier equipment in the lower half of the rack to maintain a low center of gravity to prevent the rack from falling over.

- Install and use the cable-management brackets included with the Cisco RFGW-10 UEQAM to keep the cables organized and out of the way of the cards and processors. Ensure that the cables from the other equipment already installed in the rack do not impair access to the cards or require you to disconnect cables unnecessarily to perform equipment maintenance or upgrades.
- Install rack stabilizers (if available) before you mount the chassis.
- Provide an adequate chassis ground (earth) connection for your Cisco RFGW-10 UEQAM chassis.

In addition to the preceding guidelines, review the precautions for avoiding excessive temperature conditions in the [“Electrical Safety” section on page 2-15](#).

[Table 2-3](#) shows the weight and dimensions of the Cisco RFGW-10 UEQAM.

Rack-Mounting a Cisco RFGW-10 UEQAM

The Cisco RFGW-10 UEQAM can be installed in either front-mount or mid-mount configurations. The chassis rack-mounting flanges must be secured directly to the chassis before lifting it into the rack.

Verifying Rack Dimensions

Before you install the chassis, measure the space between the vertical mounting flanges (rails) on your equipment rack to verify that the rack conforms to the measurements shown in [Figure 3-3](#).

Step 1 Mark and measure the distance between the two holes on the left and right mounting rails. The distance should measure 18.31 inches \pm 0.06 inches (46.5 cm \pm 0.15 cm).

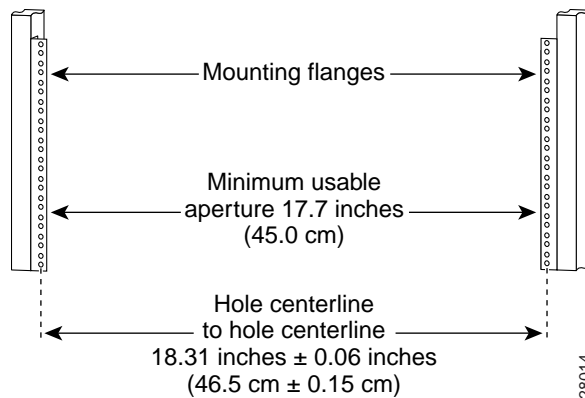


Note Measure the pairs of holes near the bottom, middle and top of the equipment rack to ensure that the rack posts are parallel.

Step 2 Measure the space between the inner edges of the left front and right front mounting flanges on the equipment rack.

The space must be at least 17.7 inches (45 cm) to accommodate the chassis, which is 17.25 inches (43.8 cm) wide and fits between the mounting posts on the rack.

Figure 3-3 Verifying Equipment Rack Dimensions



Installing the Chassis Installation Brackets

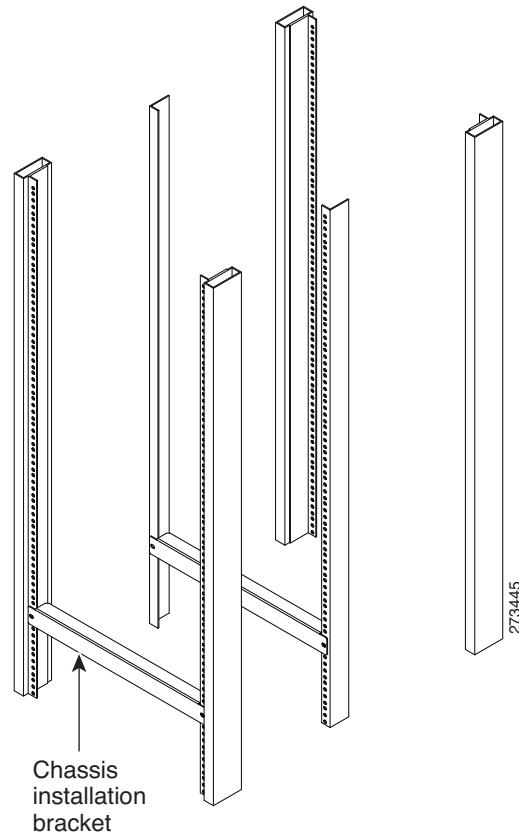
Each chassis is shipped with two chassis installation brackets in the accessory kit. These brackets are to aid in installing a chassis into a 19-inch rack and used as a support base to vertically position and set the chassis before the rack-mount screws are installed.

To install the chassis installation brackets into a rack, complete the following steps:

- Step 1** Determine where in the rack you want the chassis to be mounted. If you are mounting more than one chassis in the rack, then start from the bottom up or the center of the rack. Install the chassis installation bracket where the chassis bottom will be positioned vertically in the rack.
- Step 2** Secure the chassis installation bracket to the front rails with the rack-mount screws.
- Step 3** If there is a second internal rack rail, which is not more than 20 inches from the front rail, you can position the second installation bracket to act as a rear support for the chassis during installation.

Figure 3-4 shows the brackets attached in a rack.

Figure 3-4 Chassis Installation Bracket



Note

After the chassis is installed and secured to the rack, the chassis installation brackets can be removed from the rack. The brackets are not needed for supporting the chassis when all the rack-mount screws are installed.

Installing the Chassis Installation Handles

This section explains how to attach the chassis installation handles to the chassis.

Before installing the chassis in the rack, it is recommended that you install a chassis lifting handle to each side of the chassis to aid in lifting the chassis onto the rack.



Note

It is recommended to install the two side chassis installation handles while unpacking to aid in moving the chassis off the palette.

The parts and tools required for installing the chassis installation handles are listed in the [“Tools and Equipment”](#) section on page 2-19.

**Note**

Chassis installation handles should not be installed if the chassis is to be mid mounted.

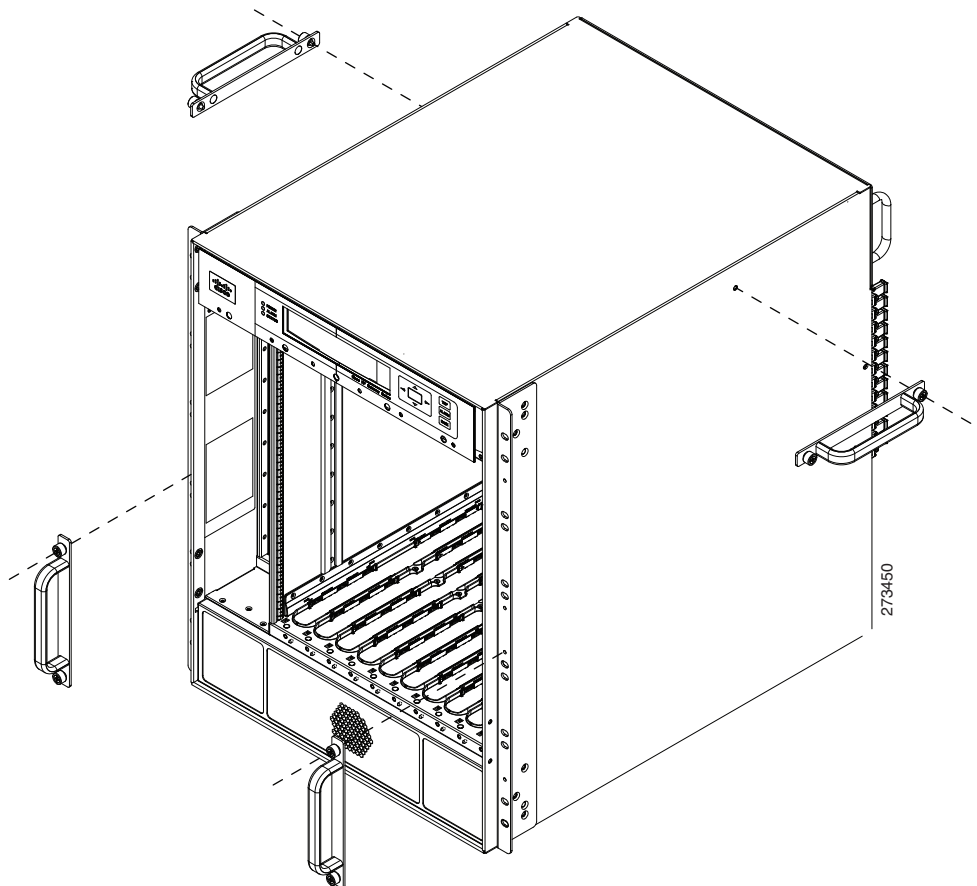
To install the chassis installation handles on a Cisco RFGW-10 UEQAM, complete the following steps:

- Step 1** Locate the two M5 threaded holes on the upper center of each side of the chassis that align with the handle captive screws. (See [Figure 3-5](#).)
- Step 2** Install the two chassis installation handles on either side of the chassis and tighten the captive screws.

**Caution**

Ensure that the captive screws are secured tightly prior to loading the handles to prevent injury or damage to the chassis.

Figure 3-5 *Attaching the Chassis Installation Handles to the Cisco RFGW-10 UEQAM*



After the chassis rack-mount brackets are installed, additional handles can be installed onto the front of the rack-mount brackets. The rack-mount brackets allow a low and high installation of the handles onto the bracket depending on the chassis installation (low or high in the rack).

Attaching the Chassis Rack-Mount Brackets

This section explains how to attach the front and the mid rack-mount brackets to the chassis. Before installing the chassis in the rack, you must install the rack-mount brackets on each side of the chassis.

The parts and tools required for installing the rack-mount brackets, chassis installation handles, chassis installation bracket, and the cable management brackets are listed in the [“Tools and Equipment” section on page 2-19](#).

**Note**

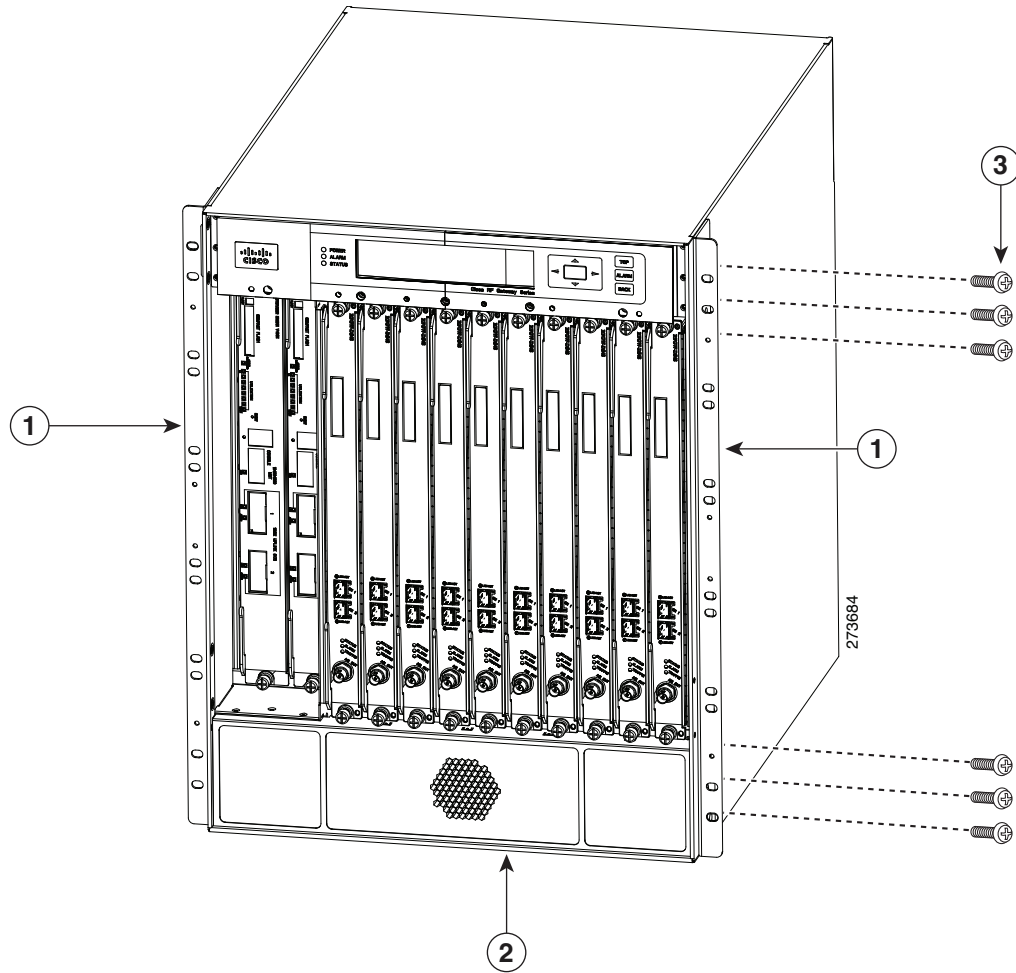
The rear RF cable-management bracket is installed on the chassis after you install the chassis rack-mount brackets and mount the chassis in the rack.

Chassis Front Rack-Mount Brackets Installation

To install the front rack-mount brackets on a Cisco RFGW-10 UEQAM, complete the following steps:

- Step 1** Locate the threaded holes on the front sides of the chassis that align with the holes in the rack-mount bracket. Ensure that you hold the front rack-mount bracket with the ear and holes facing outward and towards the front of the chassis (see [Figure 3-6](#)).
- Step 2** Install all six M5 undercut flat-head screws (provided in the accessory kit) to secure each of the rack-mounting bracket to the chassis. There will be three screws installed on each end of the rack-mounting bracket.
- Step 3** Repeat Step 1 through Step 2 on the other side of the chassis.
- Step 4** Install the chassis in the rack. To install the Cisco RFGW-10 UEQAM in the rack, go to [“Installing the Cisco RFGW-10 UEQAM in a Rack” section on page 3-12](#).

Figure 3-6 Attaching the Front Rack-Mount Brackets



1	Front rack-mount bracket	3	Front rack-mount bracket screws
2	Cisco RFGW-10 UEQAM chassis		

Chassis Mid-Mounted Rack-Mount Bracket Installation

If you are rack-mounting the chassis using a mid-mounted configuration, then it provides for the chassis being recessed in the rack or installed in a two-post rack.



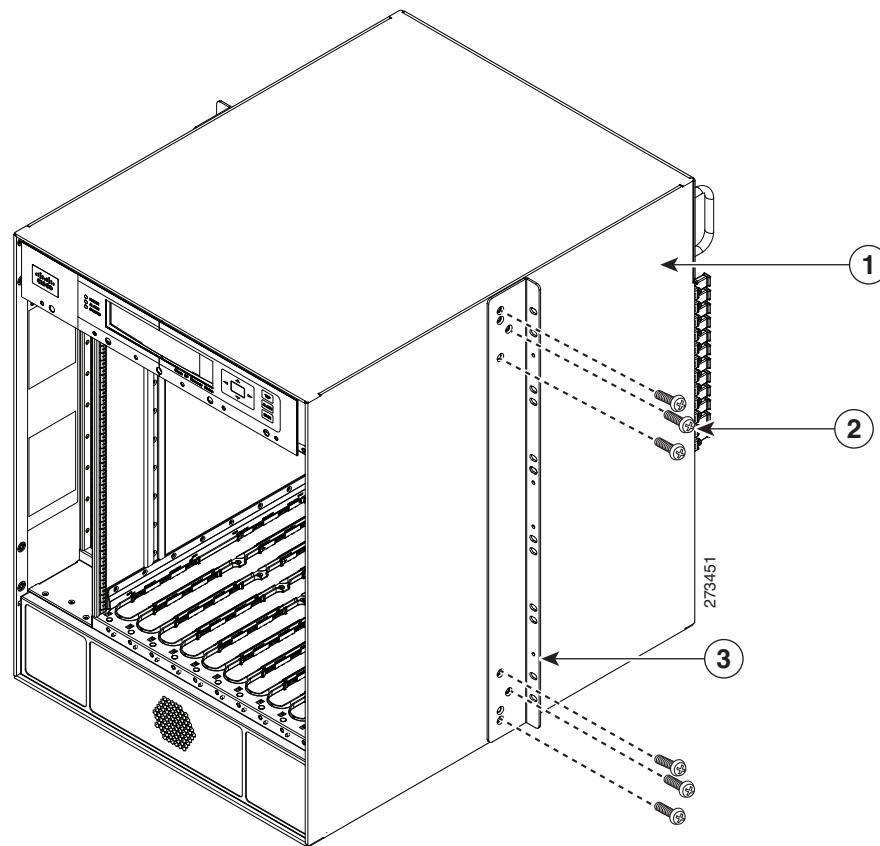
Note

Chassis installation handles cannot be installed if the chassis is to be mid-mounted.

To install the rack-mount brackets for a mid-mounted configuration on a Cisco RFGW-10 UEQAM, complete the following steps:

- Step 1** Locate the threaded holes on the middle sides of the chassis that align with the holes in the rack-mount bracket. Ensure that you hold the front rack-mount bracket with the ear and holes facing outward and towards the rear of the chassis (see [Figure 3-7](#)).
- Step 2** Install all the six M5 undercut flat-head screws (provided in the accessory kit) to secure each of the rack-mounting bracket to the chassis. There will be three screws installed on each end of the rack-mounting bracket.
- Step 3** Repeat Step 1 through Step 2 on the other side of the chassis.
- Step 4** Install the chassis in the rack. To install the Cisco RFGW-10 UEQAM in a rack, go to [“Installing the Cisco RFGW-10 UEQAM in a Rack”](#) section on page 3-12.

Figure 3-7 Attaching the Rack-Mount Brackets for Mid-Mount Configuration to the Cisco RFGW-10 Chassis



1	Cisco RFGW-10 Chassis	3	Rack-mount bracket
2	Rack-mount screws		

Installing the Cisco RFGW-10 UEQAM in a Rack

After installing the rack-mount brackets, the installation handles on the chassis, and the installation brackets in the rack, mount the chassis by securing the rack-mount brackets to the two posts or mounting strips in the rack. Because the rack-mount brackets supports the weight of the entire chassis, be sure to use at least four rack-mount screws on each side to fasten the two rack-mount brackets to the rack posts.

**Warning**

To prevent bodily injury when mounting or servicing this unit in a rack, you must take special precautions to ensure that the system remains stable. The following guidelines are provided to ensure your safety:

- **This unit should be mounted at the bottom of the rack if it is the only unit in the rack.**
- **When mounting this unit in a partially filled rack, load the rack from the bottom to the top with the heaviest component at the bottom of the rack.**
- **If the rack is provided with stabilizing devices, install the stabilizers before mounting or servicing the unit in the rack.** Statement 1006

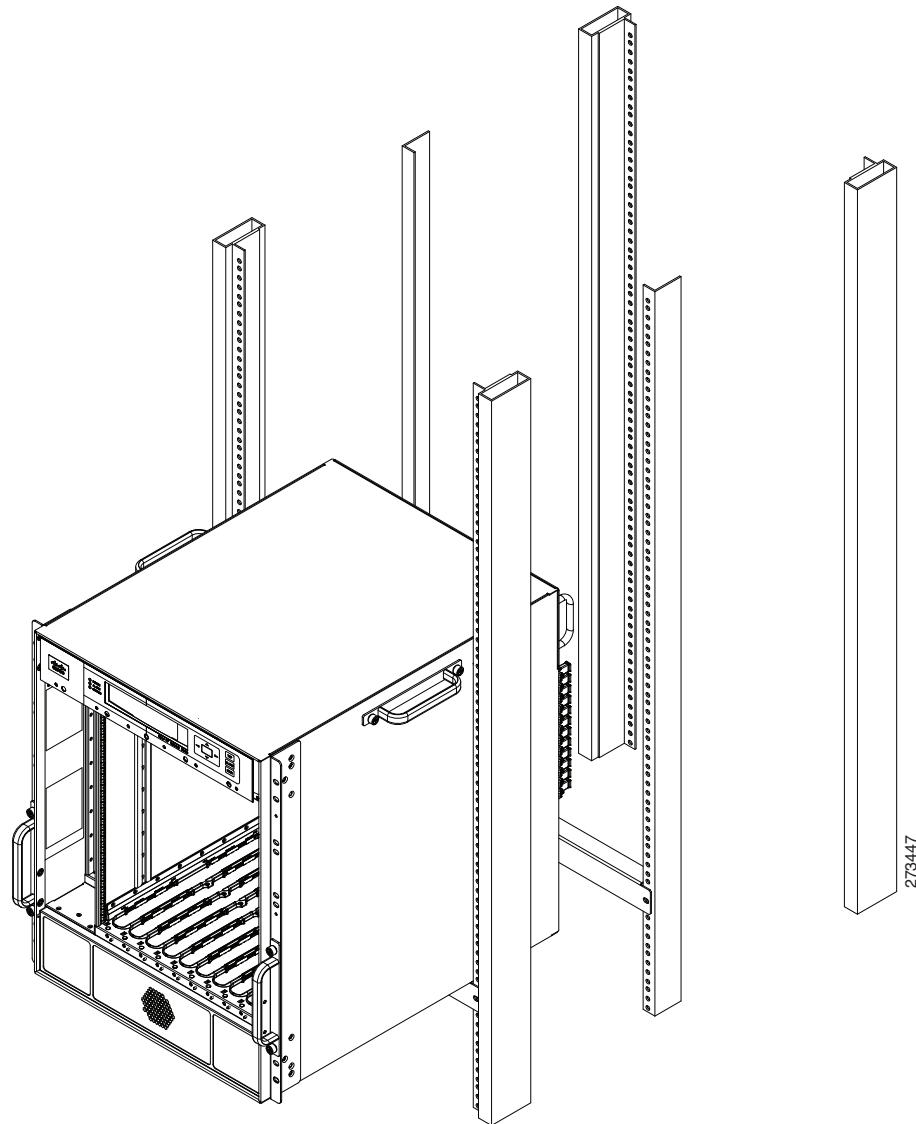
**Caution**

Before you proceed, read the instructions in [“Chassis-Lifting Guidelines” section on page 2-17](#).

To install the chassis in the rack, complete the following steps:

- Step 1** On the chassis, ensure that all the screw fasteners on the installed components are securely tightened.
- Step 2** Ensure that your path to the rack is unobstructed. If the rack is on wheels, ensure that the brakes are engaged or that the rack is otherwise stabilized.
- Step 3** (Optional) Install the chassis installation brackets into the rack to help support the chassis during installation (see [Figure 3-4](#)). If you use the brackets, this will help support the chassis while you secure it to the rack.
- Step 4** With two people, lift the chassis (partially unloaded) into position between the rack posts and rest it on the chassis installation bracket (see [Figure 3-8](#)).

