



Cisco Remote PHY Shelf 7200 Hardware Installation Guide

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CHAPTER 1

Cisco Remote PHY Shelf 7200 Overview

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Introduction

Driven by market evolution towards triple-play services, cable operators in emerging markets are seeking standardized solutions for economical and future proof access technologies. Much of the demand is driven by the need to provide higher bandwidth packet transport for Internet connectivity, video and voice services.

Data Over Cable Systems Interface Standard (DOCSIS®) is a standardized technology for services over cable and thus has strong interoperability between system providers. It also provides robust Quality of Service (QoS) methods, ensuring packet delivery during periods of network congestion.

The Cisco Remote PHY Shelf 7200 is designed to provide a dense, high availability DOCSIS upstream and downstream PHY solution. Cisco Remote PHY Shelf 7200 works in conjunction with a CCAP Core, such as a cBR-8 or cnBR, to create a distributed CMTS. The Cisco Remote PHY Shelf 7200 is fully interoperable with existing HFC infrastructure. The Cisco Remote PHY Shelf 7200 is fully DOCSIS 3.1 compliant.

Benefits

The Cisco Remote PHY Shelf 7200, in conjunction with a CCAP Core, or cnBR, implements a cost-effective, fully D3.1 compliant distributed CMTS solution.

- Reduced investment cost including capital and operational expenditure.
- Greater flexibility in mapping MAC thru-put to service groups.
- CCAP Core or cnBR need not be co-located with HFC optics, reducing local power and space requirement.
- No restriction on Converged Interconnect Network (CIN) network.
- Future-proof architecture. Easy to migrate as the hardware and control functions are on separate layers.
- End-to-end QoS assurance provided by DOCSIS.

- Support for all DOCSIS services.
- Support for existing DOCSIS network provisioning system.
- High access bandwidth.
- High availability.

Architecture Overview

Modular Headend Architecture version 2 (MHA_{v2}) is a set of specifications for Remote-PHY solutions. The Cisco Remote PHY Shelf 7200 acts as the remote PHY system. On one side, the Cisco Remote PHY Shelf 7200 connects to a CCAP Core or V-CMTS via Ethernet. On the other side, it connects to an HFC network via co-ax.

Protocols that form this architecture include:

- Downstream External PHY Interface Decapsulation—Downstream External PHY Interface (DEPI) is a L2TPv3-based protocol that is defined for downstream DOCSIS MAC management and data packets decapsulation. It is unidirectional, that is, from CMTS to Cisco Remote PHY Shelf 7200 system.

DEPI supports:

- IP/User Datagram Protocol (UDP).
- DOCSIS MPT Mode (D-MPT)/Packet Streaming Protocol (PSP).

- Upstream External PHY Interface Encapsulation—Upstream External PHY Interface (UEPI) is a L2TPv3-based protocol that is defined for upstream DOCSIS MAC management and data packets encapsulation. It is unidirectional, that is, from Cisco Remote PHY Shelf 7200 system to CMTS.

UEPI:

- Does not support UDP.
- Supports PSP mode only.
- Supports multiple pseudowires for RNG/BW-REQ/SPECTRUM-MGMT/MAP.

- GCP—Generic Control Protocol, sets up a control plane tunnel over a generic transport protocol such as TCP or UDP. GCP is used to program the Cisco Remote PHY Shelf 7200 system upstream and downstream parameters from the CMTS. It is also used to control the Cisco Remote PHY Shelf 7200 system.

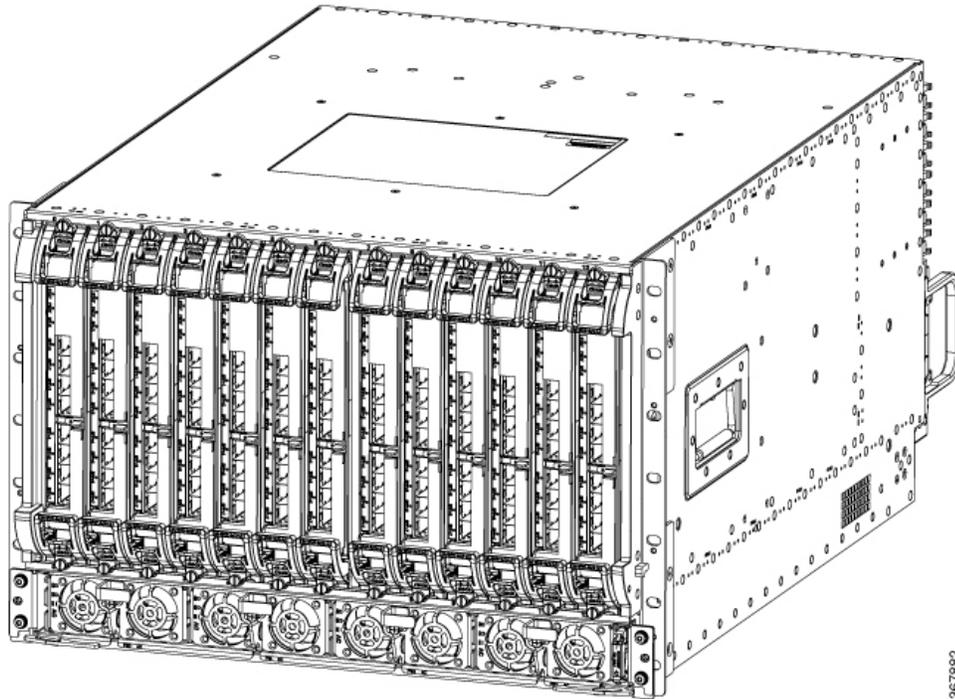
GCP supports:

- TCP/UDP
- DS/US PHY configuration and CMC provisioning/configuration
- Register mode and type, length, value (TLV) mode
- Notification

Cisco Remote PHY Shelf 7200

The Cisco Remote PHY Shelf 7200 is a 7 rack unit (RU) chassis. It supports 13 RPD modules and 6 RF PICs.