Figure 3-8 Positioning the Chassis on the Chassis Installation Bracket



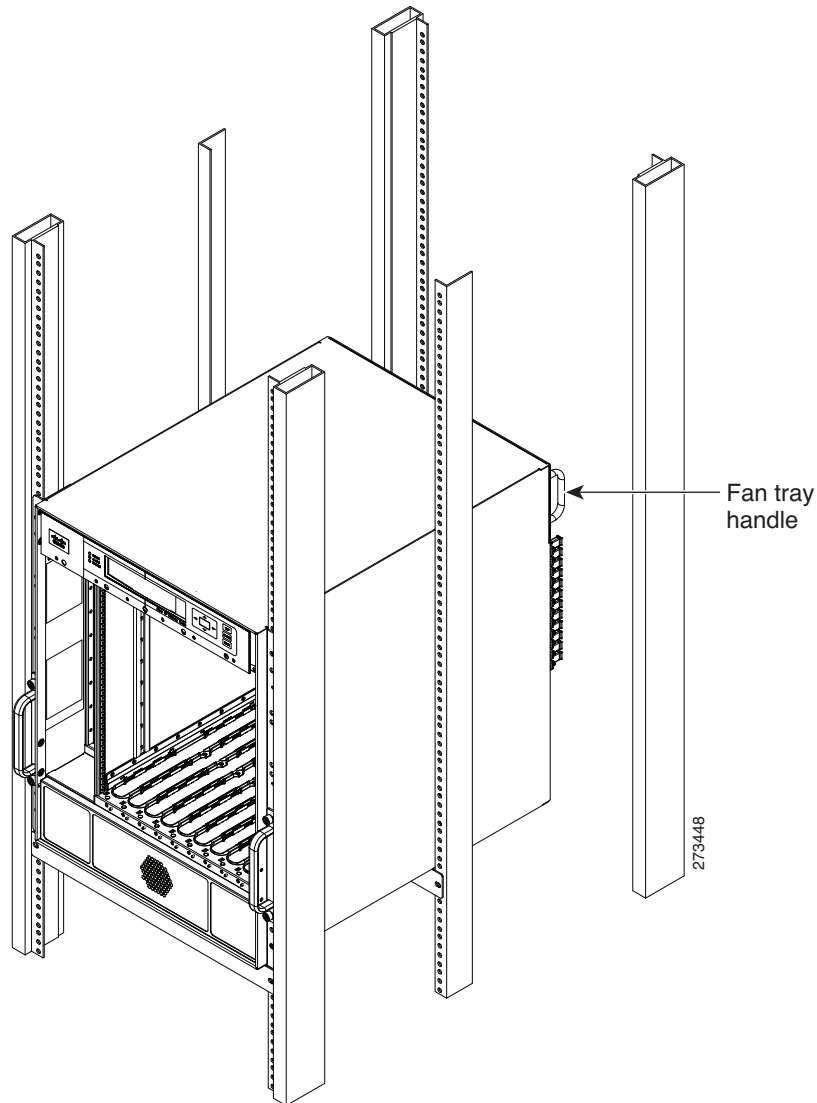
Step 5 Remove the side chassis installation handles and slide the chassis into position in the rack.



Note If you have the chassis installation handles installed on the front rack-mount rails they can be used to aid in sliding the chassis into the rack. Additionally, the fan tray handles can be used during the rack installation process.

Step 6 Position the chassis until the rack-mounting flanges flush against the mounting rails on the rack (see [Figure 3-9](#)).

Figure 3-9 Positioning the Chassis on the Rack



- Step 7** Hold the chassis in position against the mounting rails and follow these steps:
- a. Insert a bottom screw into the rack-mount ear on each side and use a hand-held screwdriver to tighten the screw to the rack rail.

**Tip**

In the next step, insert the top screw diagonally from the bottom screw that you just attached. This helps in keeping the chassis in place.

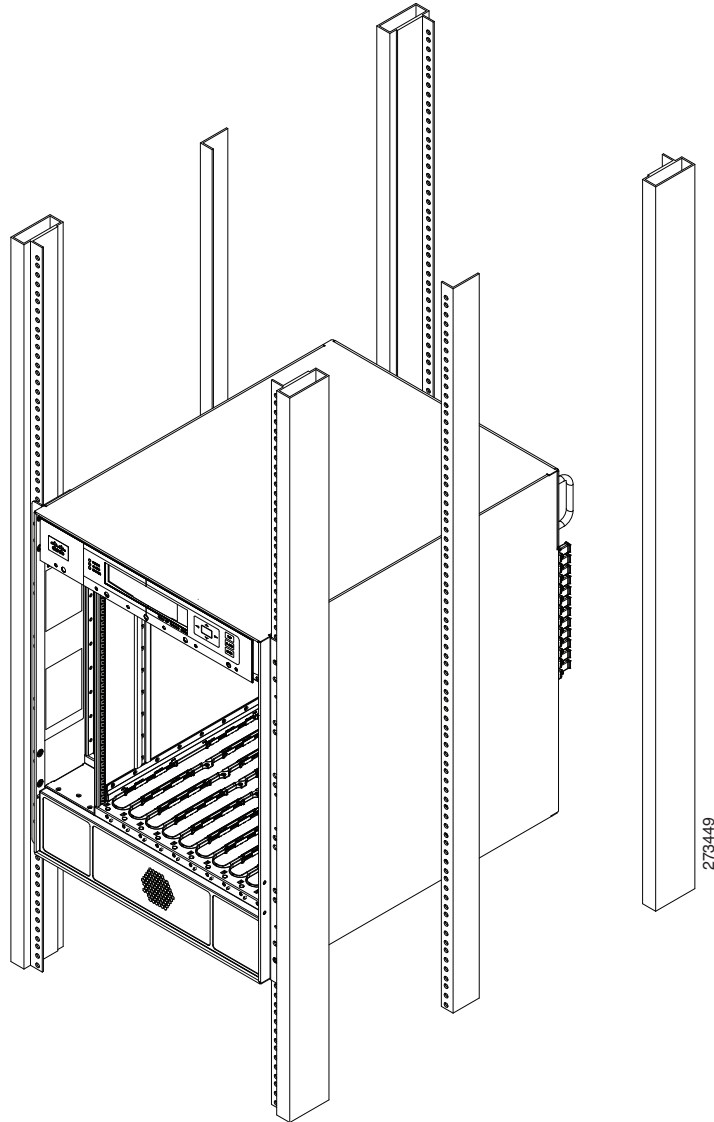
- b. Insert a top screw into each side rack-mount bracket and tighten the screw to the rack rail.
- c. Insert a minimum of four screws per bracket on both sides of the chassis.

**Note**

If you are using the chassis installation handles on the front rack-mount brackets, you must first remove the handles to install the fourth screw.

- Step 8** Ensure that all screws on each side rack-mount brackets are tightened to the equipment rack then the chassis installation brackets can be removed from the rack (see [Figure 3-10](#)).

Figure 3-10 Securing the Side Rack-Mount Brackets



You can install your Cisco RFGW-10 chassis in a two-post rack (see [“Two-Post Rack Installation Mid-Mounted”](#) section on page 3-16) or a four-post rack.

Two-Post Rack Installation Mid-Mounted

The Cisco RFGW-10 chassis can be installed in a two-post 19-inch rack either as a front mount or a mid-mount (see [Figure 3-12](#)).

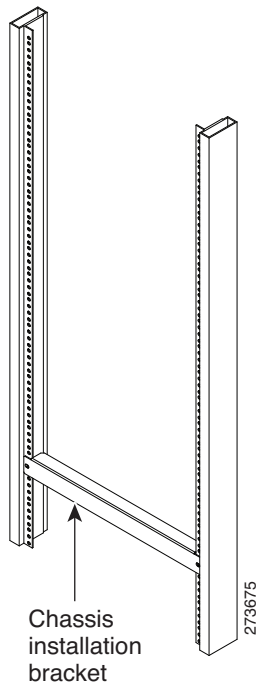


Caution

If you are using a two-post rack, secure the rack to the floor surface to prevent tipping and avoid bodily injury and component damage.

- Step 1** On the chassis, ensure that all the screw fasteners on the installed components are securely tightened.
- Step 2** Ensure that your path to the rack is unobstructed. If the rack is on wheels, ensure that the brakes are engaged or that the rack is otherwise stabilized. See the section on the types of racks you can use to install the chassis.
- Step 3** (Optional) Install the chassis installation bracket into the rack to help support the chassis during installation (see [Figure 3-11](#)). If you use the bracket, this will help support the chassis while you secure it to the rack.

Figure 3-11 Chassis Installation Bracket



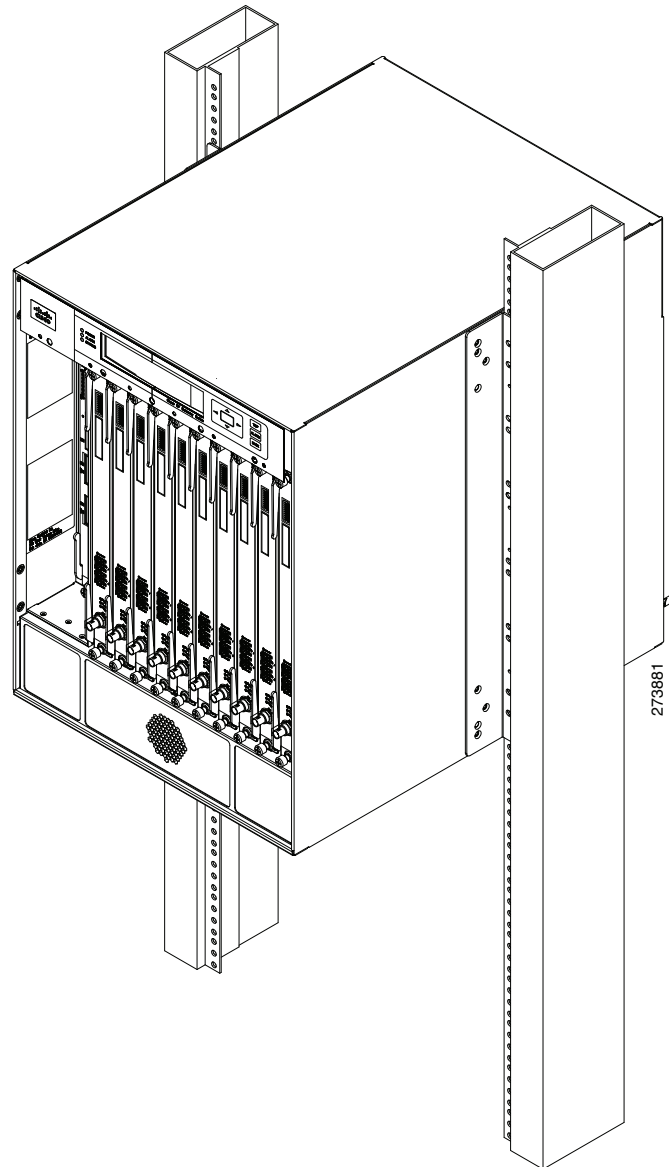
- Step 4** With two people, lift the chassis (partially unloaded) into position between the rack posts and rest it on the chassis installation bracket.
- Step 5** Position the chassis until the rack-mounting flanges flush against the mounting rails on the rack.
- Step 6** Hold the chassis in position against the mounting rails and follow these steps:
- Insert a bottom screw into the rack-mount ear on each side and use a hand-held screwdriver to tighten the screw to the rack rail.

**Tip**

In the next step, insert the top screw diagonally from the bottom screw that you just attached. This helps to keep the chassis in place.

- b. Insert a top screw into each side rack-mount bracket and tighten the screw to the rack rail.
- c. Insert a minimum of four screws per bracket on both sides of the chassis.

Figure 3-12 Installing the Cisco RFGW-10 in a Two-Post Equipment Rack



- Step 7** Ensure that all the screws on each side of the rack-mount brackets are tightened to the equipment rack before the chassis installation bracket is removed from the rack.

This completes the procedure for installing the chassis in a two-post rack. Proceed to [“Attaching a Chassis Ground Connection”](#) section on page 3-18 to continue the installation.

Attaching a Chassis Ground Connection

Connecting the Cisco RFGW-10 chassis to earth ground is required for all DC powered installations where compliance with NEBS grounding requirements is necessary.

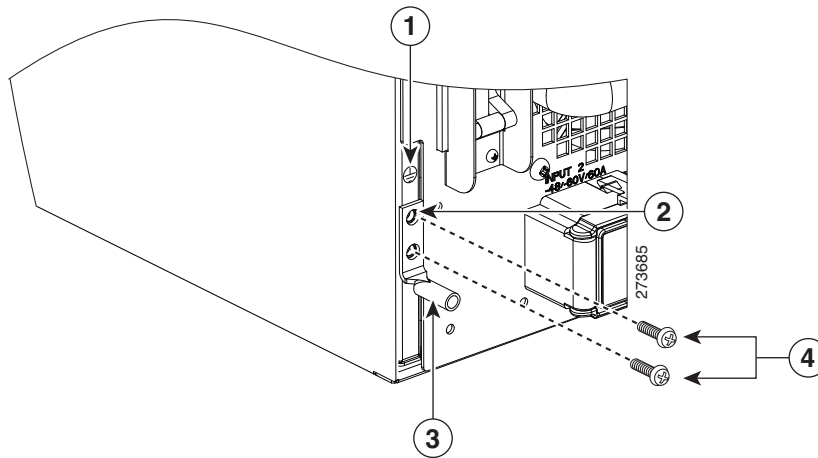
The following are the tools, equipment, and supplies necessary to connect the system ground to the chassis:

- Phillips screwdriver
- 90 degree, 6 AWG wire, dual-lug chassis ground component (provided in the accessory kit)
- 6 AWG grounding wire

Have the recommended tools and supplies before you begin this procedure.

[Figure 3-13](#) shows the Chassis NEBS grounding attached to the chassis in the lower left corner of the rear of the chassis.

Figure 3-13 Installing the Cisco RFGW-10 UEQAM Telcordia Ground Connection



1	Earth ground symbol	3	Earth ground AWG 6 wire lug
2	Chassis earth ground studs	4	Captive screws



Warning

This equipment must be grounded. Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available.
Statement 1024

Before you connect the power or turn on the power to your chassis, you must provide an adequate chassis ground (earth) connection for the chassis. A chassis ground connector is provided on each Cisco RFGW-10 chassis. There is a dual ring stud on the rear lower left side of the chassis and on each DC power supply (primary grounding stud).

**Caution**

The grounding wire is always the first to be installed or connected and the last to be removed or disconnected.

Use the following procedure to attach the grounding lug to the chassis ground connector on your chassis:

- Step 1** Use the wire stripper to strip one end of the AWG #6 wire approximately 0.75 inches (19.05 mm).
- Step 2** Insert the AWG #6 wire into the wire receptacle on the 90 degree grounding lug (see [Figure 3-14](#)).
- Step 3** Use the crimping tool to carefully crimp the wire receptacle around the wire. This step is required to ensure a proper mechanical connection.
- Step 4** Attach the grounding lug with the wire so that the grounding wire does not overlap the power supply.

Figure 3-14 90-Degree Grounding Lug

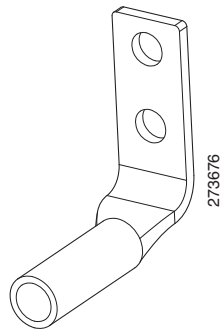
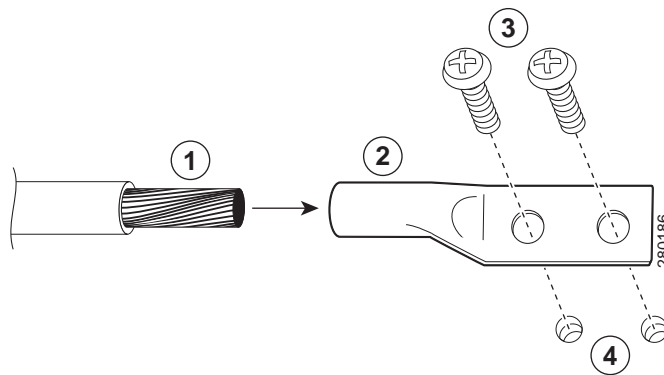


Figure 3-15 Rotating 90 Degree



1	Chassis ground lead wire	3	Ground screws
2	Grounding stud	4	Chassis ground connector holes

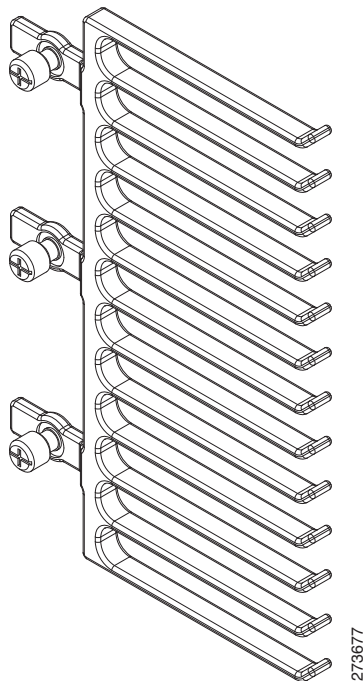
- Step 5** Locate the chassis ground connector on the rear lower left side of your chassis.
- Step 6** Insert the two screws through the holes in the grounding lug M5 screws (provided in the accessory kit) until the grounding lug is held firmly to the chassis.
- Step 7** Connect the opposite end of the grounding wire to the appropriate grounding point at your site to ensure an adequate chassis ground.

Attaching the Cable-Management Bracket

The rear RF cable-management brackets mount to the rear left side of the chassis to provide cable-management to coaxial cables exiting the RF switch modules. This bracket allows reference configuration that allows installation and removal of cables and modules in the rear of the chassis.

The RF cable-management bracket for the Cisco RFGW-10 UEQAM contains 12 independent cable-management “U” type features with three captive screws for attaching to the chassis, and provides cable dressing of each RF switch card module slot. (See [Figure 3-16](#).)

Figure 3-16 Cable-Management Bracket



Follow these steps to attach the cable-management brackets to the rear sides of the Cisco RFGW-10 chassis in the rack:

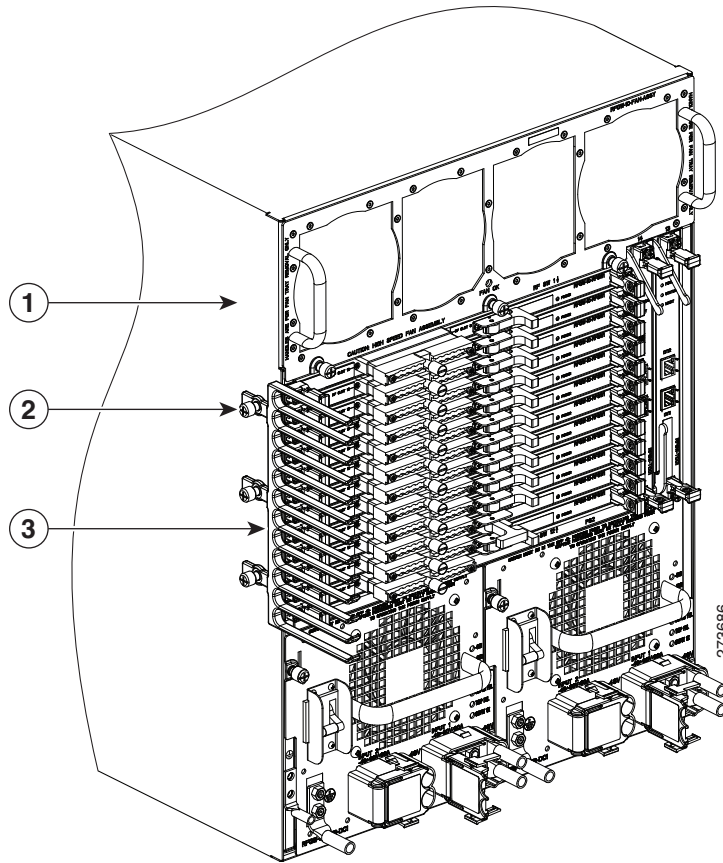
- Step 1** Align the cable-management bracket captive screws to the rear left side panel tapped holes of the Cisco RFGW-10 chassis.
- Step 2** If accessible, use a Phillips screwdriver to secure the captive screws to the chassis. If the captive screws are not accessible, hand tighten the captive screws.


Note

Do not overtighten the cable management captive screws when using a Phillips screwdriver. Tighten to 5-in lbs torque maximum.

Figure 3-17 shows the cable-management brackets attached to the chassis.

Figure 3-17 Installing the Cable-Management Bracket



1	Chassis rear left side panel	3	Cable-management bracket
2	Cable-management bracket captive screws		

Connecting Power to Cisco RFGW-10 UEQAM


Warning

The covers are an integral part of the safety design of the product. Do not operate the unit without the covers installed. Statement 1077

**Warning****When you install the unit, the ground connection must always be made first and disconnected last.** Statement 1046**Warning****Before performing any of the following procedures, ensure that power is removed from the DC circuit.** Statement 1003**Warning****Only trained and qualified personnel should be allowed to install, replace, or service this equipment.** Statement 1030

This section provides the procedures for connecting the DC-input power to your Cisco RFGW-10 UEQAM.

[Table 3-1](#) shows the common input range and circuit breaker requirements.

Table 3-1 Cisco RFGW-10 UEQAM DC PEM System Input Requirements

Cisco RFGW-10 DC PEM	System Input Rating (Amps)	Circuit Breaker Amps		AWG # Wire	
		Minimum	Maximum	Minimum	Maximum
Cisco RFGW-10 DC PEM	Two feeds of 60A per DC PEM	Always 60		AWG #4	AWG #2

**Note**

Both DC inputs to the DC PEM must be connected and energized for the Cisco RFGW-10 system to operate properly.

**Note**

Detailed instructions for removing and replacing the Cisco RFGW-10 DC PEM are in [“Installation and Removal of the DC PEM”](#) section on page 5-2.

**Caution**

Always turn off the breaker on the DC PEM, unscrew the captive screws, and partially remove the DC PEM from the chassis prior to disconnecting/connecting the DC power feed cables.

Connecting DC-Input Power to Cisco RFGW-10 UEQAM

This section describes how to connect the DC power supply to the Cisco RFGW-10 UEQAM.