Figure 1: Cisco Remote PHY Shelf 7200

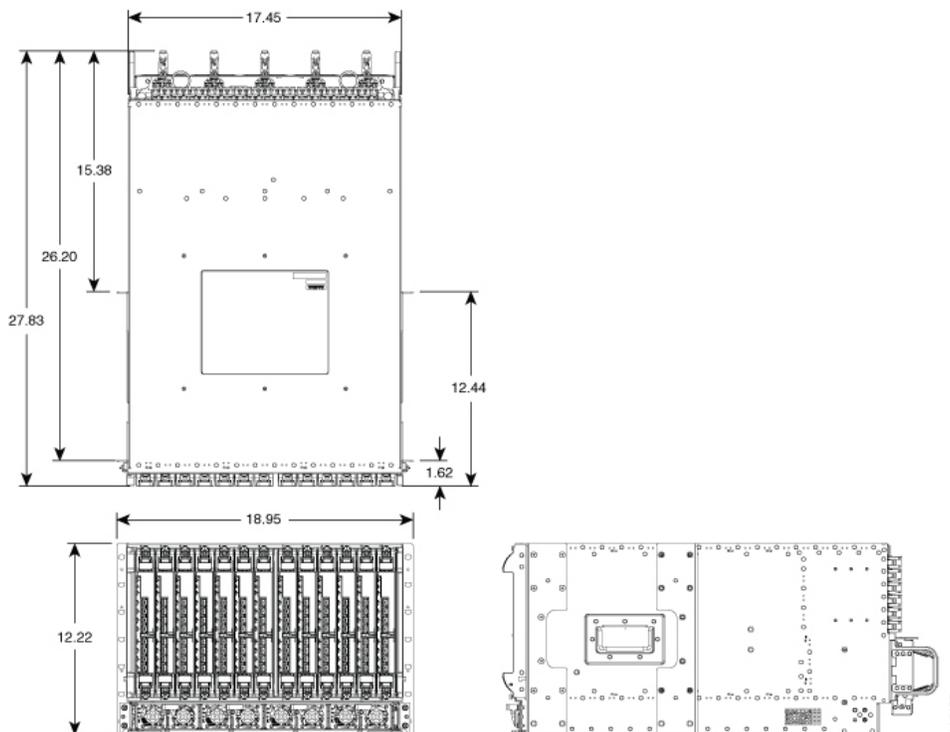


Below are some of the features of the Cisco Remote PHY Shelf 7200:

- Full spectrum DOCSIS 3.0 support
- Full spectrum DOCSIS 3.1 support
- Converged broadcast, narrowcast, and VOD video support
- Out of Band (OOB) signaling support
- Eight 10 GBE SFP + backhaul connectivity (for each RPD line card), can be configured as 4+4 or 6+2 redundant model
- CCAP support

For the Cisco Remote PHY Shelf 7200 described in this document is located at a Headend, Hub or VHUB (Virtual Hub). The output of the Cisco Remote PHY Shelf 7200 feeds a conventional HFC network with analog optical nodes and RF amplifier cascades. The Cisco Remote PHY Shelf 7200 is designed to connect to a CCAP Core or cnBR.

Figure 2: Cisco Remote PHY Shelf 7200 dimensions



The features of the Cisco Remote PHY Shelf 7200 are as follows:

Table 1: Cisco Remote PHY Shelf 7200 features

Feature	Feature Description
Functionality	<ul style="list-style-type: none"> • 72 Service Groups (1x2 ratio) • 1 DS + 2 US per Service Group • 12+1 RF Redundancy
Chassis Size	<ul style="list-style-type: none"> • 72 SG (1x2 ratio) 7RU, 19" Rack Mount Chassis (12.25" H x 17.45" W x 28.83" D) • 13 slots for RPD modules, 72 SG with 12+1 redundancy. • Front optics inputs and rear RF outputs
Power Supplies	<ul style="list-style-type: none"> • Chassis facility power requirement – 4200 W • 2 + 2 redundancy for AC and DC applications
Environment	<ul style="list-style-type: none"> • 0 to 40°C, -60 m to 3048 m (Normal Operation) • 0 to 50°C, -60 m to 4175 m (Extended Operation)

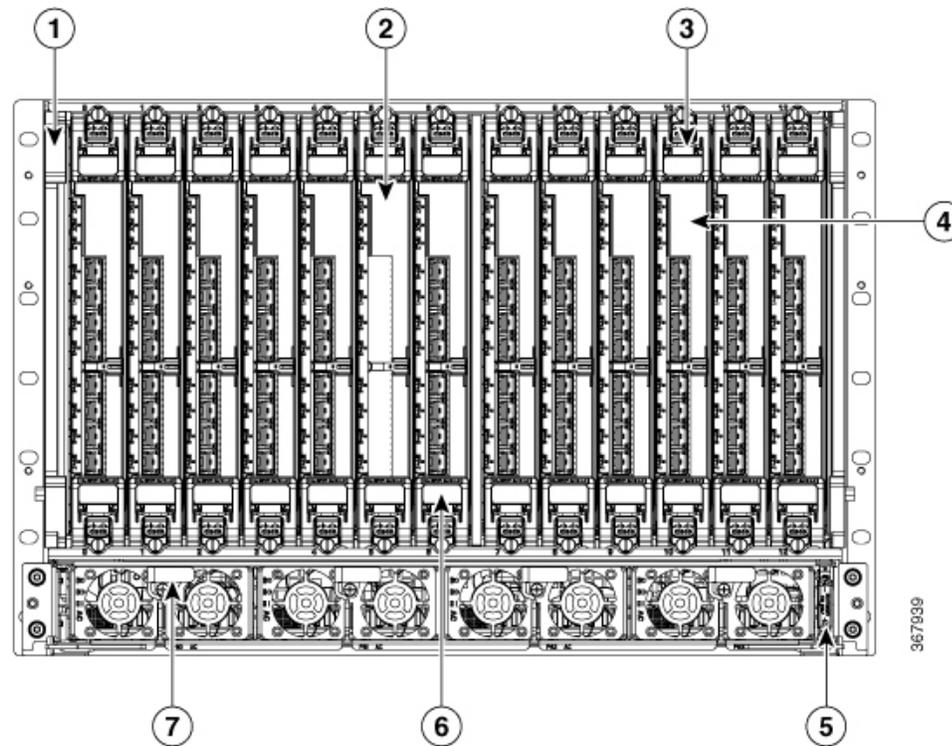
Feature	Feature Description
Simple Software Functions	Higher Availability
SUPless Design	The shelf has no supervisor card; rather one RPD, determined thru arbitration, will provide shelf manager functionality.
RPD Line Card (6x12)	<ul style="list-style-type: none"> • CIN (Converged Interconnect Network) interface: 40G (1+1 redundant) using 8 SFP+ modules • RF interface: 6 DS x 12 US RF ports • Downstream DOCSIS <ul style="list-style-type: none"> • 6 downstream RF ports • Up to 160 QAM narrowcast channels per port • Up to 6 OFDM 192 MHz channels per port • Upstream DOCSIS <ul style="list-style-type: none"> • 12 upstream RF connectors • Up to 12 single-carrier QAM channels per port (5 MHz to 85 MHz) • Up to two 96 MHz OFDMA operations per port (5 MHz to 204 MHz)
PIC Cards (RF Switch)	Provide US/DS RF switching function between dedicated-protect and active RPD Line Card. Simplified to maximize the MTTF (Mean Time To Failure): no SW, firmware or programmable images; just solid state switches, amps and off the shelf I2C chips.
Power Shelf	<ul style="list-style-type: none"> • Utilizes the same cBR8 AC and DC power supply modules • 4200W 2+2 redundant AC/DC Shelf with 4 PEMs

Feature	Feature Description
Fan Controller Card (FCC)	<ul style="list-style-type: none"> • Hot swappable module • Five 80 mm fan modules capable of cooling entire shelf with one fan failure. • System can withstand the temporary fan shelf removal of one minute if fan shelf replacement is needed. • 13 port GE Managed Ethernet Switch [MES] providing inter-RPD connections and misc. system functions e.g. PIC cards control, FAN PWM (Pulse-Wide Modulation) control and more. • Fans can operate without active PWM control – defaults to open loop (fastest speed) • RPD shelf manager arbitration function • Must be present for system to bootup, but once up system can run without the card for limited replacement durations (High availability is not supported as MES is removed).
High Availability	<p>SUPless design, any RPD Line Card (not dedicated protect) can be the shelf manager</p> <p>No service interruption upon:</p> <ul style="list-style-type: none"> • Working RPD Line Card failure – software or hardware • Switch back after software crashes • Replacing bad RPD Line Card • OIR of the working RPD Line Card <p>Consider the following points before getting started:</p> <ul style="list-style-type: none"> • Service interruption is expected upon replacement of PIC card. Plan your work accordingly. • One designated slot for protect module, which can be used as a working slot.
Midplane based design	<ul style="list-style-type: none"> • RPDs, PICs, Fan Control Card and integrated power shelf • Cable Once Capable: No re-cabling RF during RPD module replacement.

Front and Rear View

The following figure shows the front view of Cisco Remote PHY Shelf 7200.

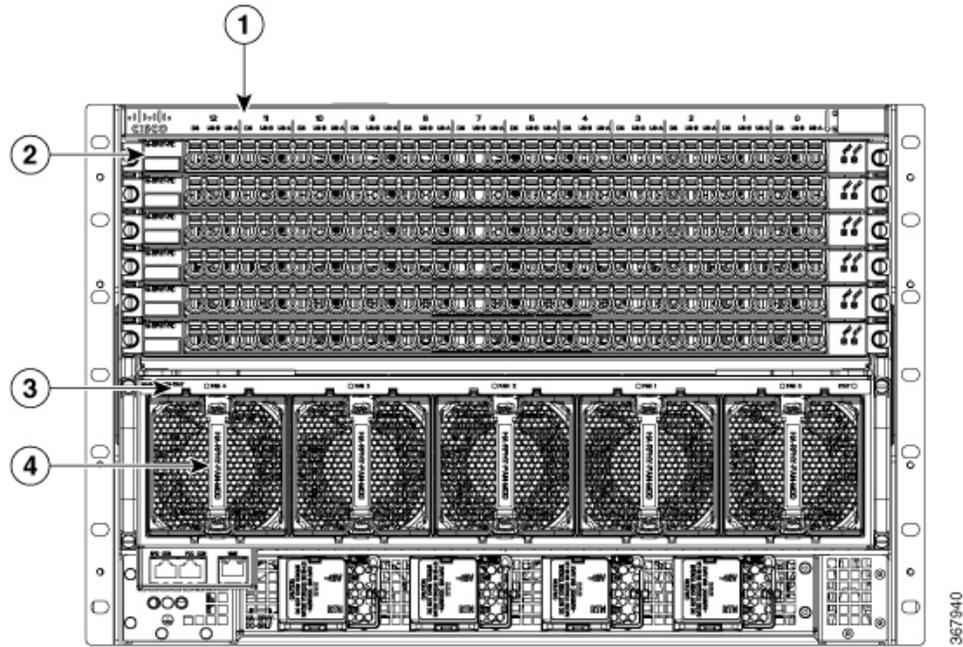
Figure 3: Cisco Remote PHY Shelf 7200 Front View