Before you begin, read these important notices:

- The color coding of the DC-input power supply leads depends on the color coding of the DC power source at your site. Typically, green or green/yellow is used for ground (GND), black is used for –48V on negative (–) terminal and red is used for RTN on the positive (+) terminal. Ensure that the lead color coding you choose for the DC-input power supply matches the lead color coding used at the DC power source.

- For the DC input power cables, select the appropriate wire gauge based on the National Electrical Code (NEC) and the local codes for 60-amp service at nominal DC input voltage (–48 VDC). Two pairs of cable leads, source DC (–) and source DC return (+), are required for each power distribution unit (PDU). These cables are available from any commercial cable vendor. All input power cables for the chassis should have the same wire gauge and cable lengths should match within 10 percent of deviation.

Each DC input power cable is terminated at the PDU by a cable lug (included in the accessory kit). The cable lugs must be dual-hole, and have a 90 degree tongue (reference Panduit LCD4-14AF-L). They must be able to fit over M6 terminal studs at 0.625-inch (15.88-mm) centers.

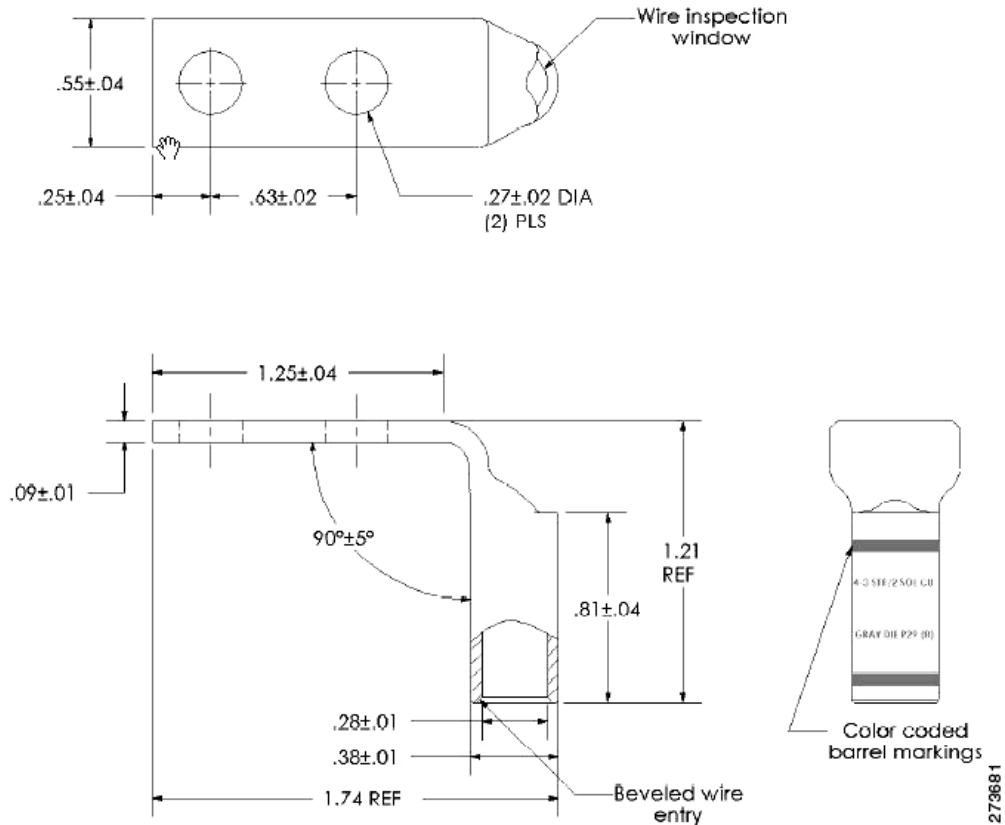
**Note**

The DC input power cables must be connected to the PDU terminal studs in the proper positive (+) and negative (–) polarity. In some cases, the DC cable leads are labeled, which is a relatively safe indication of the polarity. However, you must verify the polarity by measuring the voltage between the DC cable leads. When making the measurement, the positive (+) lead and the negative (–) lead must always match the (+) and (–) labels on the power distribution unit.

- An earth ground cable is required for each DC PDU. We recommend that you use at least 4-AWG multi-strand copper wire. This wire is not available from Cisco; it is available from any commercial cable vendor.

The ground wire cable lug (provided in the accessory kit) should be dual-hole (as shown in [Figure 3-18](#)), 90 degree tongue (reference Panduit LCD4-14AF-L), and able to fit over M6 terminal studs at 0.625 inch (1.588 cm) centers.

Figure 3-18 DC Input Power Cable Lug Example

**Note**

To avoid hazardous conditions, all components in the area where DC input power is accessible must be properly insulated. Therefore, before installing the DC cable lugs, be sure to insulate the lugs according to the manufacturer's instructions.

**Caution**

Before installing the DC cable lugs, ensure proper insulation of the entire 90 degree portion of the lugs where the wire is crimped to avoid hazardous conditions and where the DC input power is accessible through the terminal cover of the DC PEM with shrink tubing.

**Note**

Detailed instructions for removing and replacing the Cisco RFGW-10 UEQAM DC PEM are in [“Installation and Removal of the DC PEM”](#) section on page 5-2.

To connect the DC PEM, follow these steps:

**Note**

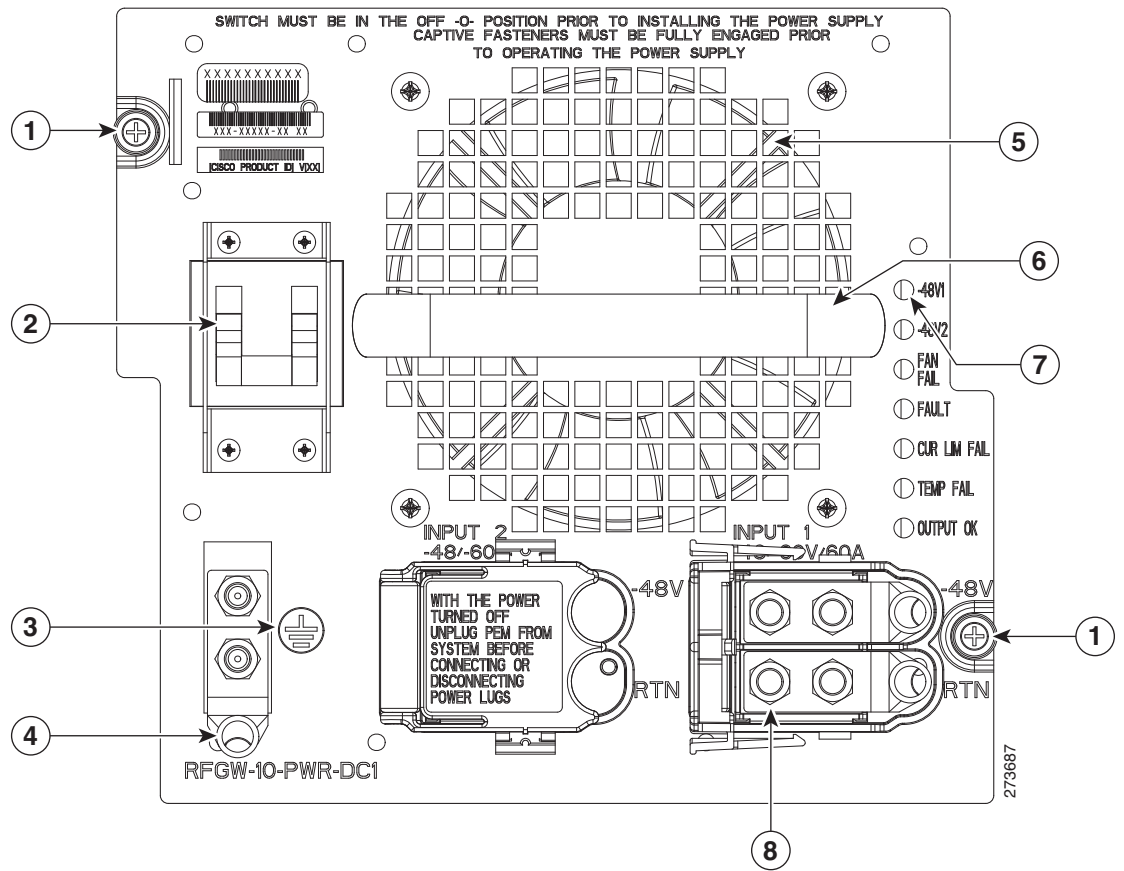
Make sure that the facility input power is removed safely from the power cables before and during wiring of the input power cables.

Step 1

Make certain that the chassis grounding is connected before you begin installing the DC PEM.

- Step 2** Ensure that the DC PEM is disconnected from the chassis midplane power connector and that the power supply breaker is in the off position.
- Step 3** Locate the stud on the DC PEM for the GND connection, which must be connected first and follow these steps:
- a. Using the provided grounding lug in the accessory kit, replace the washers and Kepnut screw in the following order:
 - Washer
 - Grounding cable lug
 - Kepnut screw
 - b. Tighten the Kepnut screws on the power supply studs to the recommended torque of 18 in-lbs minimum to 22 in-lbs maximum.

Figure 3-19 Cisco RFGW-10 DC PEM



1	DC PEM captive screws	5	Fan
2	DC PEM On (I) /Off (O) switch	6	DC PEM handle
3	Earth grounding symbol	7	DC PEM LEDs
4	DC PEM earth ground lug	8	DC PEM terminal and plastic cover

**Note**

To meet the electromagnetic interference (EMI) requirements, the DC power supply should be removed from the chassis if the PEM has failed or the circuit breaker is off.

Step 4 Attach the other end of the cable to the site ground connection.

Step 5 Remove or rotate the plastic cover from the terminal block.

**Caution**

Before you continue to install the terminal block ground wires, stop and perform Step 6 to prevent any contact with metal lead on the ground wire and the plastic cover.

Step 6 You must wrap the positive and the negative lead cables with the sleeves. Take each lead wire and cover the area from the lug to the wire with heavy shrink sleeve.

Step 7 Insert the negative lead cable first. Replace the ground lug with cable in the following order:

- a. Washer
- b. Ground lug with negative wire
- c. Kepnut screw

Step 8 Tighten the Kepnut screw to the recommended torque of 18 in-lbs minimum to 22 in-lbs maximum.

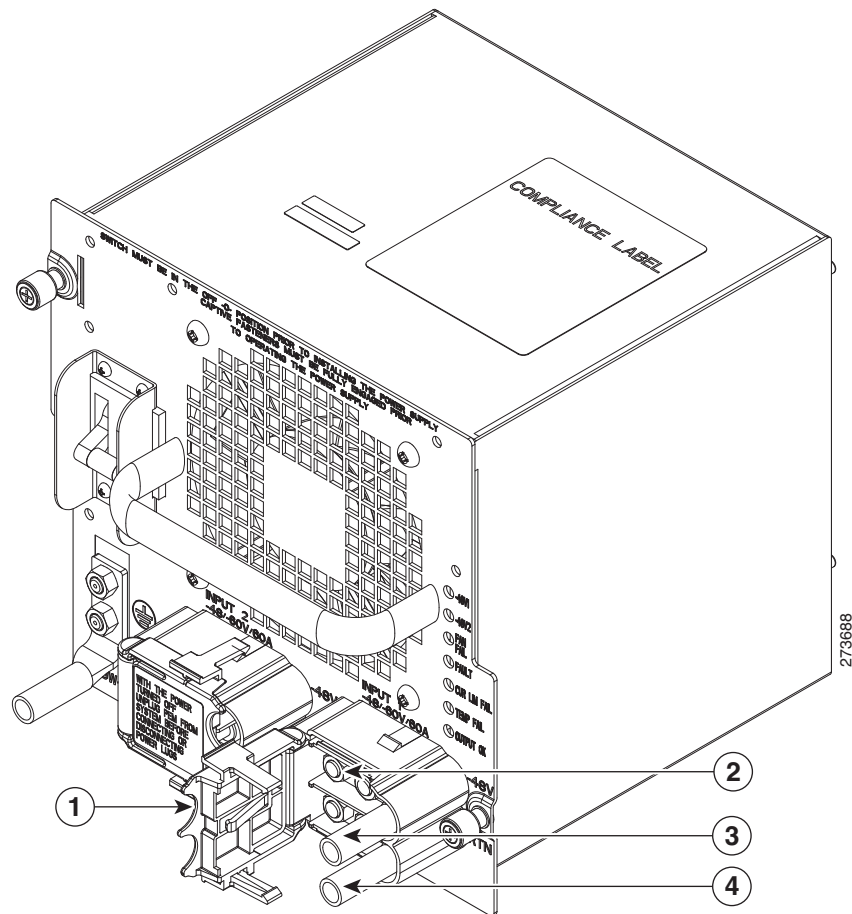
Step 9 Repeat Step 6 through Step 8 for the RTN lead cable.

**Note**

Secure the wires coming in from the terminal block so that they cannot be disturbed by casual contact.

Step 10 Replace and rotate the terminal block plastic cover back into position until it is locked.

Figure 3-20 Cisco RFGW-10 DC PEM Terminal Block Plastic Cover



1	Plastic cover	3	Negative lead
2	Terminal block	4	RTN lead

Step 11 Repeat steps 6 through 10 for the second DC input feed to the PEM.



Note Both DC inputs to the DC PEM must be connected and energized for the RFGW-10 system to operate properly.

Step 12 Fully install the DC PEM into the power supply bay and tighten the captive fasteners on the faceplate to the chassis.



Note Tighten the DC PEM captive fasteners to 12-16 in-lb torque.

**Note**

Both DC inputs to the DC PEM must be connected and energized for the Cisco RFGW-10 UEQAM system to operate properly.

Powering On the Cisco RFGW-10 UEQAM

- Step 1** Energize the facility DC power feeds to the power supply.
- Step 2** Verify power supply operation by checking the DC PEM's front panel LEDs. The -48 V1 and -48 V2 LEDs should illuminate green.
- Step 3** Switch the circuit breaker switch to the On (I) position.
- Step 4** Again verify the power supply operation by checking the power supply's front panel LEDs. The -48 V1, -48 V2 and OUTPUT OK LEDs should illuminate green.
- Step 5** Check the power supply and system status from the system console using the **show power ?** command. For more information on the commands, refer to the command reference publication for your chassis and software.

Connecting System Cables

Keep the following guidelines in mind when connecting external cables to the Cisco RFGW-10 UEQAM:

- To reduce the chance of interference, avoid crossing high-power lines with any interface cables.
- Verify all cabling limitations (particularly distance) before powering on the system.

Connecting the Lineage Power Shelf to the Cisco RFGW-10

The Lineage power shelves are used with the DC PEM modules on the Cisco RFGW-10. Two configurations are supported on the Cisco RFGW-10. For specifications, see [System Specifications, page 7-1](#).

- Configuration 1—One Lineage power shelf
- Configuration 2—Two Lineage power shelves

The following sections describe how to connect the Lineage AC-DC power shelf to the Cisco RFGW-10:

- [Cabling the Power Shelf, page 3-29](#)
- [Connecting a Single Power Shelf, page 3-30](#)
- [Connecting Dual Power Shelves, page 3-32](#)
- [Disconnecting Cables from the Power Shelf, page 3-34](#)

Cabling the Power Shelf

Prerequisites

- It is recommended that you use the AC-input, and DC power cables that are provided in the Lineage power shelf accessory kit.

Required Tools and Equipment

- Lineage AC-DC power shelf
- DC power cables, provided in the Lineage accessory kit
- AC-input power cables, provided in the Lineage accessory kit
- 10 mm hex socket driver

Steps



Warning

Before performing any of the following procedures, ensure that power is removed from the DC circuit. Statement 1003



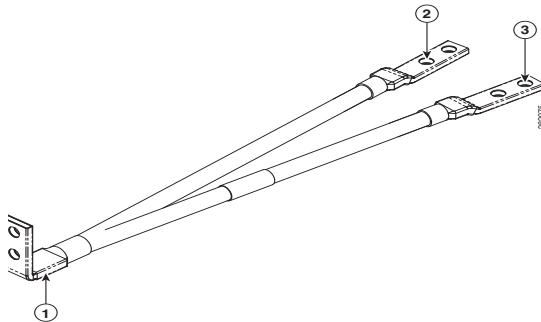
Caution

Do not connect the AC power cables to the facility power source until the DC power cables are connected to the power shelf, and to the Cisco RFGW-10 UEQAM.

To attach the cables to Lineage power shelf:

- Step 1** Open the safety covers from above the DC terminal blocks by pushing the safety cover up and off the DC power terminal blocks on the power shelf.
- Step 2** Loosen and remove the M6 nuts on the DC terminal blocks.
- Step 3** Connect the DC power cables by attaching the lugged ends of cables to the DC power terminal blocks on the shelf. Secure the cables with the M6 nuts using a 10 mm hex socket driver with an installation torque of 45-in lbs. (See [Figure 3-21](#).)

Figure 3-21 Y-Shaped DC Power Cable with Lugged Ends



1	Power shelf connector	3	DC PEM module connector
2	DC PEM module connector		—

Step 4 Place the safety covers on the DC terminal blocks.

Step 5 Proceed to connecting the Lineage power shelf to the Cisco RFGW-10 chassis.

- Single Lineage power shelf configuration—If you are using this configuration, see [“Connecting a Single Power Shelf” section on page 3-30](#).
- Dual Lineage power shelves configuration—If you are using this configuration, see [“Connecting Dual Power Shelves” section on page 3-32](#).

Step 6 Connect the de-energized AC power cables to the power shelf.

Step 7 Connect the AC power cables to the facility wall socket to energize the power shelf.



Caution

Exercise caution while connecting the AC power cables to the an energized wall socket because the power shelf will start supplying power to the Cisco RFGW-10.

Connecting a Single Power Shelf

Required Tools and Equipment

- DC PEM module (RFGW-10-PWR-DC1=)
- One Lineage AC-DC power shelf
- Four Y power cables (Amphenol), provided in the Lineage accessory kit
- Flat-head screwdriver
- 10 mm hex socket driver



Note

It is recommend that you use the Y-Shaped DC power cables provided in the Lineage accessory kit. If you are using a 4 AWG cable, use a high-flex high strand count power cable for optimal routing of the cables under the front cover of the Cisco RFGW-10 chassis. The 2 AWG wire is not supported on the RFGW-10-PWR-DC1= DC PEM module.

Steps



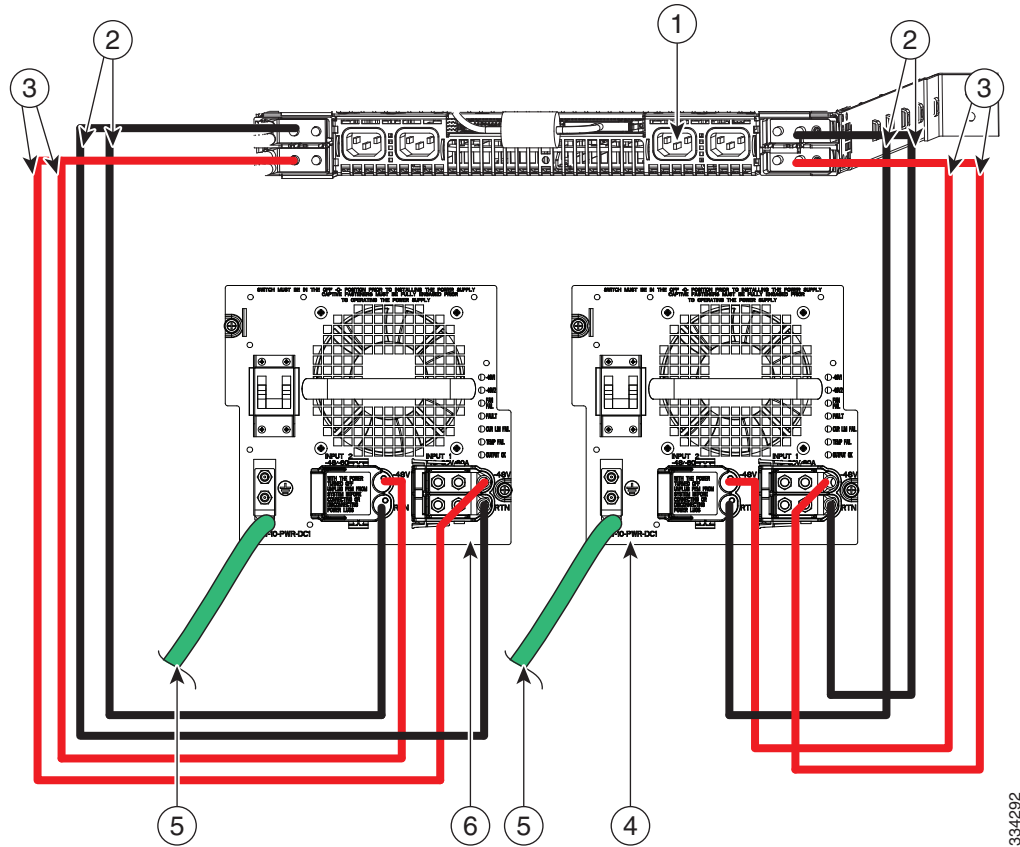
Caution Do not connect the AC power cables to the facility power sources until the DC power cables are connected to the power shelf, and to the Cisco RFGW-10 UEQAM.

To connect a single power shelf to the DC PEM modules on the Cisco RFGW-10:

- Step 1** Connect the Y-Shaped DC power cables to the Lineage power shelf, see the “Cabling the Power Shelf” section on page 3-29.
- Step 2** Connect the DC power cables to the DC-input terminals on the Cisco RFGW-10 UEQAM. For information on connecting the DC power cables to the Cisco RFGW-10, see the “Connecting DC-Input Power to Cisco RFGW-10 UEQAM” section on page 3-22.
- Step 3** Connect the AC power cables to a standard wall socket (facility power source) to provide power to the Cisco RFGW-10. See the “Powering On the Cisco RFGW-10 UEQAM” section on page 3-28.

Figure 3-22 shows the Lineage power shelf connected to the DC PEM modules.

Figure 3-22 Lineage Power Shelf Connected to DC PEM Modules - Configuration 1



334292

1	Lineage 1 RU power shelf	4	Cisco RFGW-10 DC PEM 1
2	Black Y-Shaped DC power cables from power shelf to RTN terminals DC PEM modules	5	Earth ground cable
3	Red Y-Shaped DC power cables from power shelf to -48 V terminals on DC PEM modules	6	Cisco RFGW-10 DC PEM 0

Connecting Dual Power Shelves

Required Tools and Equipment

- DC PEM module (RFGW-10-PWR-DC1=)
- Two Lineage AC-DC power shelves
- Eight straight DC power cables (Elmech), provided in the Lineage accessory kit
- Flat-screw driver
- 10 mm hex socket driver



Note

It is recommend that you use the straight DC power cables provided in the Lineage accessory kit. If you are using a 4 AWG cable, use a high-flex high strand count power cable for optimal routing of the cables under the front cover of the Cisco RFGW-10. The 2 AWG wire is not supported on the RFGW-10-PWR-DC1= DC PEM module.

Steps



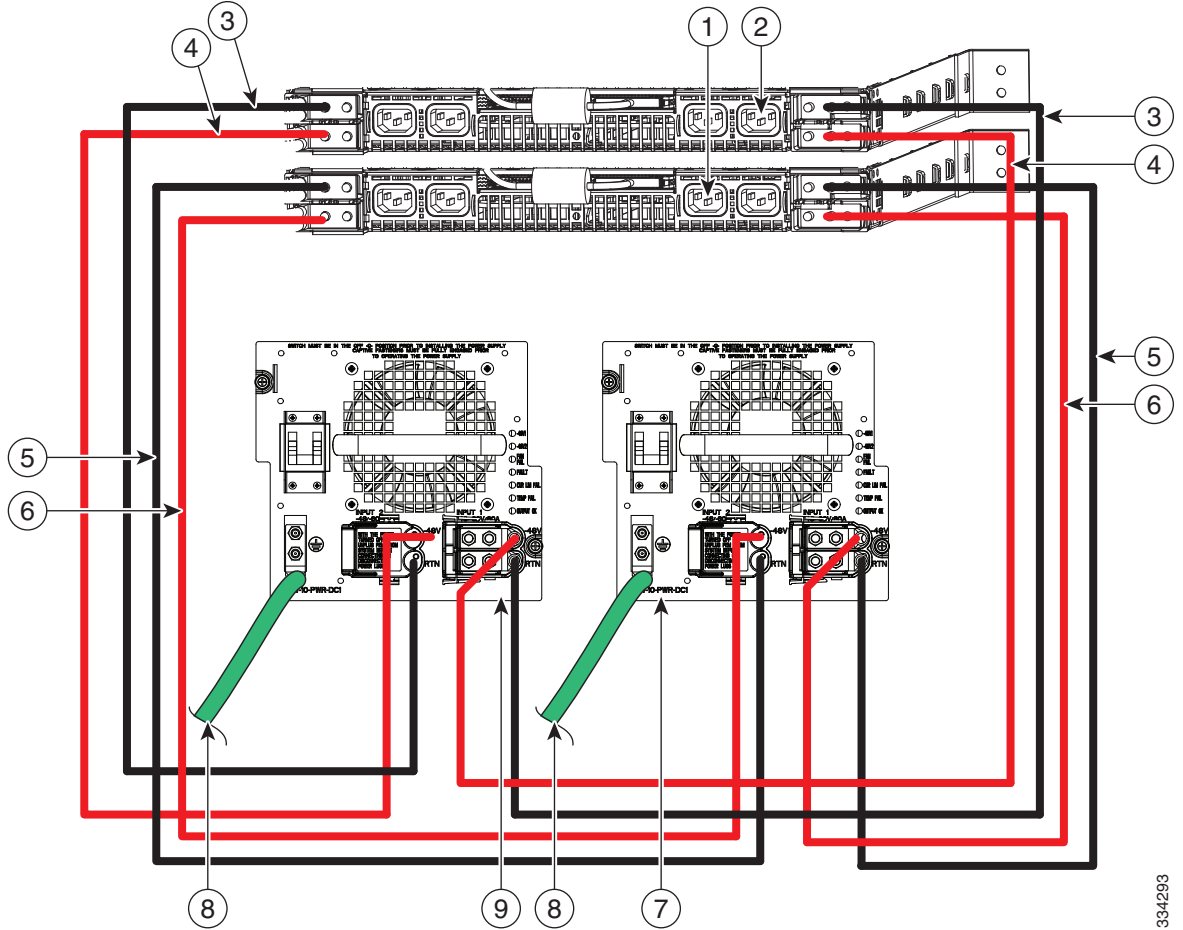
Caution

Do not connect the AC power cables to the facility power sources until the DC power cables are connected to the power shelf, and to the Cisco RFGW-10.

- Step 1** Connect the cables to the two Lineage power shelves, see [“Cabling the Power Shelf” section on page 3-29](#).
- Step 2** Connect the DC “straight” power cables to the DC-input terminals on the on the Cisco RFGW-10 UEQAM. For information on connecting the cables, see [“Cabling the Power Shelf” section on page 3-29](#).
- Step 3** Connect the AC power cables to a standard wall socket (facility power source) to provide power to the Cisco RFGW-10 UEQAM. See [“Powering On the Cisco RFGW-10 UEQAM” section on page 3-28](#).

[Figure 3-23](#) shows two Lineage power shelves connected to the DC PEM modules.

Figure 3-23 Lineage Power Shelf Connected to DC PEM Modules - Configuration 2



334293

1	Lineage power shelf 1	6	Red straight cables from Lineage shelf 2 to -48 V terminal on DC PEM modules
2	Lineage power shelf 2	7	Cisco RFGW-10 DC PEM 1
3	Black straight cables from Lineage shelf 1 to RTN terminal on DC PEM modules	8	Earth ground cables
4	Red straight cables from Lineage shelf 1 to -48 V terminal on DC PEM modules	9	Cisco RFGW-10 DC PEM 0
5	Black straight cables from Lineage shelf 2 to RTN terminal on DC PEM modules	10	—

Disconnecting Cables from the Power Shelf

**Caution**

Ensure that the power is turned off on the power shelf by disconnecting the power supply at the facility before proceeding to disconnect the other cables.

Steps

To disconnect cables from the Lineage power shelf and the Cisco RFGW-10:

-
- Step 1** Power off the power shelf by disconnecting the power supply at the facility. Wait a few minutes before disconnecting the power cables so that they discharge.
 - Step 2** Disconnect the AC cables from the standard wall socket. Disconnect the AC power cables from each of the AC-input power supply sources on the power shelf.
 - Step 3** Disconnect the DC power cables on each side of the DC power sources, on the power shelf.
 - Step 4** Disconnect the other ends of the DC power cable from the DC power terminal blocks of the Cisco RFGW-10.
-



CHAPTER 4

Thermal Management

The Cisco RF Gateway 10 (RFGW-10) Universal Edge Quadrature Amplitude Modulation (UEQAM) is capable of dissipating 4535W (15,474.06 Btu/hour) of heat load to the facility via forced air cooling. The forced air cooling flows front to back with 800 cubic feet per minute (CFM) exhaust volume (main fan tray and power supply fans) at full flow.

The system cooling, which is a multi-speed controlled system, is triggered by the ambient air inlet temperature readings from the DS-48 line cards. It is important to understand the thermal features of the unit to physically configure the unit in the rack and to monitor the environment.

[Table 4-1](#) outlines the operational environmental limits of the system.

Table 4-1 Cisco RFGW-10 UEQAM Operational Environmental Limits

Operating temperature (nominal)	32 to 104°F (0 to 40°C)
Operating temperature (short-term)	23 to 122°F (-5 to 50°C)
Operating humidity (nominal) (relative humidity)	10 to 85%
Operating humidity (short-term)	5 to 90%
Operating altitude	-200 to 10000 feet (-60 to 3050 m)

Blank Panels



Warning

Blank faceplates and cover panels serve three important functions: they prevent exposure to hazardous voltages and currents inside the chassis; they contain electromagnetic interference (EMI) that might disrupt other equipment; and they direct the flow of cooling air through the chassis. Do not operate the system unless all cards, faceplates, front covers, and rear covers are in place. Statement 1029



Caution

Never operate the Cisco RFGW-10 UEQAM for prolonged periods without a line card or blank panel in each slot of the chassis. Use of the chassis with open slots degrades the cooling performance of the chassis and can cause over-temperature conditions on adjacent cards due to air flow bypass. Card slots can be left open only during card replacement.

Table 4-2 outlines the card blanks available for the Cisco RFGW-10 UEQAM.

Table 4-2 Available Blank Covers for the Cisco RFGW-10

RFGW-SUP-COVER	RFGW supervisor slot cover
RFGW-SUP-COVER=	RFGW supervisor slot cover spare
RFGW-LC-COVER	RFGW line card cover
RFGW-LC-COVER=	RFGW line card cover spare
RFGW-TCC-COVER	RFGW TCC card cover
RFGW-TCC-COVER=	RFGW TCC card cover spare
RFGW-10-PWR-COVER	RFGW PEM cover
RFGW-10-PWR-COVER=	RFGW PEM cover spare



Note

The RF switch card does not have blank panels. The system requires all the 12 RF switch cards to be installed all the time for proper system operation.

Cooling Path

The Cisco RFGW-10 UEQAM has a single air intake in the front lower portion of the chassis, and has multiple exhausts in the rear of the chassis from the fan tray and the DC PEMs. See [Figure 1-4](#).



Note

Keep all obstructions at least 4 inches away from the system's air intake or exhausts. Any close obstruction will choke the airflow and impact the system's cooling performance.

Fan Tray Removal

The Cisco RFGW-10 UEQAM has a single fan tray module, which cools the Supervisor Cards, Universal RF slots, TCC cards and the fan tray as well. The Cisco RFGW-10 UEQAM supports hot-swapping, which lets you install, remove, and replace without powering off the system.

Removal and replacement of the fan tray must be coordinated so that the time to remove and replace the fan tray does not exceed 1.5 minutes.



Note

If the replacement takes more than 1.5 minutes, the system software will generate an alarm and power down the entire system.



Warning

When removing the fan tray, keep your hands and fingers away from the spinning fan blades. Let the fan blades completely stop before you remove the fan tray. Statement 258

**Caution**

Never operate the system for more than three minutes when the fan assembly is removed. An over-temperature condition can cause severe equipment damage.

Environmental Monitoring

The Cisco RFGW-10 UEQAM is equipped to monitor the ambient air intake and exhaust temperatures. Each RF line card has ambient air intake sensors that are located on the leading edge of the line card and are used for monitoring the ambient air inlet temperatures. These temperature readings are used as input for the fan tray speed control system for optimized system cooling, acoustics, and system thermal alarms.

The Supervisors have thermal sensors located at various locations on the printed circuit board (PCB). These sensors monitor board level temperatures only. Temperatures read from these sensors are used for Supervisor board level thermal alarming and board thermal protection shutdown.

**Note**

The temperatures read from the Supervisor Cards are not ambient intake temperatures but specific board location temperatures used for board level thermal alarming.

The fan tray is equipped with exhaust sensors located over the Supervisor slots. These are for additional temperature monitoring on the Supervisors. These temperature readings are used as input for the fan tray speed control system for optimized system cooling, acoustics, and system thermal alarms.



Installing and Removing FRUs

This chapter tells you how to remove and replace Cisco RF Gateway 10 (RFGW-10) UEQAM field-replaceable units (FRUs). The Cisco RFGW-10 UEQAM supports hot-swapping, which allows installation, removal, and replacement of a component without powering off the system. When the system detects that a module has been installed or removed, it runs diagnostic and discovery routines automatically, acknowledges the presence or absence of the module, and resumes system operation without operator intervention.

The following sections describe how to install, remove and replace the various components:

- [Installation and Removal of the DC PEM, page 5-2](#)
- [Installation and Removal of the Fan Assembly, page 5-7](#)
- [Installation and Removal of the Supervisor Cards, page 5-9](#)
- [Installation and Removal of the RF Switch Card, page 5-14](#)
- [Installation and Removal of the TCC Cards, page 5-19](#)
- [Installation and Removal of the Line Cards, page 5-23](#)
- [Installation and Removal of the SFP Modules, page 5-27](#)



Warning

Read the installation instructions before connecting the system to the power source. Statement 1004



Warning

Only trained and qualified personnel should be allowed to install, replace, or service this equipment. Statement 1030



Warning

This equipment must be grounded. Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available. Statement 1024



Warning

Before working on equipment that is connected to power lines, remove jewelry (including rings, necklaces, and watches). Metal objects will heat up when connected to power and ground and can cause serious burns or weld the metal object to the terminals. Statement 43

**Warning**

Ultimate disposal of this product should be handled according to all national laws and regulations. Statement 1040

Installation and Removal of the DC PEM

**Note**

To meet the electromagnetic interference (EMI) requirements, the DC power supply should be removed from the chassis if the PEM has failed or the circuit breaker is off.

This section describes how to remove and install the DC PEM (see [Figure 5-1](#)) for the Cisco RFGW-10 UEQAM.

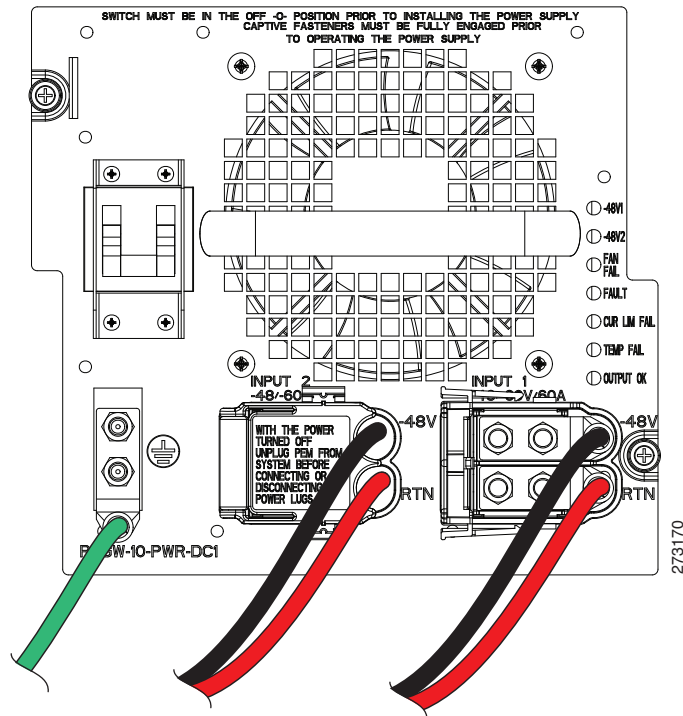
**Warning**

Hazardous voltage or energy is present on the backplane when the system is operating. Use caution when servicing. Statement 1034

**Note**

The DC PEMs are hot-swappable, so in redundant mode there is no need to power down the chassis to replace or upgrade the DC PEMs.

Figure 5-1 DC PEM



**Warning**

Blank faceplates and cover panels serve three important functions: they prevent exposure to hazardous voltages and currents inside the chassis; they contain electromagnetic interference (EMI) that might disrupt other equipment; and they direct the flow of cooling air through the chassis. Do not operate the system unless all cards, faceplates, front covers, and rear covers are in place. Statement 1029

Installing a DC PEM

This section describes how to install a DC PEM.

**Warning**

Before performing any of the following procedures, ensure that power is removed from the DC circuit. Statement 1003

**Warning**

A readily accessible two-poled disconnect device must be incorporated in the fixed wiring. Statement 1022

**Warning**

This product requires short-circuit (overcurrent) protection, to be provided as part of the building installation. Install only in accordance with national and local wiring regulations. Statement 1045

**Warning**

Use copper conductors only. Statement 1025

**Warning**

When stranded wiring is required, use approved wiring terminations, such as closed-loop or spade-type with upturned lugs. These terminations should be the appropriate size for the wires and should clamp both the insulation and conductor. Statement 1002

To install a DC PEM, connect it to a power source, and verify its operation, do the following:

Before proceeding, read the following instructions:

- The color coding of the DC-input power supply leads depends on the color coding of the DC power source at your site. Typically, green or green/yellow is used for ground (GND), black for –48V on negative (–) terminal and red for RTN on the positive (+) terminal. Ensure that the lead color coding you choose for the DC-input power supply matches the lead color coding used at the DC power source.
- For DC-input power cables, select the appropriate wire gauge based on the National Electrical Code (NEC) and local codes for 60-amp service at nominal DC-input voltage (–48 VDC). Two pairs of cable leads - source DC (–) and source DC return (+), are required for each Power Distribution Unit (PDU). These cables are available from any commercial cable vendor. All input power cables for the chassis must have the same wire gauge and the cable lengths must match (with a 10 percent deviation). Each DC-input power cable is terminated at the PDU by a cable lug (included in the accessory kit). The cable lugs must be dual-hole, and have a 90 degree tongue (reference Panduit LCD4-14AF-L). They must fit over M6 terminal studs at 0.625-inch (15.88-mm) centers.

**Note**

The DC-input power cables must be connected to the PDU terminal studs in the proper positive (+) and negative (–) polarity. In some cases, the DC cable leads are labeled, which is a safe indication of the polarity. However, you must verify the polarity by measuring the voltage between the DC cable leads. While measuring, the positive (+) lead and the negative (–) lead must always match the (+) and (–) labels on the PDU.

- An earth ground cable is required for each DC PDU. We recommend that you use at least 4-AWG multi-strand copper wire. This wire is not available from Cisco; it is available from any commercial cable vendor.

The ground wire cable lug (provided in the accessory kit) should be dual-hole, 90 degree tongue (reference Panduit LCD4-14AF-L), and fit over M6 terminal studs at 0.625 inch (15.88mm) centers.

**Warning**

When you install the unit, the ground connection must always be made first and disconnected last. Statement 1046

**Caution**

Before installing the DC cable lugs, ensure proper insulation of the entire 90 degree portion of the lugs where the wire is crimped to avoid hazardous conditions and where the DC input power is accessible through the terminal cover of the DC PEM with shrink tubing.

**Caution**

Failure to follow this procedure in the right sequence could pose a safety risk and cause damage to the unit.

**Note**

To avoid hazardous conditions, all components in the area where DC input power is accessible must be properly insulated. Therefore, before installing the DC cable lugs, be sure to insulate the lugs according to the manufacturer's instructions.

- Step 1** Ensure that the facility that feeds the DC -48V power supply to the chassis is turned off.
- Step 2** Ensure that the breaker on the PEM power supply is turned off.
- Step 3** Make sure that the chassis grounding is connected before you begin installing the DC power supply.
- Step 4** Grasp the power supply handle with one hand. Place your other hand underneath it as you slowly insert the power supply into the bay. Do not fully install the DC power supply to the midplane connector, leave the power supply disconnected from the chassis by 1 inch.
- Step 5** Locate the stud on the DC power supply for the GND connection, which must be connected first and follow these steps:
 - a. Using the provided grounding lug in the accessory kit, replace the washers and Kepnut screw in the following order:
 - Washer
 - Grounding cable lug
 - Kepnut screw
 - b. Tighten the Kepnut screws on the power supply studs to the recommended torque of 18 in-lbs minimum to 22 in-lbs maximum.

Step 6 Attach the other end of the cable to the site ground connection.

Step 7 Before you connect the power supply to a power source, ensure that all site power and grounding requirements are met.

Step 8 Remove or rotate the plastic cover from the terminal block.



Caution Before installing the DC cable lugs, insulate the entire 90 degree portion of the lugs where the wire is crimped to avoid hazardous conditions and where the DC input power is accessible through the terminal cover of the DC PEM.



Note To avoid hazardous conditions, all components in the area where DC input power is accessible must be properly insulated. Therefore, before installing the DC cable lugs, be sure to insulate the lugs according to the manufacturer's instructions.

Step 9 Insert the negative lead cable first. Replace the ground lug with cable in the following order:

- a. Washer
- b. Ground lug with negative wire
- c. Kepnut screw

Step 10 Tighten the Kepnut screw to the recommended torque of 18 in-lbs minimum to 22 in-lbs maximum.

Step 11 Repeat Step 7 and Step 8 for the RTN lead cable.



Note Secure the wires coming in from the terminal block so that they are not disturbed by casual contact.

Step 12 Replace and rotate the terminal block plastic cover back into position until it is locked.



Note Both DC inputs to the DC PEM must be connected and energized for the Cisco RFGW-10 UEQAM system to operate properly.

Step 13 Fully install the DC PEM into the power supply bay and tighten the captive fasteners on the faceplate to the chassis.

Step 14 Tighten the DC PEM captive fasteners to 12-16 in-lb torque.



Note Both DC inputs to the DC PEM must be connected and energized for the Cisco RFGW-10 UEQAM system to operate properly.

Step 15 Energize the facility DC power feeds to the power supply.

Step 16 Verify power supply operation by checking the power supply's front panel LEDs. The -48 V1 and -48 V2 LEDs should illuminate green.

Step 17 Switch the circuit breaker switch to the On (I) position.

Step 18 Again verify the power supply operation by checking the power supply's front panel LEDs. The -48 V1, -48 V2 and OUTPUT OK LEDs should illuminate green.

- Step 19** Check the power supply and system status from the system console by entering the show power command. For more information on the commands, refer to the command reference publication for your chassis and software.

**Caution**

If power is supplied to the DC PEM before the PEM is inserted, the circuit breaker will trip. If the circuit breaker trips, wait at least five seconds before further manipulating the unit. Do not touch any connector during these five seconds.

Removing a DC PEM


This section describes how to remove a DC PEM.

**Warning**

Before performing any of the following procedures, ensure that power is removed from the DC circuit. Statement 1003

**Caution**

Failure to follow this procedure in the right sequence could pose a safety risk and cause damage to the unit.

- Step 1** Turn off the PEM in-line power switch.
- Step 2** Ensure that the facility that feeds the DC -48V power supply to the chassis is turned off.
- Step 3** Verify that power is off to the DC circuit on the power supply you are removing.
-  **Note** To meet the electromagnetic interference (EMI) requirements, the DC power supply should be removed from the chassis if the PEM has failed or the circuit breaker is off.
- Step 4** Unscrew the top left-hand side captive fastener on the power supply faceplate (thumb screw) first, then unscrew the bottom right-hand side captive fastener.
Wait for five seconds.
- Step 5** Grasp the power supply handle with one hand and pull until you feel the power supply disconnect from the midplane connector and move freely (approximately 1" removal from the chassis).
- Step 6** Unhinge the terminal covers from the terminal blocks to expose the terminal block studs.
- Step 7** Using a socket wrench and 10 mm socket disconnect the kepnut retaining the DC-input lugs from the terminal block.
- Step 8** Repeat Step 6 and Step 7 for the second terminal block.
- Step 9** Using a socket wrench and 10 mm socket disconnect the kepnut retaining the DC PEM ground lug from the power supply faceplate.