1	Cisco Remote PHY Shelf 7200 Chassis	2	Cisco Remote PHY Shelf 7200 LC Blank
3	Cisco Remote PHY Shelf 7200 6X12 LC	4	Cisco Remote PHY Shelf 7200 Filter (RPD Air Filter Replacement)
5	System Power ON/OFF switch on the Cisco Remote PHY Shelf 7200-AC-SHLF or Cisco Remote PHY Shelf 7200-DC-SHLF	6	Slot 6 is designated as the redundant RPD
7	CBR-AC-PS Or, CBR-DC-PS		

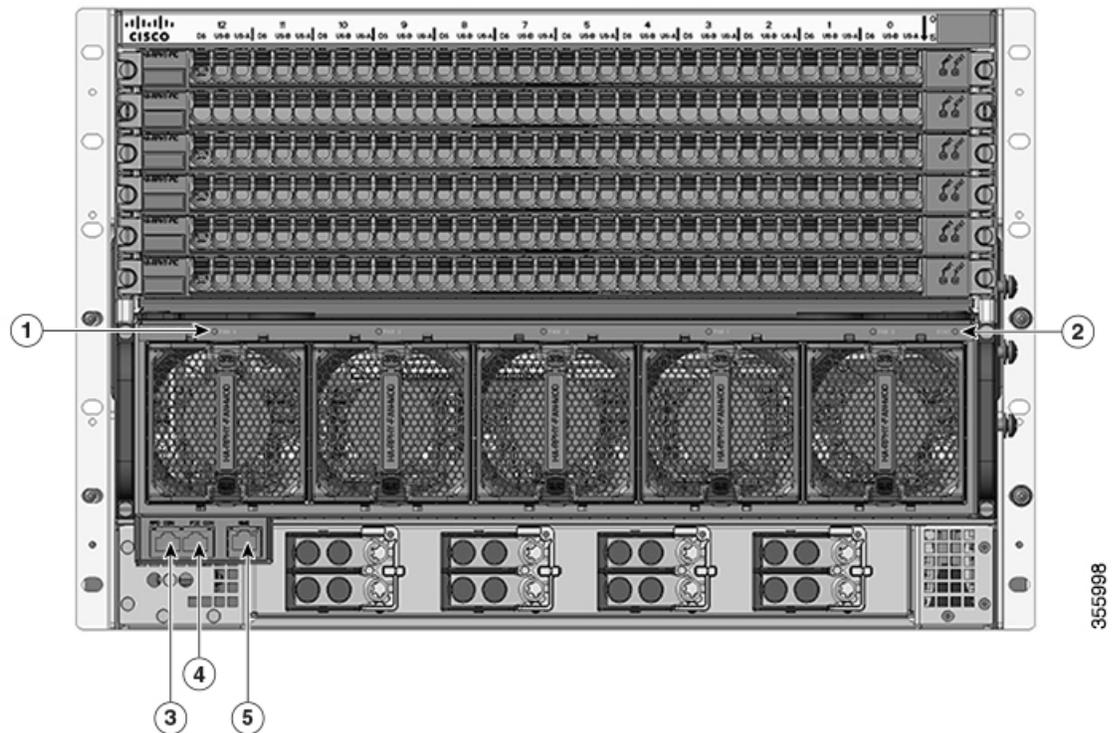
The following figure shows the rear view of Cisco Remote PHY Shelf 7200.

Figure 4: Cisco Remote PHY Shelf 7200 Rear View



1	Cisco Remote PHY Shelf 7200 Chassis	2	Cisco Remote PHY Shelf 7200 PIC
3	Cisco Remote PHY Shelf 7200 Fan Tray	4	Cisco Remote PHY Shelf 7200 Fan Module

Figure 5: Cisco Remote PHY Shelf 7200 LED's and ports



1	Cisco Remote PHY Shelf 7200 Fan Status LED	2	Cisco Remote PHY Shelf 7200 Fan Control Card Status LED
3	Cisco Remote PHY Shelf 7200 RPD Console	4	Cisco Remote PHY Shelf 7200 Fan Control Card Console
5	Cisco Remote PHY Shelf 7200 1 Gbps Network Port		

The chassis has a front-to-rear airflow. Five rear fans modules draw cooling air into the front RPD's in the chassis and across internal components to maintain an acceptable operating temperature. The fans are numbered from 0 to 4, right to left. The fans are hot-swappable.

Four power supplies (AC or DC) are accessed from the front of the chassis and are hot-swappable.

Physical Characteristics

Be familiar with the physical characteristics of the Cisco Remote PHY Shelf 7200 Device Shelf to assist you in placing the system at a proper location.