**Warning**

When installing or replacing the unit, the ground connection must always be made first and disconnected last. Statement 1046

- Step 10** Grasp the power supply handle with one hand. Place your other hand underneath as you slowly pull the power supply out of the bay.
- Step 11** If the bay is to remain empty, install a blank power supply filler plate over the opening and secure it with the mounting screws. This protects the inner chassis from dust and prevents accidental contact with live voltage at the rear of the bay.

**Warning**

Blank faceplates and cover panels serve three important functions: they prevent exposure to hazardous voltages and currents inside the chassis; they contain electromagnetic interference (EMI) that might disrupt other equipment; and they direct the flow of cooling air through the chassis. Do not operate the system unless all cards, faceplates, front covers, and rear covers are in place. Statement 1029

Installation and Removal of the Fan Assembly

This section describes how to install and remove the fan assembly of the Cisco RFGW-10 chassis.

**Note**

Always use a wrist-strap or other grounding device to prevent ESD damage while handling the DS-48 line card.

Removing the Fan Assembly

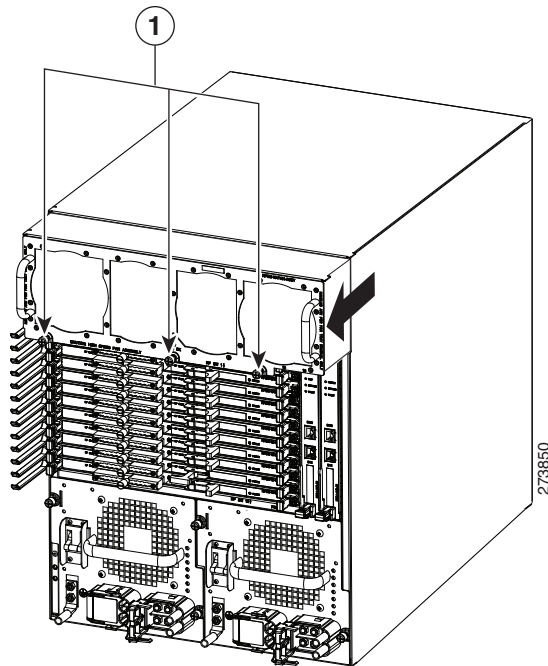
**Caution**

Never operate the system for more than three minutes when the fan assembly is removed. An over-temperature condition can cause severe equipment damage.

Follow these steps to remove the existing chassis fan assembly:

- Step 1** Loosen the three captive installation screws on the fan assembly front panel by turning them counterclockwise (see [Figure 5-2](#)).

Figure 5-2 Cisco RFGW-10 UEQAM System Fan Assembly



1	Captive installation screws		
---	-----------------------------	--	--

**Warning**

When removing the fan tray, keep your hands and fingers away from the spinning fan blades. Let the fan blades completely stop before you remove the fan tray. Statement 258

Step 2

Grasp the fan assembly handles with both hands and pull it outward to disengage the midplane connector. Slide it out of the chassis and place it in a safe place. Do not touch the fans, hold the fan tray by the handles only.

Installing the Fan Assembly

Follow these steps to install the new fan assembly:

**Caution**

Follow all installation instructions carefully to prevent damage to the connectors.

**Caution**

Never operate the system for more than three minutes when the fan assembly is removed. An over-temperature condition can cause severe equipment damage.

Step 1

Place the fan assembly into the fan assembly bay so it rests on the chassis, and then lift the fan assembly up slightly, aligning the top and sides with the bay opening.

- Step 2** Gently slide the fan assembly into the chassis until the fan tray front panel makes contact with the chassis.



Note Apply a slow and even pressure on the fan assembly handles so that the fan tray does not tilt from side-to-side.

- Step 3** Using a screwdriver, tighten the three front panel captive screws by turning them clockwise.



Note Tighten the fan tray captive screws to 6-8 in-lbs.

Verifying the Fan Assembly Installation



Note To check the operation of the fans, you need to power up the chassis.

Follow these steps to verify that the new fan assembly was installed correctly:

- Step 1** Listen for the fans; you should immediately hear them operating. If you do not hear them, ensure that the fan assembly is inserted completely in the chassis and that the faceplate is flush with the chassis back panel.



Note The fan tray has multiple speeds based on the ambient air temperature conditions. The default control mode setting configures the fans at a maximum speed at startup. After startup, it may take up to 30 seconds for the fans to stabilize to the requested RPM.

- Step 2** The fan tray LED should illuminate green.

- Step 3** If after several attempts the fans do not operate, or if you experience trouble with the installation (for instance, if the captive installation screws do not align with the chassis holes), contact the Cisco TAC for assistance.

Installation and Removal of the Supervisor Cards

This section describes how to remove and install the Supervisor Cards.



Note When you handle the Supervisor Cards, use a wrist-strap or other grounding device to prevent ESD damage.

Installing the Supervisor Cards

The Cisco RFGW-10 UEQAM has vertical chassis slots that are numbered from left to right. The Supervisor Cards can be installed only in Slot 1 and/or 2.

**Caution**

During this procedure, wear grounding wrist-straps to avoid ESD damage to the card. Do not directly touch the backplane with your hand or any metal tool. This could result in an electric shock.

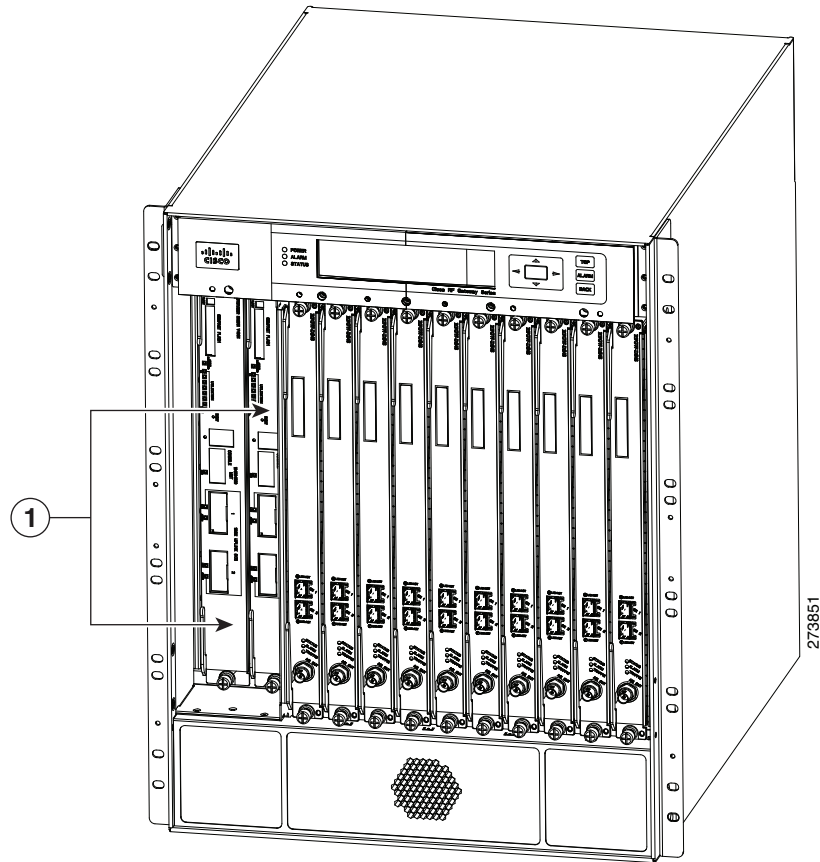
**Caution**

To prevent ESD damage, handle the Supervisor Cards by the carrier edges only.

To install a Supervisor Card in a Cisco RFGW-10 UEQAM chassis, do the following:

- Step 1** Take necessary precautions to prevent ESD damage as described in the [Preparing Your Site for Installation](#) chapter.
- Step 2** Ensure that you have enough clearance to accommodate any interface equipment that you will connect directly to the Supervisor Card ports.
- Step 3** Loosen the captive installation screws that secure the Supervisor blank panel or the existing Supervisor Card (whichever is present).
- Step 4** Remove the Supervisor blank panel or the existing Supervisor Card from Slot 1 or 2 as shown in [Figure 5-3](#). If a Supervisor blank panel is installed, keep it for future use. To remove an existing Supervisor Card, follow the instructions in [“Removing the Supervisor Card”](#) section on page 5-13.

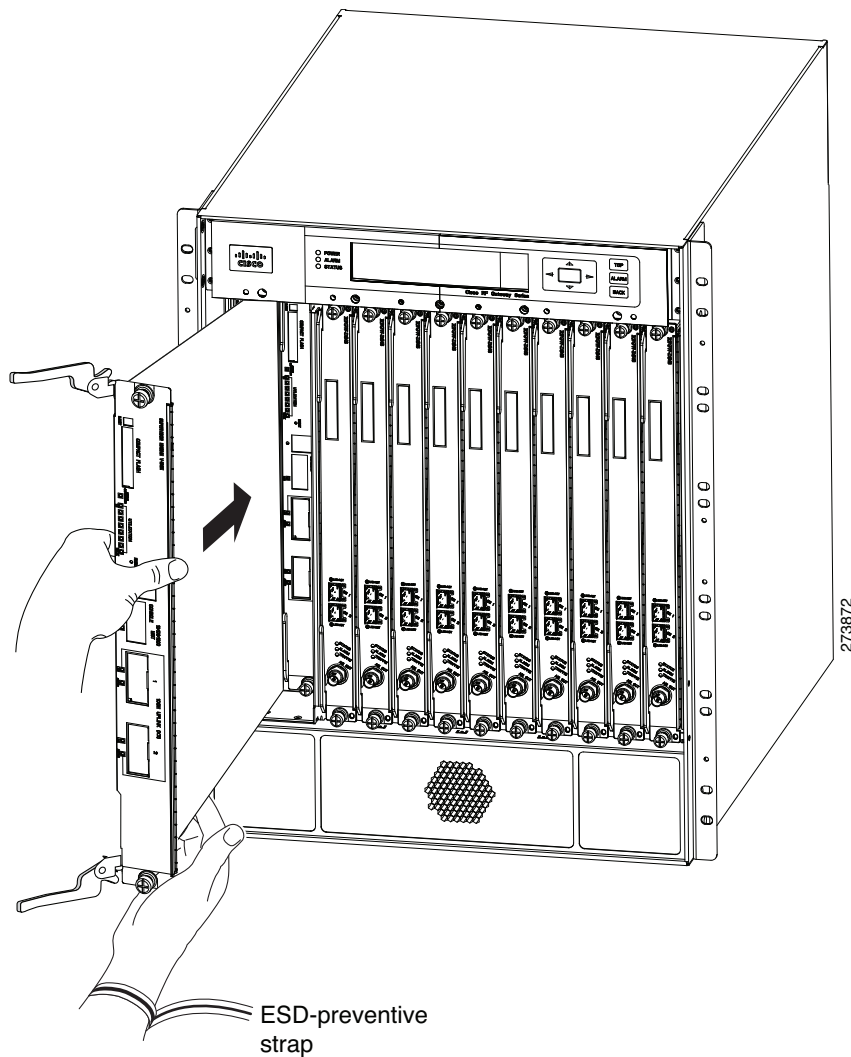
Figure 5-3 Supervisor Slot Locations In the Cisco RFGW-10 Chassis



1	Two supervisor slots		
---	----------------------	--	--

- Step 5** To install a Supervisor Card, turn the module sideways with the board facing right, grasp the switching module front panel with one hand and place your other hand under the board's side edge to support the Supervisor Card as shown in [Figure 5-4](#). Do not touch the printed circuit boards or the connector pins.

Figure 5-4 Installing the Supervisor Card in the Chassis



- Step 6** Align the edges of the Supervisor Card's printed circuit board with the slot guides on the top and bottom of the Cisco RFGW-10 UEQAM chassis, as shown in [Figure 5-4](#).

**Note**

The Supervisor Card slides into the chassis guides on the printed circuit board (PCB) edge and not on the sheet metal carrier edge.

- Step 7** Pivot the two module ejector levers out and away from the faceplate.
- Step 8** Carefully slide the Supervisor Card into the slot until the notches on both the ejector levers engage the chassis' top and bottom.
- Step 9** Using the thumb and the forefinger of each hand, simultaneously pivot in both the ejector levers to fully seat the Supervisor Card in the backplane connector.

**Caution**

Always use the ejector levers when installing or removing a Supervisor Card. A Supervisor Card that is partially seated in the backplane will not function correctly.

- Step 10** Use a screwdriver to tighten the captive installation screws on each end of the Supervisor Card's faceplate.



Note Tighten the captive screws to 6-8 in-lbs.

Verifying the Status of the Supervisor Card

To check the status of the module, do the following:

- Step 1** Ensure that the STATUS LED illuminates green (module operational).
- Step 2** When the supervisor is online, enter the **show module all** command. Verify that the system acknowledges the new module and that the module's status is good.
- Step 3** If the module is not operational, re-seat it. If the module is still not operational, contact your customer service representative.

Removing the Supervisor Card



Note If you are removing a Supervisor card from the chassis when the system is up and running, ensure that the card is in the standby mode. If the card is in active mode, execute the **redundancy force-switchover** command to change the card to the Standby mode, and then remove the card from the chassis.



Caution When no fiber cable is connected, the aperture of the port may be emitting invisible radiation. Avoid exposure to the radiation and do not stare into the apertures.



Caution During this procedure, wear grounding wrist-straps to avoid ESD damage to the card. Do not directly touch the backplane with your hand or any metal tool. This could result in an electric shock.

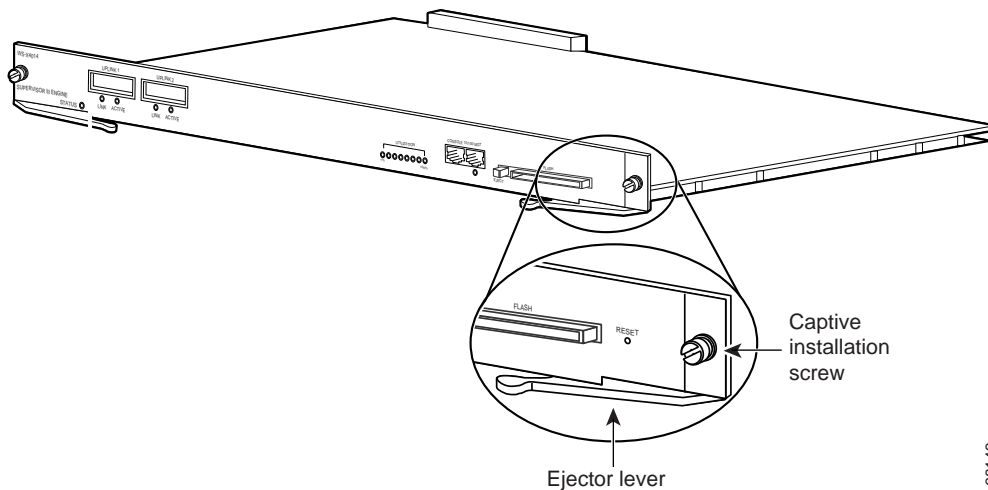


Caution To prevent ESD damage, handle the Supervisor Cards by the carrier edges only.

To remove a Supervisor Card from a Cisco RFGW-10 UEQAM, do the following:

- Step 1** Disconnect the network interface cables attached to the ports on the Supervisor Card that you intend to remove.
- Step 2** Loosen the captive installation screws (see [Figure 5-5](#)).

Figure 5-5 Captive Installation Screws and Ejector Levers



- Step 3** Grasp the top and bottom ejector levers and simultaneously pivot the levers outward to release the Supervisor Card from the backplane connector. [Figure 5-5](#) shows a close-up of the bottom ejector lever.
- Step 4** Grasp the ejector levers of the Supervisor Card and pull it out of the slot until you can grab the carrier faceplate. Do not touch the printed circuit board components or the connector pins.
- Step 5** Grasp the front panel of the Supervisor Card with one hand and place your other hand under the side PCB edge to support and guide it out of the slot. Do not touch the printed circuit board components or the connector pins.
- Step 6** Carefully pull the Supervisor Card straight out of the slot, keeping your other hand under the PCB edge to guide it.
- Step 7** Place the Supervisor Card on an antistatic mat or antistatic foam, or immediately install it in another slot.

**Warning**

Blank faceplates and cover panels serve three important functions: they prevent exposure to hazardous voltages and currents inside the chassis; they contain electromagnetic interference (EMI) that might disrupt other equipment; and they direct the flow of cooling air through the chassis. Do not operate the system unless all cards, faceplates, front covers, and rear covers are in place. Statement 1029

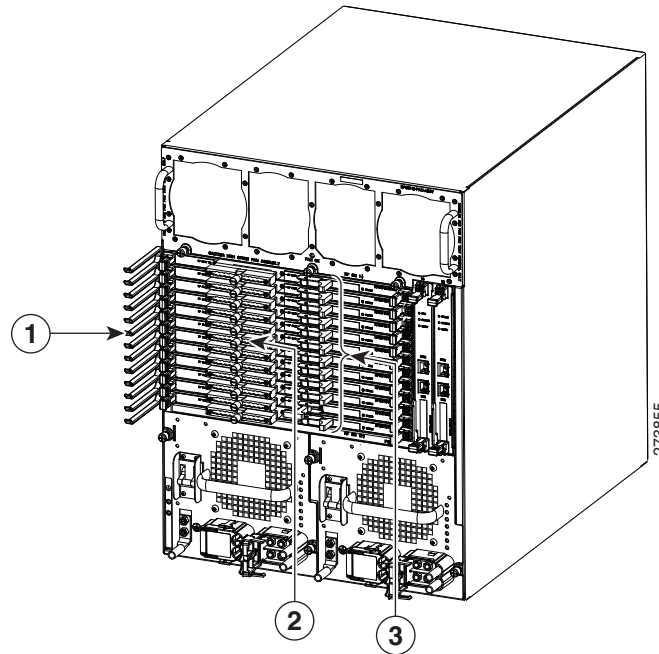
- Step 8** If the slot is to remain empty, install a Supervisor blank panel (part number RFGW-SUP-COVER=).

Installation and Removal of the RF Switch Card

The RF switch cards are the RF coaxial termination for the Cisco RFGW-10 UEQAM chassis. There are 12 RF switch cards per Cisco RFGW-10 UEQAM chassis. (See [Figure 5-6](#).) Each RF switch card connects to one port on each of the 10 DS-48 line cards. When removing and replacing the RF switch card, a physical port on each DS-48 line card is affected. All 12 RF switch cards are required for proper system operation.

The Cisco RFGW-10 UEQAM is a “cable once” system allowing removal of individual front-side DS-48 line cards without disconnecting any specific physical RF coaxial connection. All RF signaling is terminated on the rear-side RF switching modules. Each switch card supports a single UCH2 connector header and each UCH2 supports 10 MCX style coaxial connections per RF switch card.

Figure 5-6 12 RF Switch Cards Installed with UCH2



1	Rear RF cable-management bracket	3	RF switch cards (1 to 12)
2	UCH2		



Note

When you handle the RF switch cards, use a wrist-strap or other grounding device to prevent ESD damage.

Installing the RF Switch Card

The Cisco RFGW-10 UEQAM chassis has horizontal RF switch card slots that are numbered from top to bottom (Slots 1 through 12).



Caution

During this procedure, wear grounding wrist-straps to avoid ESD damage to the card. Do not directly touch the backplane with your hand or any metal tool. This could result in an electric shock.



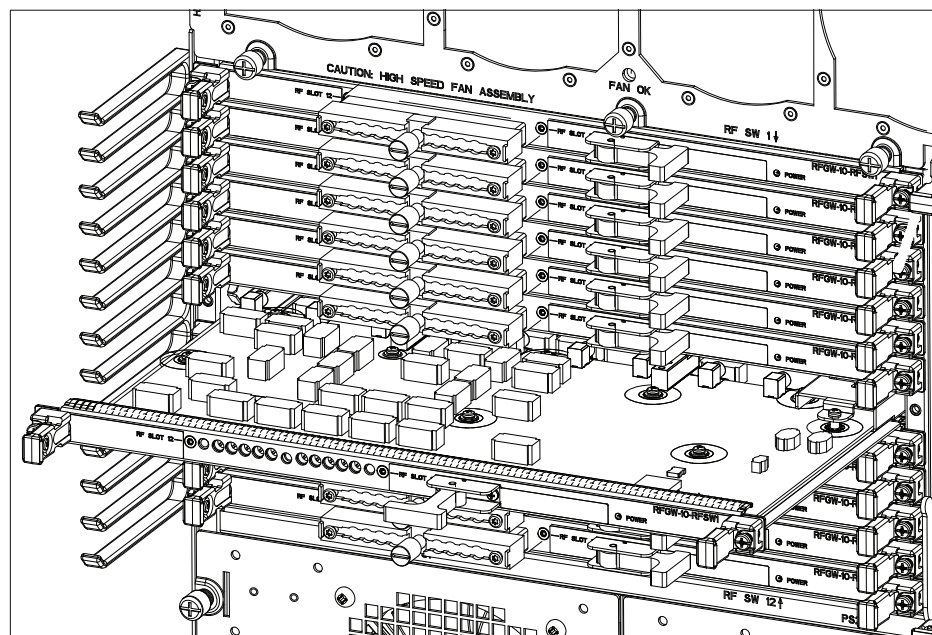
Caution

To prevent ESD damage, handle the RF switch cards by the carrier edges only. Do not touch the RF connectors on the back of the card.

To install an RF switch card in a Cisco RFGW-10 UEQAM chassis, do the following:

- Step 1** Take necessary precautions to prevent ESD damage as described in the [Preparing Your Site for Installation](#) chapter.
- Step 2** Ensure that you have enough clearance to accommodate any interface equipment that you will connect directly to the RF switch card RF ports.
- Step 3** Carefully move the cables away from the RF switch card slot to insert the RF switch card without obstruction.
- Step 4** Hold the RF switch card by placing one hand under the board carrier to support the card and align the RF switch card carrier with the open chassis slot and slot card guides. See [Figure 5-7](#).

Figure 5-7 RF Switch Card Installation



- Step 5** Gently insert the RF switch card into the open slot while ensuring not to angle the card, which could create an interference with the cables or adjacent cards.
- Step 6** Gently push the RF switch card front panel and the side captive screw pull tabs to fully insert and connect the midplane connectors.



Note

While pushing the RF switch card into the card slot, balance the card to ensure that it installs straight. Imbalance can create off center loading that can cause binding of the card and prevent full insertion of the RF switch card midplane connectors and require re-seating.

- Step 7** Ensure the RF switch card is fully seated in the chassis. Use a screwdriver and gently tighten the two side captive screws. There may be a need to wiggle the card left or right if the captive screws are not aligned to the captive chassis nuts.



Note

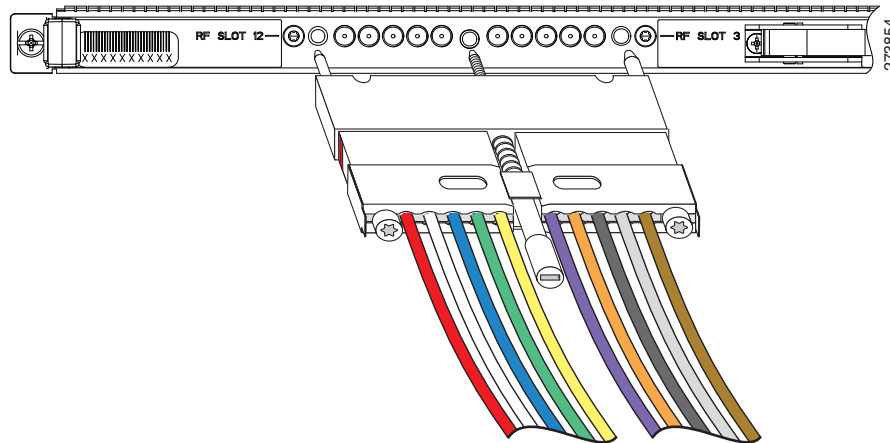
Tighten the RF switch card captive screws to 6-8 in-lbs.

- Step 8** Bring the coaxial cables back across the RF switch card faceplate and align the UCH to the RF switch card coaxial connector guide pin holes. Align the red marking on the UCH facing left towards the red line on the left side of the RF switch card label. See [Figure 5-8](#).



Note The UCH is keyed and can only be installed in one orientation to the RF switch card connector.

Figure 5-8 **Aligning the UCH to the RF Switch Card Coaxial Connector**



- Step 9** 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 settle securely in place on the faceplate, wiggle the holder to re-settle the connectors.
- Step 10** 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 a maximum of 20 in-lbs can cause the lead screw to fail.



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

Verifying the RF Switch Card Status

To verify the status of the RF switch card, do the following:

- Step 1** Ensure that the POWER LED illuminates green (module operational).
- Step 2** When the RF switch card is online, use the **show module** command to verify that the system acknowledges the new module and that the module's status is good.

- Step 3** If the module is not operational, re-seat it. If the module is still not operational, contact your customer service representative.

Removing the RF Switch Card



Caution During this procedure, wear grounding wrist-straps to avoid ESD damage to the card. Do not directly touch the backplane with your hand or any metal tool. This could result in an electric shock.

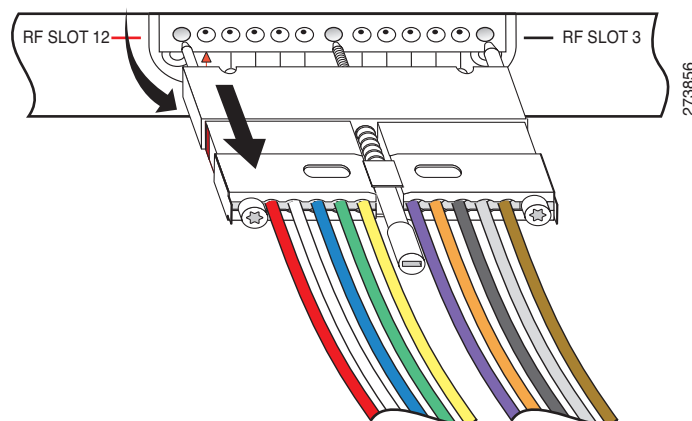


Caution To prevent ESD damage, handle the RF switch cards by the carrier edges only. Do not touch the RF connectors on the back of the card.

To remove an RF switch card in a Cisco RFGW-10 UEQAM chassis, do the following:

- Step 1** Take necessary precautions to prevent ESD damage as described in the [Preparing Your Site for Installation](#) chapter.
- Step 2** Ensure that you have enough clearance to accommodate any interface equipment that you will connect directly to the RF switch card RF ports.
- Step 3** Carefully move the cables away from the RF switch card slot to reach the lead screw on the UCH.
- Step 4** Use the flathead screwdriver to loosen the lead screw on the UCH. Turn the lead screw counterclockwise. See [Figure 6-4](#).
- Step 5** Unscrew the lead screw until it is completely out of the faceplate on the RF switch card.
- Step 6** Use the lead screw to pull the UCH and the cables straight out of the card (see [Figure 5-9](#)).

Figure 5-9 Using the Lead Screw to Pull the UCH



Caution Do not use the cables to pull the holder from the faceplate. Be careful not to bend the cables at right angles to the holder.

- Step 7** Move the UCH and cables completely out of the RF switch card faceplate extraction direction.
- Step 8** Loosen the captive installation screws on each side of the RF switch card faceplate.
- Step 9** Flip out the extraction handle on the front faceplate of the RF switch card faceplate.
- Step 10** Grasp the extraction handle with one hand and pull the RF switch card from the slot and place your other hand under the board carrier to support the card.



Caution During this procedure, wear grounding wrist-straps to avoid ESD damage to the card. Do not directly touch the backplane with your hand or any metal tool. This could result in an electric shock.



Caution To prevent ESD damage, handle the RF switch card by the carrier edges only.

- Step 11** Carefully pull the RF switch card straight out of the slot keeping your other hand under the sheet metal carrier to guide it.
- Step 12** Place the RF switch card on an antistatic mat or antistatic foam.



Note If you are returning a card to the factory, after removing the card from the chassis immediately place it into an antistatic shielding bag.

Installation and Removal of the TCC Cards

This section describes how to install and remove the TCC cards in a Cisco RFGW-10 UEQAM chassis.



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

Installing the TCC Card

The Cisco RFGW-10 UEQAM has vertical TCC card chassis slots in the rear of the chassis that are numbered from right to left. The TCC cards can be installed only in slots 13 and 14.



Caution During this procedure, wear grounding wrist-straps to avoid ESD damage to the card. Do not directly touch the backplane with your hand or any metal tool. This could result in an electric shock.



Caution To prevent ESD damage, handle the TCC cards by the carrier edges only.

To install a TCC card in a Cisco RFGW-10 UEQAM chassis, do the following:

- Step 1** Take the necessary precautions to prevent ESD damage as described in the [Preparing Your Site for Installation](#) chapter.

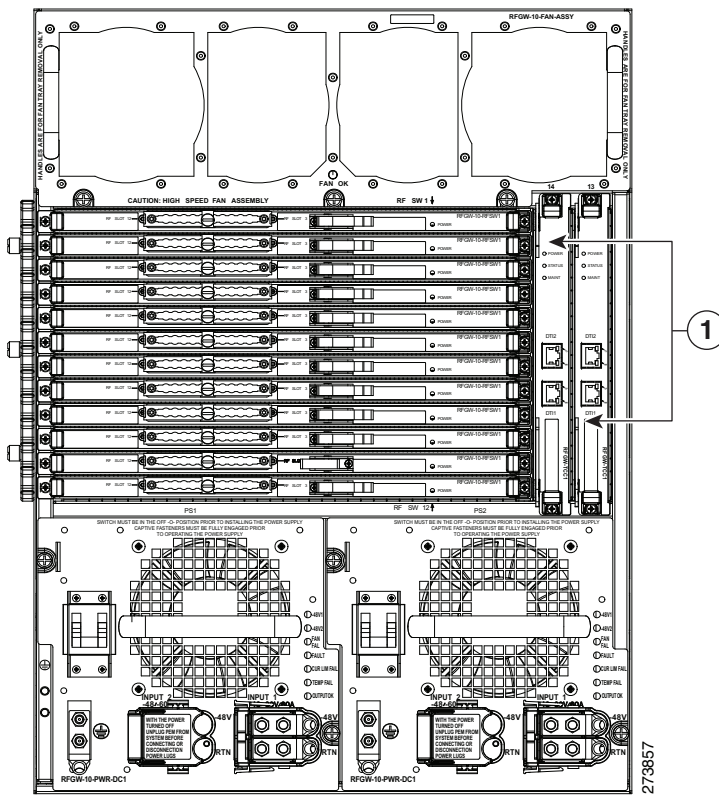
- Step 2** Ensure that you have enough clearance to accommodate any interface equipment that you will connect directly to the Supervisor Card ports.
- Step 3** Loosen the captive installation screws that secure the TCC blank panel or the existing TCC card (whichever is present).



Note If a TCC card is currently installed in the chassis slot, disconnect the associated cabling before loosening the captive screws to maintain proper grounding of the TCC card.

- Step 4** Remove the TCC blank panel or the existing TCC card from slot 13 or 14 as shown in [Figure 5-10](#). If a TCC blank panel is installed, keep it for future use. To remove an existing TCC card, follow the instructions in [“Removing the TCC Card”](#) section on page 5-22.

Figure 5-10 TCC Card Slot Locations in the Cisco RFGW-10 Chassis



1	Two TCC cards		
---	---------------	--	--

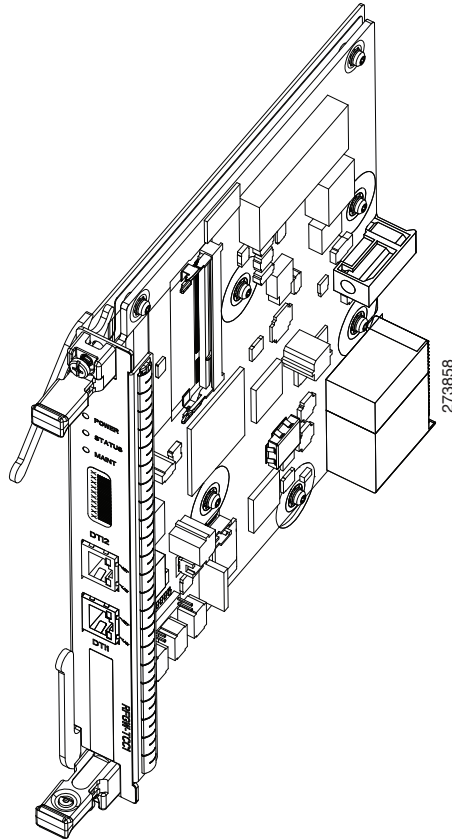
- Step 5** To install a TCC card, turn the module sideways with the board facing right, grasp the TCC card front panel with one hand and place your other hand under the sheet metal carrier edge to support the TCC card. Do not touch the printed circuit boards or the connector pins.
- Step 6** Align the edges of the TCC card sheet metal carrier edges with the slot guides on the top and bottom of the Cisco RFGW-10 UEQAM chassis.



Note The TCC card slides into the chassis guides on the sheet metal carrier edge.

Step 7 Pivot the two module ejector levers out and away from the faceplate (see [Figure 5-11](#)).

Figure 5-11 Pivoting the Two Ejector Levers



Step 8 Carefully slide the TCC card into the slot until the notches on both the ejector levers engage the chassis TCC slot's top and bottom.

Step 9 Using the thumb and the forefinger of each hand, simultaneously pivot in both the ejector levers to fully seat the TCC card in the backplane connector.



Caution Always use the ejector levers when installing or removing a TCC card. A TCC card that is partially seated in the backplane will not function correctly.

Step 10 Use a screwdriver to tighten the captive installation screws on each end of the TCC card faceplate.



Note Tighten the captive screws to 6-8 in-lbs.

Verifying the Status of the TCC Card

To check the status of the module, do the following:

-
- Step 1** Ensure that the POWER LED illuminates green (module operational).
 - Step 2** When the switch is online, use the **show module** command to verify that the system acknowledges the new module and that the module's status is good.
 - Step 3** If the module is not operational, re-seat it. If the module is still not operational, contact your customer service representative.
-

Removing the TCC Card



Caution

During this procedure, wear grounding wrist-straps to avoid ESD damage to the card. Do not directly touch the backplane with your hand or any metal tool. This could result in an electric shock.



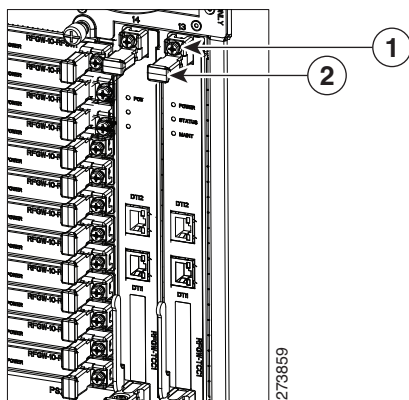
Caution

To prevent ESD damage, handle the TCC card by the carrier edges only.

To remove a TCC card from a Cisco RFGW-10 UEQAM, do the following:

-
- Step 1** Disconnect the network interface cables attached to the ports on the TCC card that you intend to remove.
 - Step 2** Loosen the captive installation screws (see [Figure 5-12](#)).

Figure 5-12 Captive Installation Screws and Ejector Levers



1	Captive installation screw	2	Ejector Lever
---	----------------------------	---	---------------

- Step 3** Grasp the top and bottom ejector levers and simultaneously pivot the levers outward to release the TCC card from the backplane connector. [Figure 5-12](#) shows a close-up of the bottom ejector lever.

- Step 4** Grasp the ejector levers of the TCC card and pull it out of the slot until you can grab the carrier faceplate. Do not touch the printed circuit board components or the connector pins.
- Step 5** Grasp the front panel of the TCC card with one hand and carefully pull the TCC card straight out of the slot.
- Step 6** Place the TCC card on an antistatic mat or antistatic foam, or immediately install it in another slot.

**Warning**

Blank faceplates and cover panels serve three important functions: they prevent exposure to hazardous voltages and currents inside the chassis; they contain electromagnetic interference (EMI) that might disrupt other equipment; and they direct the flow of cooling air through the chassis. Do not operate the system unless all cards, faceplates, front covers, and rear covers are in place. Statement 1029

- Step 7** If the slot is to remain empty, install a TCC blank panel (part number RFGW-TCC-COVER=).

Installation and Removal of the Line Cards

**Note**

For information on installing and removing the Cisco RFGW-10 DS-384 line card, see the *Cisco RF Gateway 10 Downstream 384 Line Card Hardware Installation Guide*.

This section describes how to remove and install the DS-48 line cards.

**Note**

Always use a wrist-strap or other grounding device to prevent ESD damage while handling the DS-48 line card.

Installing the DS-48 Line Card

The Cisco RFGW-10 UEQAM has vertical chassis slots numbered from left to right. The DS-48 line cards can be installed only in Slot 3 through 13.

**Caution**

During this procedure, wear grounding wrist-straps to avoid ESD damage to the card. Do not directly touch the backplane with your hand or any metal tool. This could result in an electric shock.

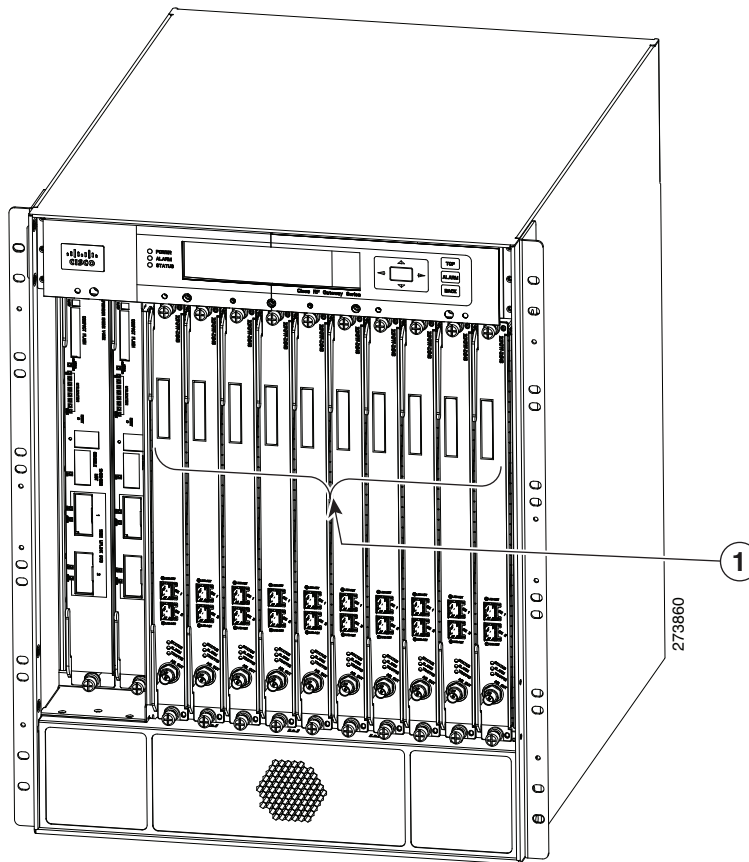
**Caution**

To prevent ESD damage, handle the DS-48 line card by the carrier edges only. Do not touch any of the RF connectors along the back of the card.

To install a DS-48 line card in a Cisco RFGW-10 UEQAM chassis, do the following:

- Step 1** Take the necessary precautions to prevent ESD damage as described in [Preparing Your Site for Installation](#) chapter.
- Step 2** Ensure that you have enough clearance to accommodate any interface equipment that you will connect directly to the Supervisor Card ports.
- Step 3** Loosen the captive installation screws that secure the line card blank panel or the existing DS-48 line card (whichever is present).
- Step 4** Remove the line card blank panel or the existing DS-48 line card from the appropriate RF capable slot as shown in [Figure 5-13](#). If a blank panel is installed, keep it for future use. If you are removing an existing DS-48 line card, follow the instructions in [“Removing the DS-48 Line Card”](#) section on [page 5-26](#).

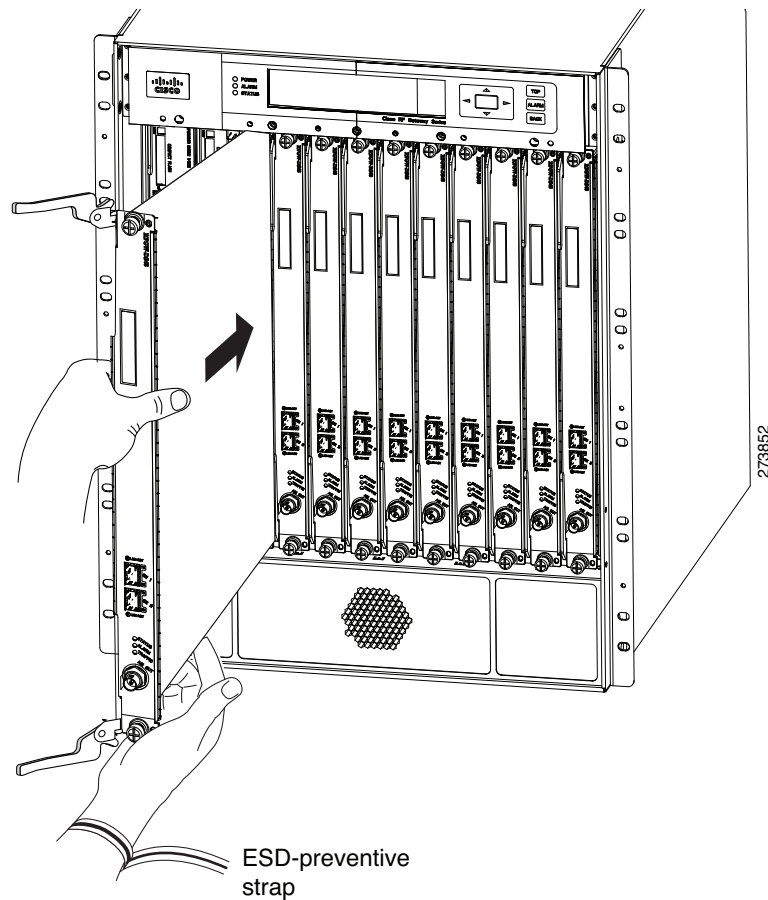
Figure 5-13 DS-48 Line Cards (RF Slots 3 through 12) Locations in the Cisco RFGW-10 Chassis



1	10 DS-48 line cards (RF slots 3 through 12)	
---	---	--

- Step 5** To install a DS-48 line card, turn the module sideways with the board facing right, grasp the DS-48 module front panel with one hand and place your other hand under the board's side edge to support the line card as shown in [Figure 5-14](#). Do not touch the printed circuit boards or the connector pins.

Figure 5-14 Installing the DS-48 Line Card in the Chassis



- Step 6** Align the edges of the DS-48 line card carrier with the slot guides on the top and bottom of the Cisco RFGW-10 UEQAM chassis, as shown in [Figure 5-14](#).



Note The DS-48 line cards slide into the chassis guides on the sheet metal carrier edge.

- Step 7** Pivot the two module ejector levers out and away from the faceplate.

- Step 8** Carefully slide the DS-48 line card into the appropriate slot until the notches on both the ejector levers engage the chassis top and bottom.

- Step 9** Using your thumb and forefinger of each hand to simultaneously pivot in both the ejector levers to fully seat the DS-48 line card in the backplane connectors.

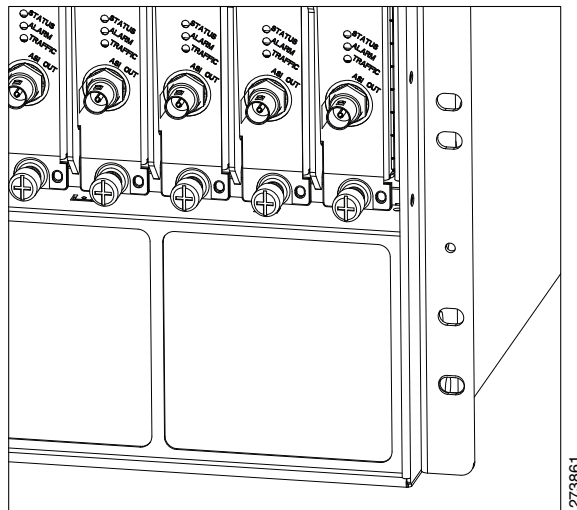


Caution Always use the ejector levers when installing or removing a DS-48 line card. A DS-48 line card that is partially seated in the backplane will not function correctly.