The following table shows the weight and dimensions of the Cisco Remote PHY Shelf 7200 Device Shelf:

Table 2: Physical Characteristics of the Cisco Remote PHY Shelf 7200

Characteristic	Cisco Remote PHY Shelf 7200 Device Shelf
Height	12.25 in. (31.12 cm) - 7RU
Width	<ul style="list-style-type: none"> • 17.45 in. (44.32 cm) without rack mounts, or mounts reversed • 17.65 in. (44.83 cm) with front rack mounts
Depth	<ul style="list-style-type: none"> • 27.83 in. (70.69 cm) overall excluding cables • 26.20 in. (66.55cm) from front rack mount excluding cables
Weight	271 lbs (123 kg) Maximum Capacity
Airflow	Front-to-back

Power Shelf

The Cisco Remote PHY Shelf 7200 supports AC or DC power supply options. The modular chassis configurations support the installation of four power supplies for 2+2 redundancy, the current sharing feature is supported when two or more power suppliers are installed in the system. When a power supply module fails, or is removed, the other power supply provides power requirements for the chassis. This allows you to hot-swap the power supply modules without impacting the functionality of the system.



Caution

Cisco Remote PHY Shelf 7200 system can support up to four power supply modules, 2+2 redundant. Mixed AC and DC power supply units are not supported in the same chassis and the slots are keyed for AC or DC only depending on the configuration.

The Power Shelves provide the power conversion, filtering, and conditioning from facility input power to the required -54 V midplane power that is used within the chassis. Both AC and DC Power Shelves are available depending on the facility input voltage. These modules have internal fans for cooling.

The Power Shelves are installed in the front of the chassis.

Power System

The Cisco Remote PHY Shelf 7200 Solution chassis is powered using AC or DC power inputs.

The Cisco Remote PHY Shelf 7200 power system supports:

- 2+2 redundancy for the DC power systems and AC power systems
- Online Insertion and Removal (OIR)

Redundancy

- For the DC-powered Cisco Remote PHY Shelf 7200 with 2+2 redundancy, the chassis must have at least two operational DC Power Modules to be functional.

- For the AC-powered Cisco Remote PHY Shelf 7200 with 2+2 redundancy, the chassis must have at least two operational AC Power Modules to be functional.

The physical specifications of the AC and DC shelves are as follows:

Figure 6: AC Power Shelf

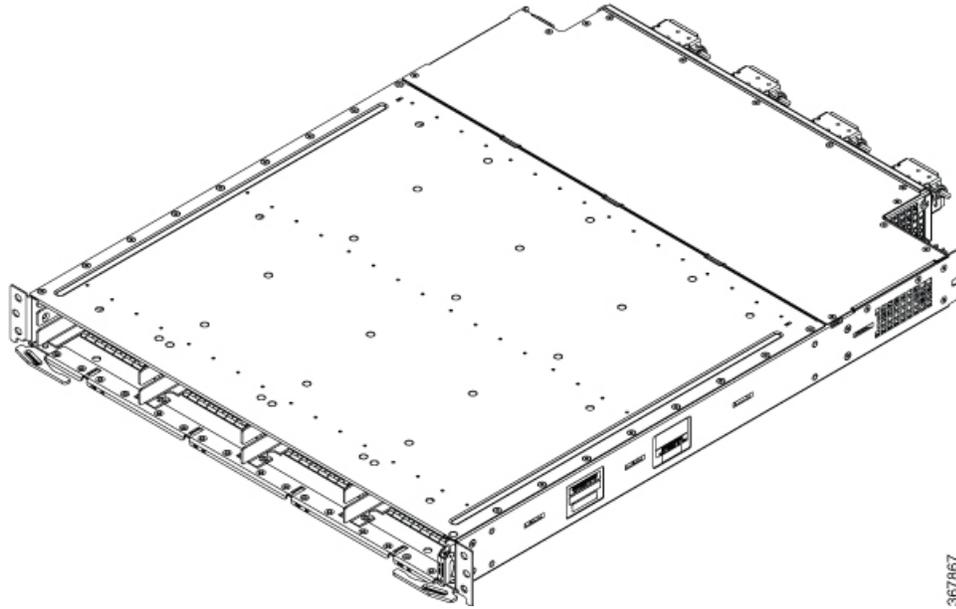
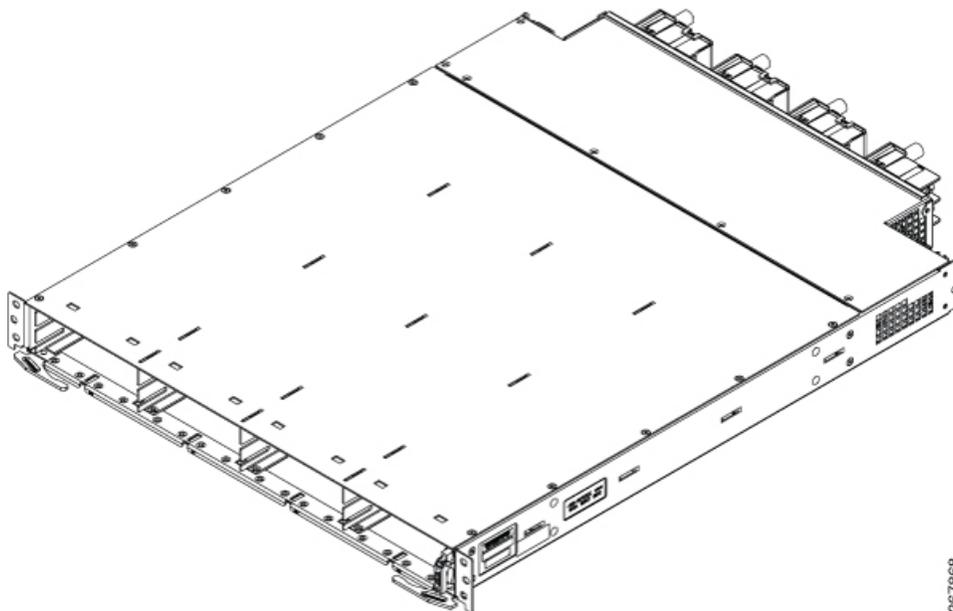


Table 3: Physical Specifications of the AC Power Shelf

Unit	Dimensions
Width	18.59 in (47.21cm)
Height	1.94 in (4.92cm)
Depth	23.72 in (60.24cm)
Weight	14.7 lb (6.67 Kg)

Figure 7: DC Power Shelf



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Table 4: Physical Specifications of the DC Power Shelf

Unit	Dimensions
Width	18.59 in (47.21cm)
Height	1.94 in (4.92cm)
Depth	23.72 in (60.24cm)
Weight	15.1 lb (6.85 Kg)

Power Supply LEDs

Both AC and DC Power Modules have the following LEDs:

- Input power LED—Power input status LED
- Output power LED—Power output status LED
- Fault LED—Fault status LED

The following table describes the power supply LEDs.

Table 5: Power Module LEDs

Function Label	Color	Description	Default State
Input OK	Green	Green when input power is ok, off otherwise. Set by module logic.	Off

Function Label	Color	Description	Default State
Output OK	Green	Green when output power is ok, off otherwise. Set by module logic.	Off
Fault	Red	Red when fault occurs, off otherwise. Set by module logic.	Off

Power Supply Fans

The fans in the power supply module are used for cooling the power supply module. The system-level cooling is provided by fans within the chassis. The power supplies do not depend on the system-level fans for cooling. Fan failure is determined by fan-rotation sensors.



Note The fans in the power supply modules will run when the power supply is plugged in, and even when the chassis power switch is turned-off.

Power Cords

The following table lists the supported power cords.

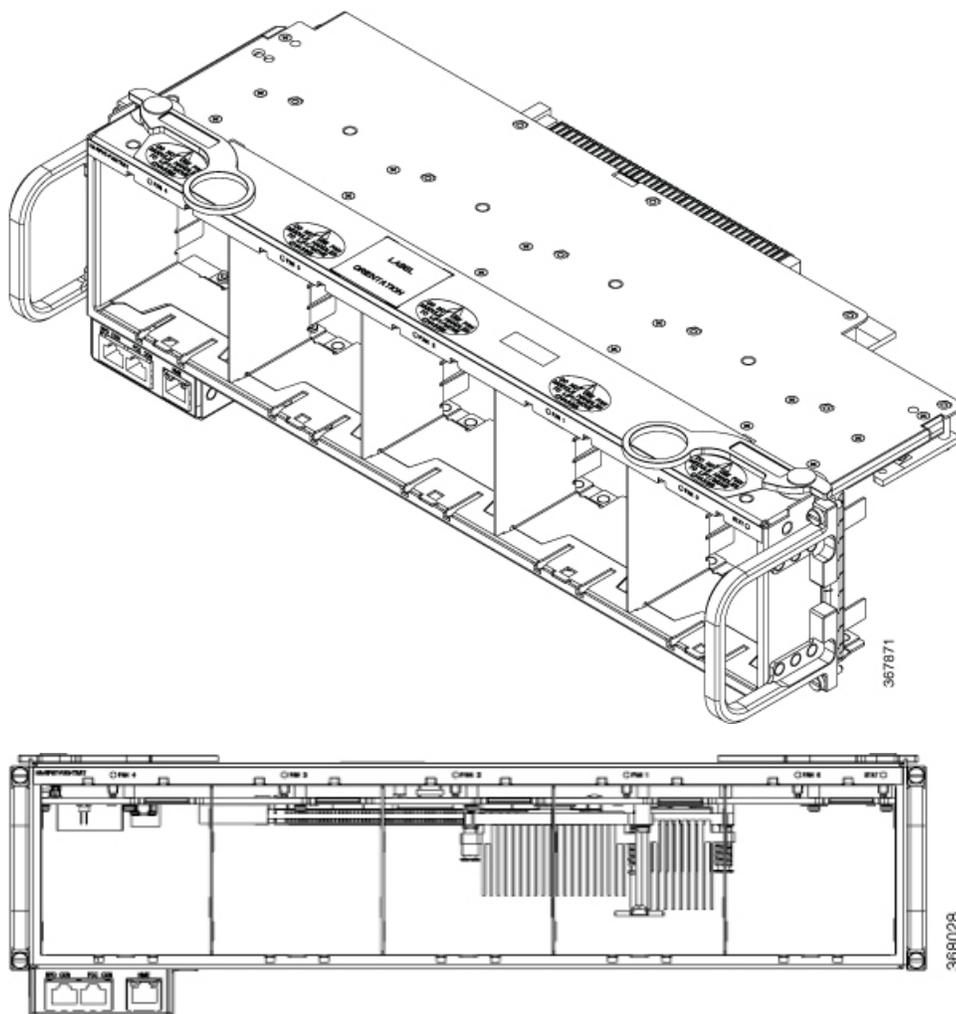
Power Cord Item Number	Description
PWR-CAB-AC-BLK	Power Cord, 20A, C20-C21, BLK
PWR-CAB-AC-ARG	Power Cord for AC Power Module - Argentina, 10A, 250V, 2500mm, -40°C to +85°C
PWR-CAB-AC-AUS	Power Cord for AC V2 Power Module Australia, 10A, 250V, 2500mm, -40°C to +85°C
PWR-CAB-AC-BRA	Power Cord for AC V2 Power Module - Brazil, 10A, 250V, 2500mm, -40°C to +85°C
PWR-CAB-AC-CHN	Power Cord for AC V2 Power Module - China, 10A, 250V, 2500mm, -40°C to +85°C
PWR-CAB-AC-EU	Power Cord for AC V2 Power Module - Europe, 16/10A, 250V, 2500mm, -40°C to +85°C
PWR-CAB-AC-ISRL	Power Cord for AC V2 Power Module - Israel, 16/10A, 250V, 2500mm, -40°C to +85°C
PWR-CAB-AC-ITA	Power Cord for AC V2 Power Module - Italy, 10A, 250V, 2500mm, -40°C to +85°C
PWR-CAB-AC-SUI	Power Cord for AC V2 Power Module - Swiss, 10A, 250V, 2500mm, -40°C to +85°C