Note The DS-48 line card sheet metal carrier faceplate has holes on the top and bottom for aligning to the chassis pin features. This feature aids in positioning each line card faceplate within the chassis. See [Figure 5-15](#).

Figure 5-15 RF Line Card Faceplate to Chassis Alignment Features



Step 10 Use a screwdriver to tighten the captive installation screws on each end of the DS-48 line card faceplate.



Note Tighten the captive screws to 6-8 in-lbs.

Verifying the Status of the DS-48 Line Card

To check the status of the module, do the following:

- Step 1** Ensure that the STATUS LED illuminates green (module operational).
- Step 2** When the DS-48 is online, use the **show module** command to verify that the system acknowledges the new module and that the module's status is good.
- Step 3** If the module is not operational, re-seat it. If the module is still not operational, contact your customer service representative.

Removing the DS-48 Line Card



Caution When no fiber cable is connected, the aperture of the port may be emitting invisible radiation. Avoid exposure to the radiation and do not stare into the apertures.



Caution During this procedure, wear grounding wrist-straps to avoid ESD damage to the card. Do not directly touch the backplane with your hand or any metal tool. This could result in an electric shock.

**Caution**

To prevent ESD damage, handle the DS-48 line card by the carrier edges only.

To remove a DS-48 line card from a Cisco RFGW-10 UEQAM, do the following:

- Step 1** Disconnect the network interface cables attached to the ports on the DS-48 line card that you intend to remove.
- Step 2** Loosen the captive installation screws.
- Step 3** Grasp the top and bottom ejector levers and simultaneously pivot the levers outward to release the DS-48 line card from the backplane connector.
- Step 4** Grasp the front panel of the DS-48 line card with one hand and place your other hand under the side sheet metal carrier edge to support and guide it out of the slot. Do not touch the printed circuit board components or the connector pins.
- Step 5** Carefully pull the DS-48 line card straight out of the slot keeping your other hand under the sheet metal carrier edge to guide it.
- Step 6** Place the DS-48 line card on an antistatic mat or antistatic foam, or immediately install it in another slot.

**Note**

If you are returning a card to the factory, after removing the card from the chassis, immediately place it in an antistatic shielding bag.

**Warning**

Blank faceplates and cover panels serve three important functions: they prevent exposure to hazardous voltages and currents inside the chassis; they contain electromagnetic interference (EMI) that might disrupt other equipment; and they direct the flow of cooling air through the chassis. Do not operate the system unless all cards, faceplates, front covers, and rear covers are in place. Statement 1029

- Step 7** If the slot is to remain empty, install a line card blank panel (part number RFGW-LC-COVER=).

Installation and Removal of the SFP Modules

The following sections describe how to install, remove, and maintain the SFP modules.

Installing SFP Modules

The Supervisor Engine and DS-48 line card can be configured with any combination of small form-factor pluggable (SFP) modules. The Cisco RF Gateway 10 supports the following SFP modules:

- SFP-GE-T 1000BASE-T SFP (NEBS 3 ESD) (328 feet or 100 m on Cat5 UTP)
- SFP-GE-S 1000BASE-SX short wavelength; with DOM (1804.4 feet or 550 m of MMF)
- SFP-GE-L 1000BASE-LX/LH short wavelength; with DOM (32808 feet or 10 Km on SMF)
- X2-10GB-SR 10GBASE-SR X2 Module (85.3 feet or 26 m on MMF)
- X2-10GB-LR 10GBASE-LR X2 Module (32808 feet or 10 km on SMF)

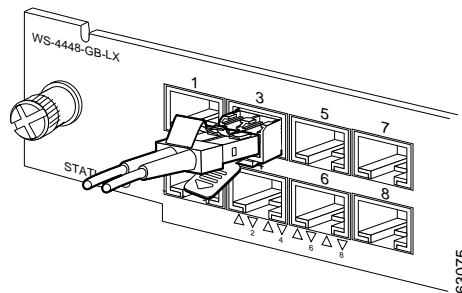
**Warning**

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

**Caution**

Protect your SFP modules by inserting clean dust plugs into the SFPs after the cables are extracted from them. Be sure to clean the optic surfaces of the fiber cables before you plug them back into the optical bores of another SFP module. Avoid getting dust and other contaminants into the optical bores of your SFP modules: The optics will not work correctly when obstructed with dust.

Figure 5-16 Connecting LC Connectors to the SFP Module



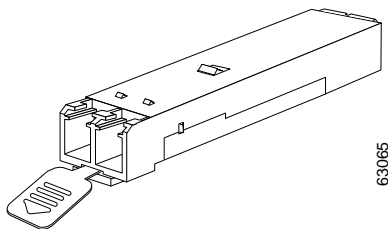
The SFP modules have three different types of latching devices used to secure and detach the SFP module from a switching module port. The three types of SFP modules are described in the following sections:

- [Mylar Tab SFP Modules, page 5-28](#)
- [Actuator/Button SFP Modules, page 5-29](#)
- [Bale Clasp SFP Modules, page 5-31](#)

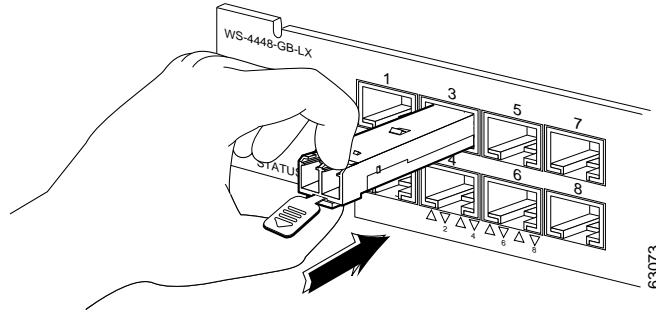
Mylar Tab SFP Modules

The Mylar tab SFP module (see [Figure 5-17](#)) has a tab that you must pull in order to remove the module from a switching module port.

Figure 5-17 Mylar Tab SFP Module

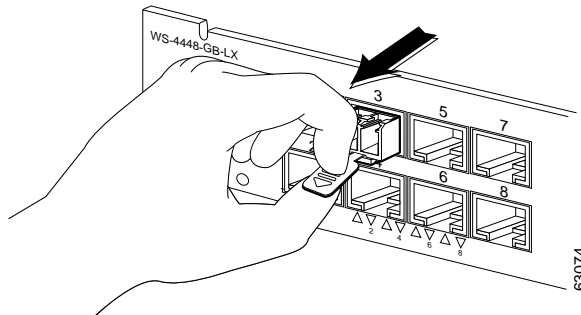


To insert the Mylar tab SFP module into a switching module port, line up the SFP module with the port, and slide it into place (see [Figure 5-18](#)).

Figure 5-18 *Inserting a Mylar Tab SFP Module***Caution**

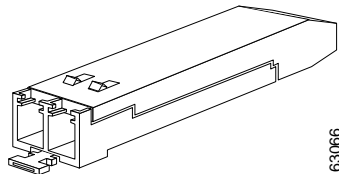
When pulling the tab to remove the SFP module, be sure to pull in a straight outward motion. Do not twist or forcibly pull the tab because you may disconnect it from the SFP module.

To remove the SFP module from the switching module port, pull the tab gently until the SFP module disengages from the port, and then pull the SFP module out (see [Figure 5-19](#)).

Figure 5-19 *Removing a Mylar Tab SFP Module*

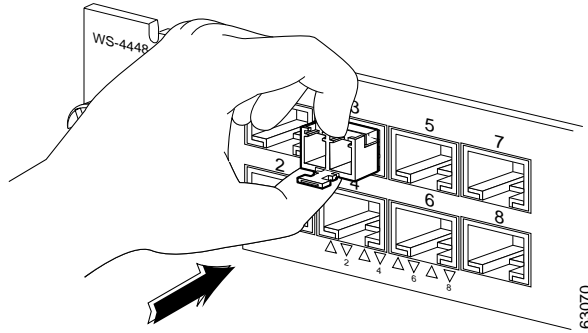
Actuator/Button SFP Modules

The actuator/button SFP module (see [Figure 5-20](#)) has a button that you must push to remove the SFP module from a switching module port.

Figure 5-20 *Actuator/Button SFP Module*

To insert the actuator/button SFP module into a switching module port, line up the SFP module with the port and slide it in until the actuator/button clicks into place (see [Figure 5-21](#)). Be sure not to press the actuator/button as you insert the SFP module because you might inadvertently disengage the SFP module from the port.

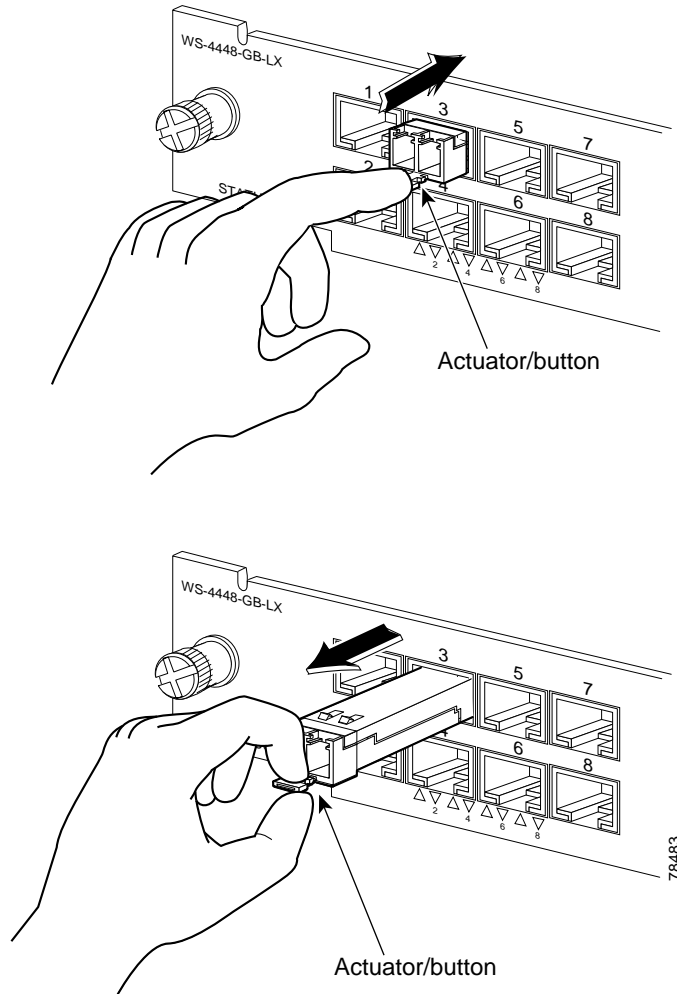
Figure 5-21 Inserting an Actuator/Button SFP Module



To remove an actuator/button SFP module from a switching module port, perform the following steps:

-
- Step 1** Gently press the actuator/button on the front of the SFP module until it clicks and the latch mechanism activates, releasing the SFP module from the port (see [Figure 5-22](#)).
 - Step 2** Grasp the actuator/button between your thumb and index finger and carefully pull the SFP module from the port.

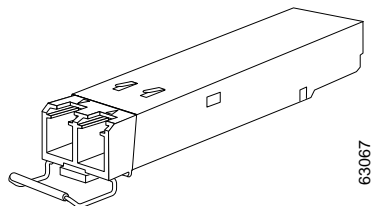
Figure 5-22 Press the Actuator/Button to Remove an SFP Module



Bale Clasp SFP Modules

The bale clasp SFP module (see [Figure 5-23](#)) has a bale clasp that you use to secure the SFP module in a switching module port.

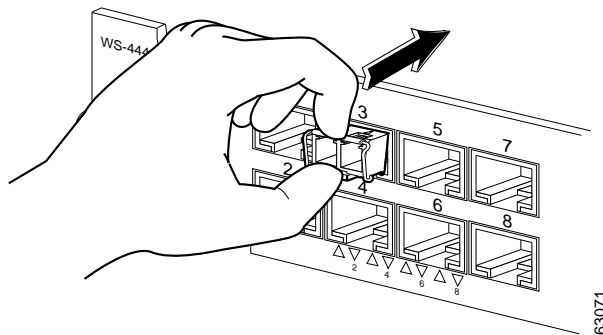
Figure 5-23 Bale Clasp SFP Module



To insert a bale clasp SFP module into a switching module port, perform the following steps:

-
- Step 1** Close the bale clasp in the upward direction before inserting the SFP module.
 - Step 2** Line up the SFP module with the port and slide it into the port (see [Figure 5-24](#)).

Figure 5-24 Inserting a Bale Clasp SFP Module into a Switching Module Port



To remove a bale clasp SFP module from a switching module port, perform the following steps:

-
- Step 1** Open the bale clasp on the SFP module: With your index finger, press the clasp downward as shown in [Figure 5-25](#). If the bale clasp is obstructed and you cannot use your index finger to open it, use a small, flat-blade screwdriver or other long, narrow instrument to open the bale clasp as shown in [Figure 5-26](#).
 - Step 2** Grasp the SFP module between your thumb and index finger and carefully remove it from the switching module port as shown in [Figure 5-25](#).

Figure 5-25 *Removing a Bale Clasp SFP Module*

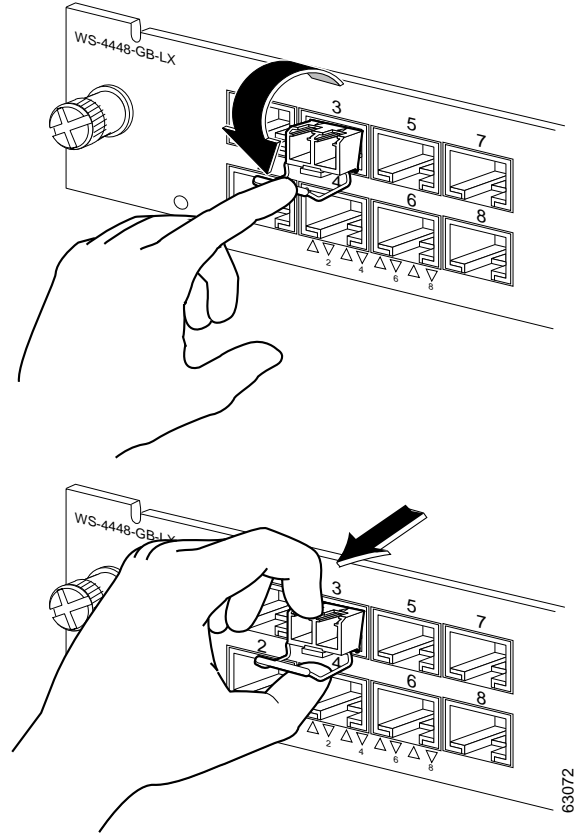
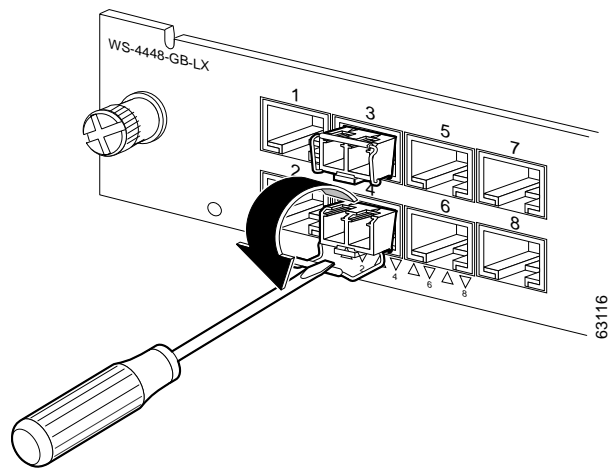


Figure 5-26 *Opening a Bale Clasp with a Flat-Blade Screwdriver*





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.

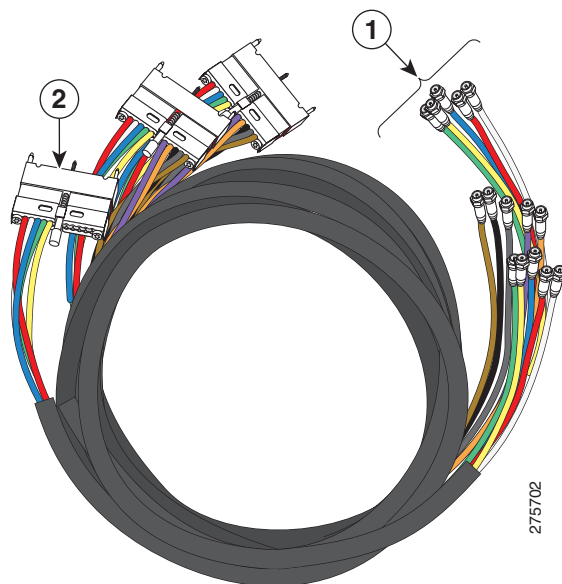


Note

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 separate 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.

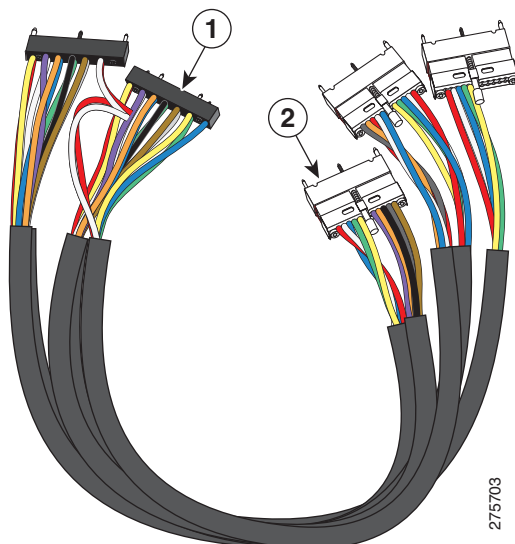
Figure 1 Cable Bundle with UCH2 Units and F Connectors



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.

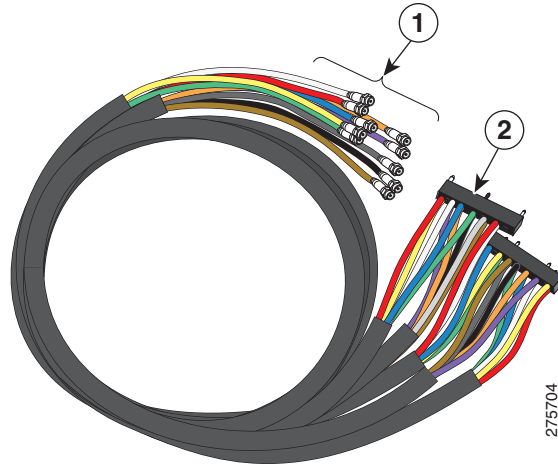
Figure 2 Cable Bundle with UCH2 Units and RF Switch Header Blocks



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



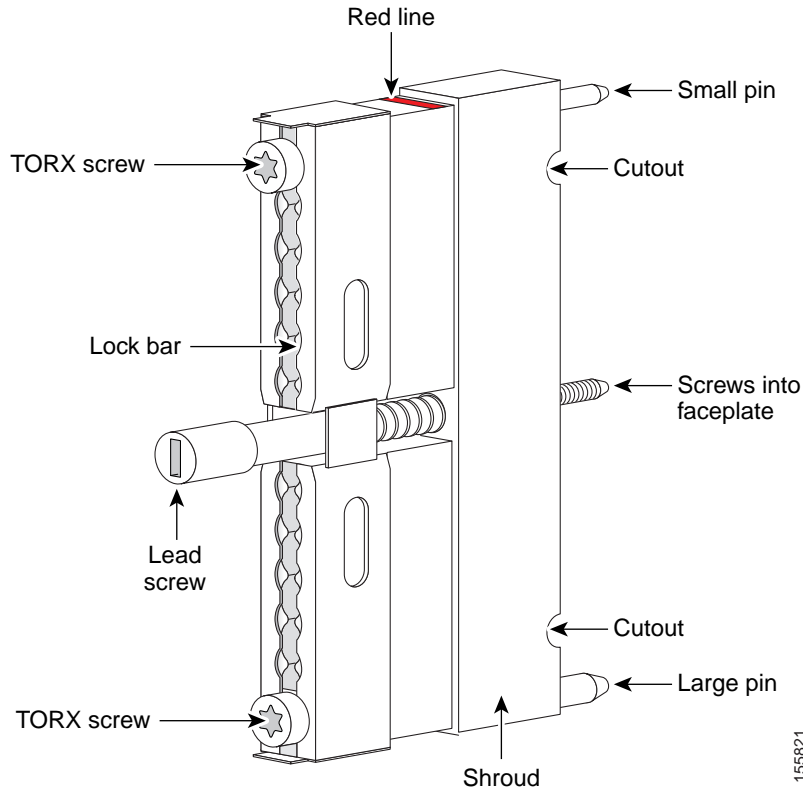
1	F Connectors	2	RF Switch Header Blocks
---	--------------	---	-------------------------


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

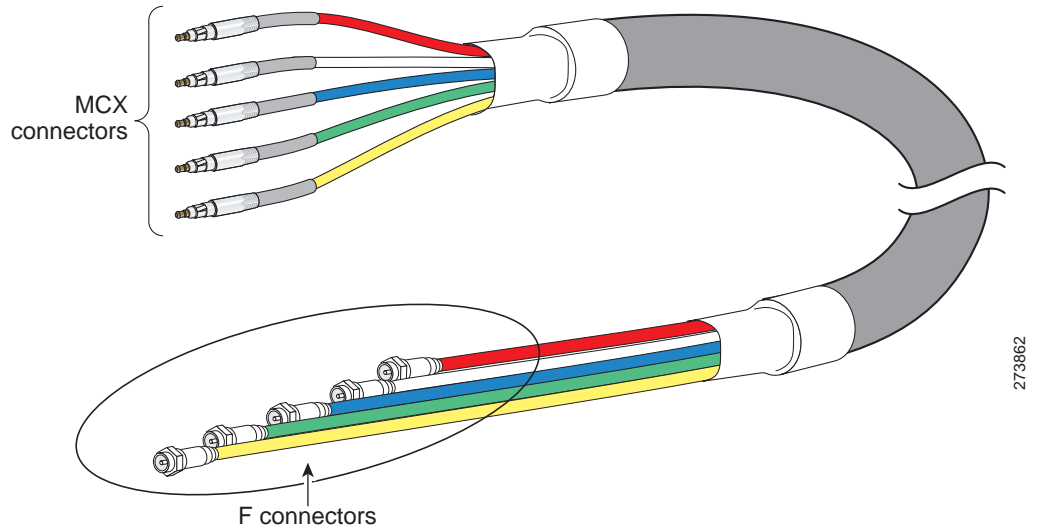
The Cisco RFGW-10 UEQAM coaxial termination must use quad-shielded 75-ohm precision miniature video cable.