Power Cord Item Number	Description
PWR-CAB-AC-UK	Power Cord for AC V2 Power Module - UK, 13/10A, 250V, 2500mm, -40°C to +85°C
PWR-CAB-AC-USA	Power Cord for AC V2 Power Module - USA, 20A, 250V, 2500mm, -40°C to +85°C
PWR-CAB-AC-JPN	Power Cord for AC V2 Power Module - Japan
PWR-CAB-AC-SA	Power Cord for AC V2 Power Module - South Africa

Fan Tray

The Fan Tray is installed at the rear of the Cisco Remote PHY Shelf 7200 and is comprised of the Fan Control Card and associated support enclosure for installation of five fan modules for system level cooling. The fan bays are numbered from 0 to 4 (right to left).

Figure 8: An empty Fan Tray



The faceplate of the Fan Tray has the following LEDs:

Table 6: Fan Tray LEDs:

Function Label	Color	Description	Default State
Fan 0-4	Green	Fan is running ok.	Off
	Yellow	Fan is not running ok.	Off
Status	Green	FCC is up and running (Nemo watchdog is touched).	Off
	Yellow	FCC has detected a fault. Watchdog has timed out setting LED or software crashed with core-dump and sets the LED.	Off

Table 7: Physical Specifications of the Fan Tray (Empty)

Unit	Dimensions
Width	17.45 in (44.32cm)
Height	4.98 in (12.64cm)
Depth	8.38 in (21.28cm)
Weight	5.9 lb (2.68 Kg)

Fan Module

The Cisco Remote PHY Shelf 7200 has five modular Fan Modules installed in the rear Fan Tray to supply cooling air to the system. The bays are numbered from 0 to 4.

The following image shows a Fan Module.

Figure 9: Fan Module

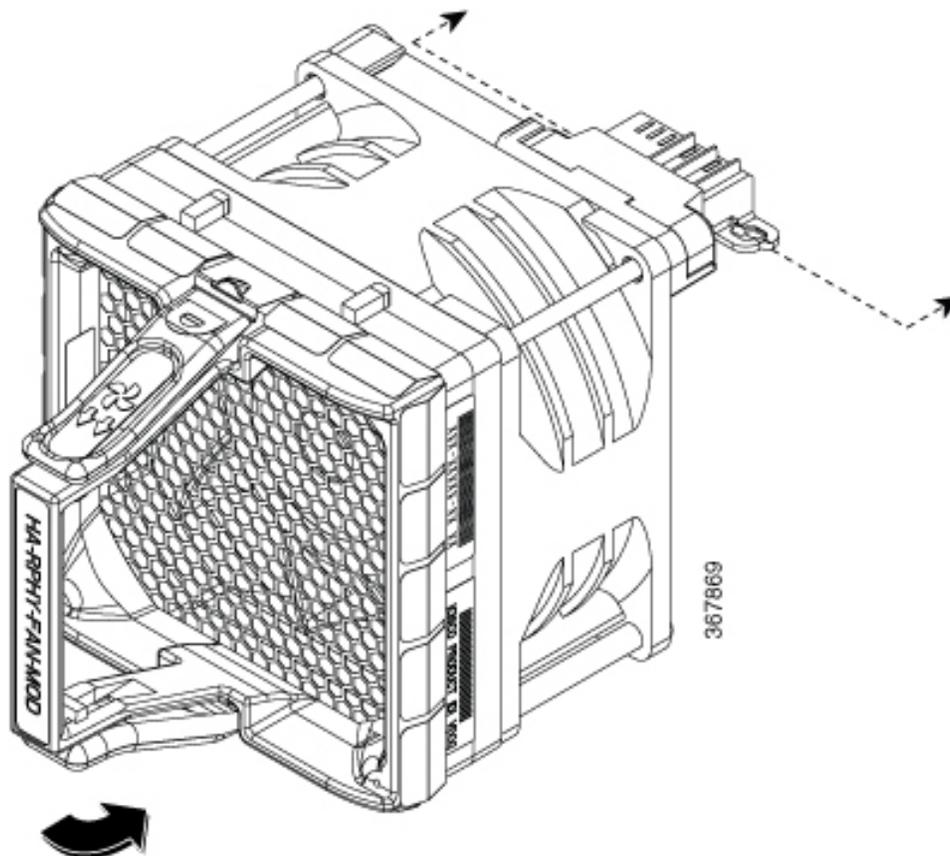


Table 8: Physical Specifications of the Fan Module

Unit	Dimensions
Width	3.38 in (8.58cm)
Height	3.38 in (8.58cm)
Depth	5.14 in (13.05cm)
Weight	0.625 lb (0.28 Kg)