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



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-RFGW3G60QTIME, 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.
<ol style="list-style-type: none"> 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. 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. 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. 	<ol style="list-style-type: none"> 1. CAB-RFSW520QTIMF2= 2. CAB-RFSW520QTIMM2= 3. CAB-RFSW520QTPMF2=



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

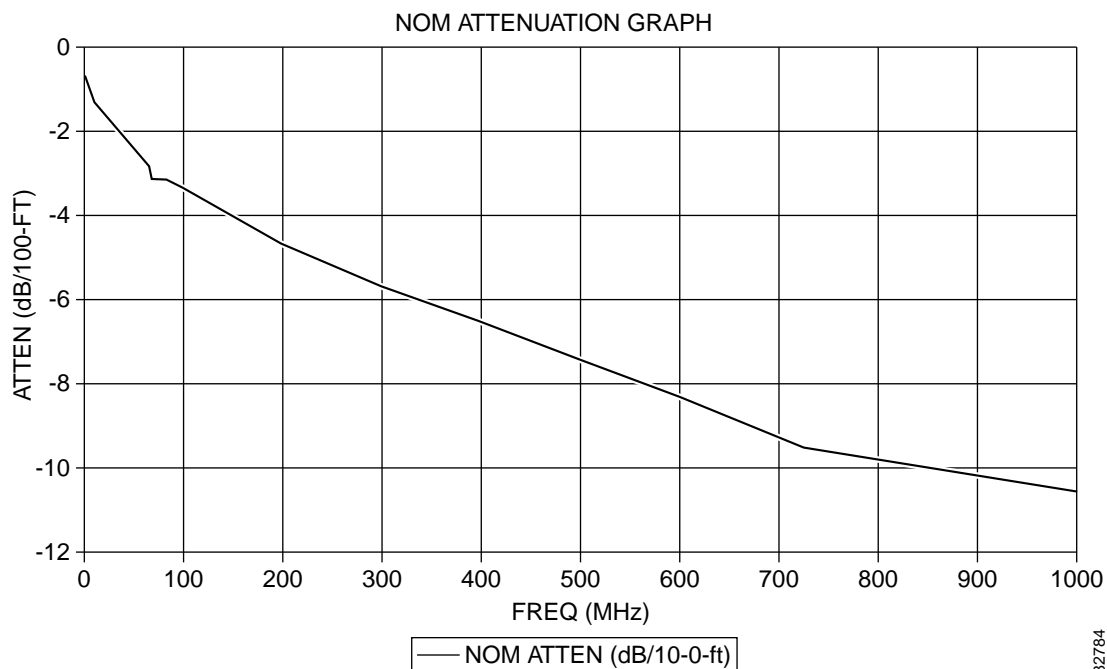
Nominal Attenuation

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	1.43	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



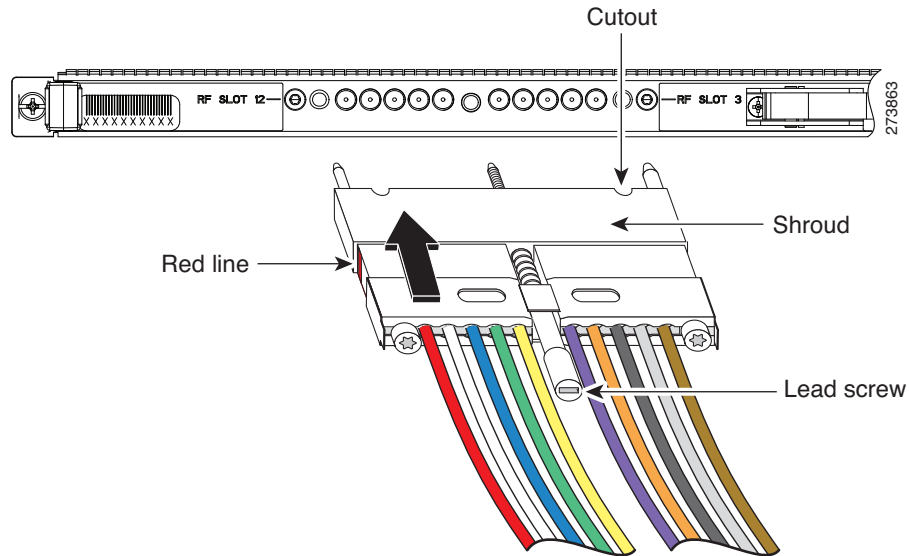
Caution

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:

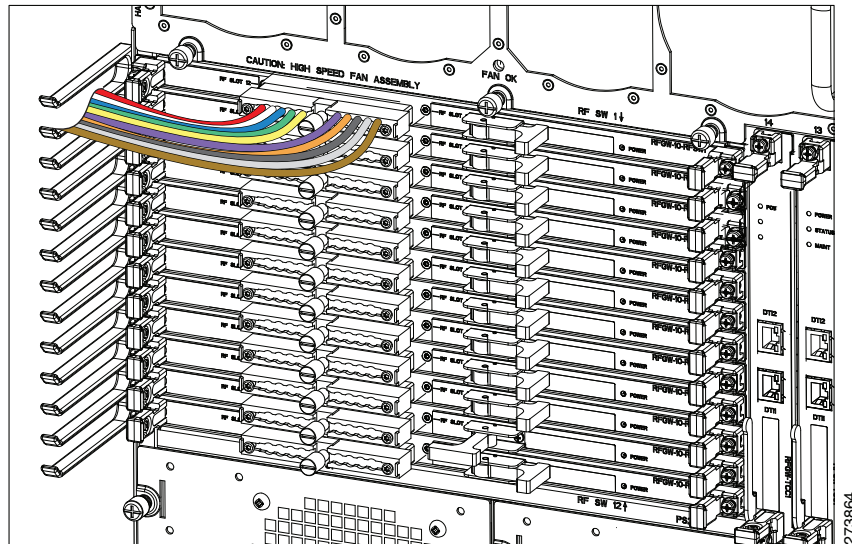
- Step 1** Position the UCH red line to the red line on the RF switch card (see [Figure 6-7](#)).

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.

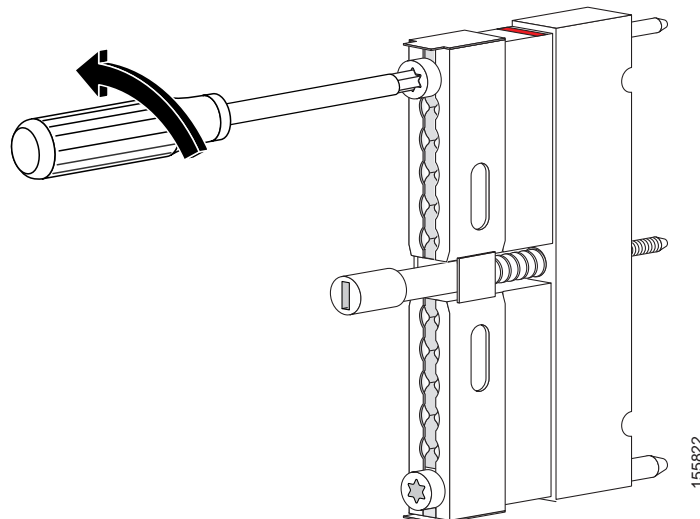
Table 6-3 RF Switch Universal Cable Holder Reference Color Coding

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:

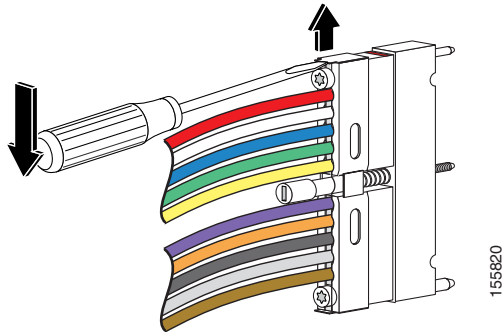
- Step 1** Use the T-10 TORX driver tool to loosen the lock bar on the side where the cable will be installed (See [Figure 6-9](#)).

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

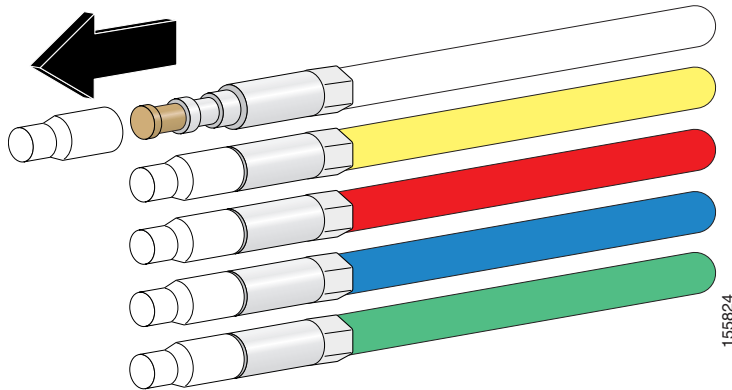
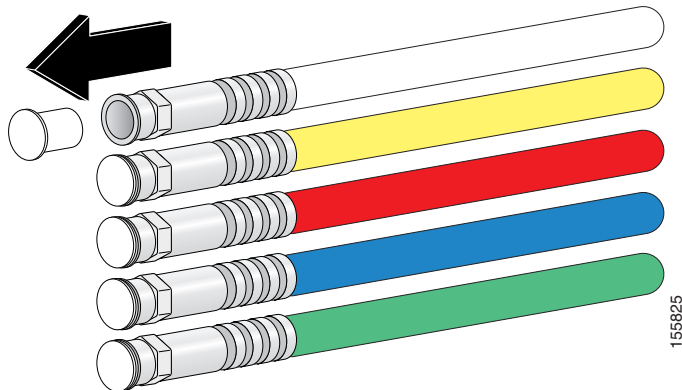
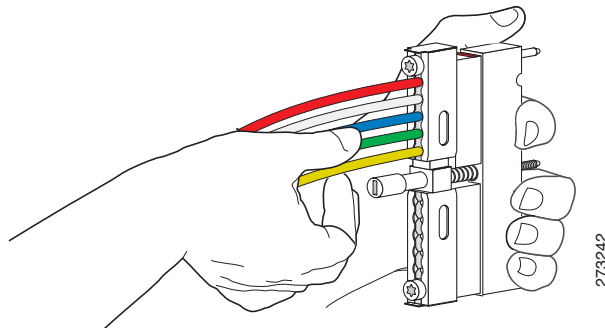


Figure 6-12 Removing an ESD Cap from an F Connector



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

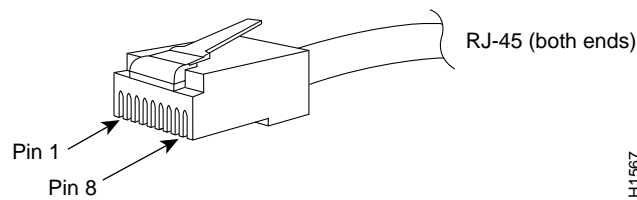
Transceiver Speed (Mbps)	Cable Type	Duplex Mode	Maximum Distance Between Stations
10	Category 3 UTP	Half or full	328 ft (100 m)
10	MMF	Half or full	1.2 miles (2 km)
100	Category 5 UTP	Half or full	328 ft (100 m)
100	MMF	Half	1312 ft (400 m)
100	MMF	Full	1.2 miles (2 km)

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

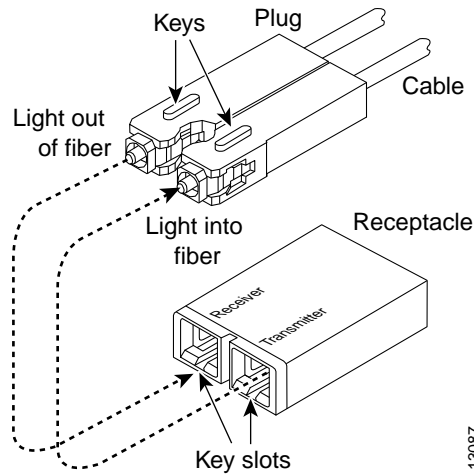
Always keep caps and plugs on the fiber-optic connectors on the cable and the switch when they are not in use.



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



13087

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

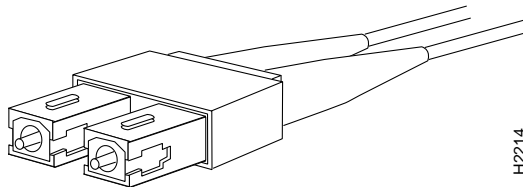
Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments. Statement 1051



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



H2214

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**

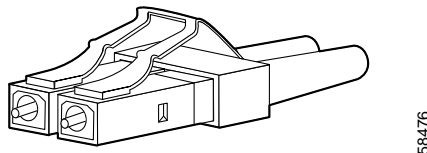
Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments. Statement 1051

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 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, page 6-22](#)
- [Removing the 10-Gigabit Ethernet X2 Transceiver, page 6-24](#)
- [X2 Transceiver Maintenance Guidelines, page 6-24](#)

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:

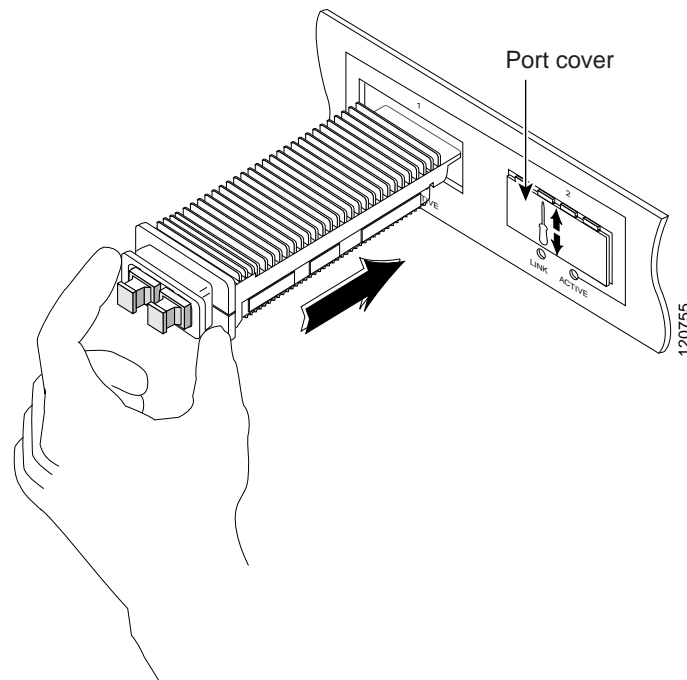
- Step 1** Using a small flat-blade screwdriver, carefully pry the X2 transceiver port cover off the module faceplate. Use the two arrows on the port cover as guides for inserting the screwdriver blade. Save the port cover for future use.
- Step 2** Remove the 10-Gigabit Ethernet X2 transceiver from 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



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

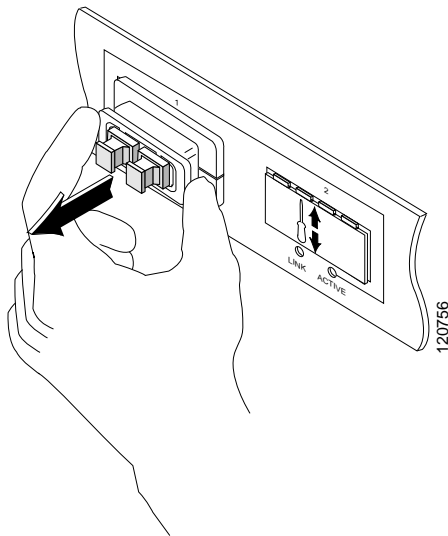


Caution The 10-Gigabit Ethernet X2 transceiver is a static-sensitive device. Always use an ESD wrist-strap or similar individual grounding device when handling X2 transceivers or coming into contact with modules.

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, page 6-25](#)
- [1000BASE-T SFP Modules, page 6-27](#)
- [CWDM SFP Modules, page 6-27](#)

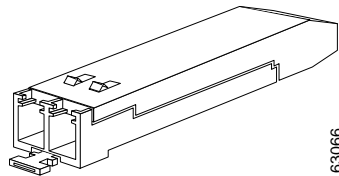
Fiber-Optic SFP Modules

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.

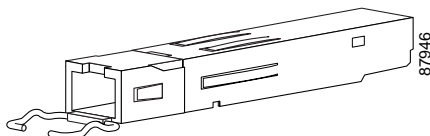
**Note**

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 than 15.43 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](#).

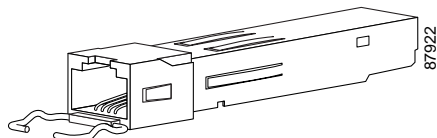
Figure 6-21 MT-RJ Fiber-Optic SFP Module



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 indicate 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 cards.

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:




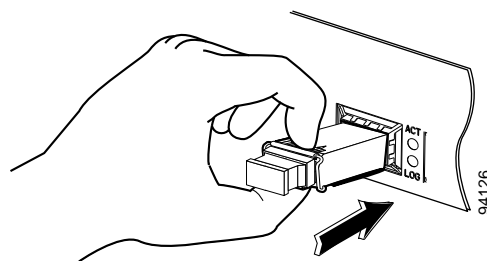
- Step 1** Wear an ESD protective wrist-strap on your wrist and attach the other end to a bare metal grounded surface or an ESD ground connector to prevent ESD damage.
- Step 2** Remove the SFP transceiver module from its protective packaging.
-  **Note** Do not remove the optical bore dust plugs until 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.

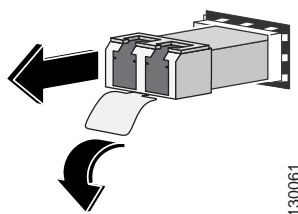
**Tip**

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](#).

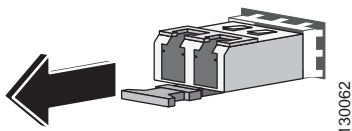
- If the SFP transceiver has a Mylar tab latch, pull the tab gently in a slightly downward direction until the transceiver disengages from the socket connector, and then pull the SFP transceiver straight out of the socket. Do not twist or pull the Mylar tab as you could detach it from the SFP transceiver.

Figure 6-24 *Removing an SFP Transceiver Equipped with a Mylar Tab*



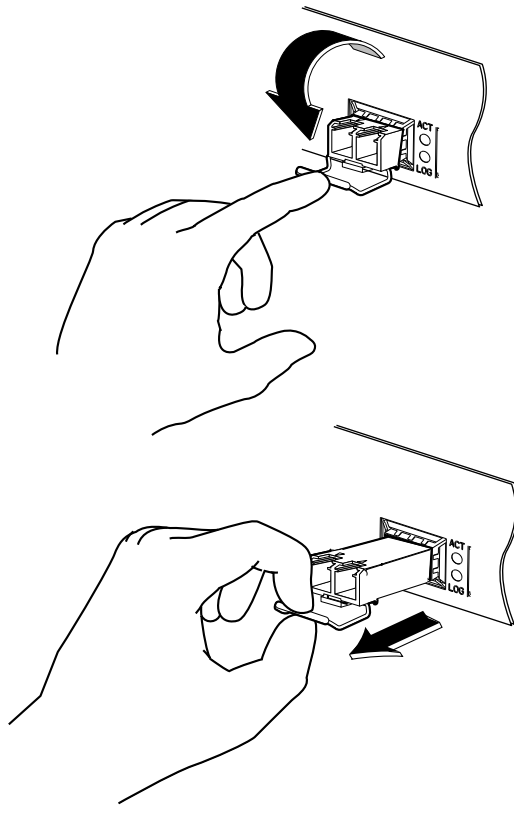
- If the SFP transceiver has an actuator button latch, gently press the actuator button on the front of the SFP transceiver until it clicks and the latch mechanism releases the SFP transceiver from the socket connector. Grasp the actuator button between your thumb and index finger, and carefully pull 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, page 6-37](#)
- [Monitoring a Specific QAM via the ASI Port, page 6-37](#)
- [Configuring the Byte-gap, page 6-38](#)
- [Retrieving ASI Statistics, page 6-38](#)

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
```



Cisco RFGW-10 UEQAM System Specifications

This chapter lists the system specifications and the power requirements for the Cisco RFGW-10 UEQAM.

System Specifications

[Table 7-1](#) lists the system specifications for Cisco RFGW-10 UEQAM.

Table 7-1 Cisco RFGW-10 UEQAM System Specifications

Model/Component	Specifications
Physical specifications	Height: 13RU (22.75 in./577.85mm) Width: 17.30 in. (439.4 mm) without rack-mounts installed. 17.48" (444mm) with rack-mounts installed. Overall Depth: 24.23 in. (612.9 mm) Weight: 275 lb (125 kg) (with dual DC PEMs and RFGW DS-48 line cards)
Supervisor Slots	2 in front of chassis
Universal RF Card Slots	10 in front of chassis
RF Switch Slots	12 in rear of chassis
TCC Slots	2 in rear of chassis
DC PEM	2 PS Bays in rear of chassis
Fan Tray	1 in rear of chassis
Airflow	Front-to-back

Power Requirements

[Table 7-2](#) lists the power requirements for the Cisco RFGW-10 UEQAM.

Table 7-2 Cisco RFGW-10 UEQAM Power Requirements

Component/Attribute	Requirements
Redundant power supply	Dual power supply by default; DC only
Power input	Worldwide ranging DC (–40VDC to –60VDC: –48VDC Nominal)
Power consumption	Maximum (DC): 4536W
Heat Dissipation	4536W (15,474.06 Btu/hour)
Airflow	Front to back flow with 800 CFM exhaust volume (main fan tray + DC PEM fans) at full flow
Operating temperature (nominal)	32 to 104°F (0 to 40°C)
Operating temperature (short-term)	23 to 122°F (–5 to 50°C)
Operating humidity (nominal) (relative humidity)	10 to 85%
Operating humidity (short-term)	5 to 90%
Storage temperature	–40 to 158°F (–40 to 70°C)
Storage (relative humidity)	5 to 95%
Operating altitude	–200 to 10000 feet (–60 to 3050 m)
Altitude, nonoperational: over allowable temperature range	–200 to 30,000 feet (–60 to 9144 m)
Network Equipment Building Standards (NEBS)	GR-1089 and GR-63
EMC standards	
CE marking	