Each Fan Module is comprised of a fan, a handle support structure, EMI containment, and the interface connector to the FCC card. The fans in each module operate at variable speeds as set by the FCC based on inlet air temperature to the system after bootup. Fan speed during bootup are fixed to a default RPM value until the system has properly booted up and the RPDs are able provide temperature data. The multi-Fan Module cooling architecture permits one fan failure or removal at any time during normal operational conditions. All the remaining fans are capable of changing to full speed operation to compensate for the failed fan module.

**Warning**

When the Fan Tray is OIR'd all the Fan Module are removed with it which results in a total loss of cooling air to the system. If a Fan Tray is removed, replace it with a functioning Fan Tray within one minute of the removal in order to avoid critical thermal alarms relating to overheating of individual components.

Shelf Manager

Every RPD in a Cisco Remote PHY Shelf 7200 runs a Shelf Manager service on its local CPU. Each Shelf Manager provides services including software upgrade, configuration download, and status monitor.

A Primary Shelf Manager is elected among all RPDs in an arbitration process that is facilitated by the Fan Control Card (FCC) that is located in the Fan Tray. The Primary Shelf Manager is responsible for all Shelf communication with external devices, as well as interaction with Fan Control Card. The FCC keeps a coherent copy of each RPDs Shelf Manager state at all times.

Keep alive messages are passed between RPD Shelf Managers through EOBC (Ethernet Out-Of-Band Communications). If an RPD goes offline, the other RPDs will be made aware of this by the absence of these periodic keep alive messages. If the RPD hosting the Primary Shelf manager goes offline, a new Primary Shelf Manager will be elected among the remaining Shelf Managers.

The Primary Shelf Manager election protocol essentially promotes the RPD with the lowest IP address to Primary Shelf Manager status. This election process is dependent on EOBC via the Fan Control Card.

When an RPD is inserted, the Shelf Manager on the newly installed RPD will detect the system elected Primary Shelf Manager by monitoring keep alive messages from Primary Shelf Manager. If there is no existing Primary Shelf Manager on chassis, this new inserted Shelf RPD Shelf Manager will be the Primary Shelf Manager.

All RPDs monitor the presence of the Fan Control Card through a dedicated presence pin. If the Fan Control Card is removed, all RPDs will be aware of this event. In this situation, IPC connections between Shelf Managers will fail and each RPD will continue to operate independently. LCHA failover is not supported in this condition.

The following functions need to be met for the Shelf Manager:

- **Keep alive:** After IPC communication between shelf line cards and Fan Control Card setup, there will be keep alive messages between shelf managers, and keep alive between primary shelf manager and Fan Control Card manager. This keep alive message is software process level message used to tracking IPC connections between shelf line cards and Fan Control Card. It also used for primary shelf manager role notification. If keep alive messages between primary shelf manager to shelf managers are lost, primary shelf manager election function will be executed and a new primary shelf line card manager will be elected.
- **Software upgrade:** There are two methods for a software upgrade. One is through CLI, another is through SSD. For CLI upgrading, only the Primary Shelf Manager located on the Shelf Line Card CLI will accept software upgrade operation. Upgrade operations on other Shelf Line Card CLI will be redirected to the Primary Shelf Manager located shelf line card CLI. Primary shelf manager will get the bundle image from CCAP or server side depend on configuration, then dispatch the bundle image to Fan Control Card. The Fan Control Card will power off the shelf line cards and reload self to achieve software upgrade operation.
- **Status collection:** Primary Shelf Manager collects the status information on all Shelf Line Cards, RPDs and Fan Control Cards.

- **Reload shelf line cards:** After the Primary Shelf Manager receives the reload command from CLI, the Primary Shelf Manager will send IPC to all cards including the Fan Control Card. The Fan Control Card will reload all cards after 30 seconds.
- **Configuration download:** The shelf chassis-related configuration is stored on each shelf line card. The Primary Shelf Line Card will collect Shelf Line Cards configuration and Fan Control Card related settings. Every time the Shelf Line Card has a configuration change, it will trigger the Shelf Manager by sending IPC to the Primary Shelf Manager to do the configuration sync, and the configuration will send a copy to Fan Control Card through Primary Shelf Manager.

Digital Midplane

The Digital Midplane provides connections between the RPDs, Fan Control Card, PICs and the Power Shelf cable harness. It also provides the -54V and 5V AUX voltage distribution. Unlike other cable chassis, there is no ACT2 on the Midplane storing MAC addresses. The Midplanes highest signal rate is just 1Gbps, and no RF goes through the Digital Midplane.

RPD

The Remote PHY Device (RPD) is a DOCSIS 3.1 PHY with logic allowing it to operate remotely from the MAC. RPD controls the power, clock, data-plane, control, and the dejitter buffer.

The Cisco Remote PHY Shelf 7200 Line Card has the following features:

- Compliance to DOCSIS 3.1 specification
- 12 US RF ports
 - US Frequency Range 5 MHz – 204 MHz
 - Support up to 12 ATDMA /8 ATDMA+4 SCDMA per port
 - Support up to 2 OFDMA (96 MHz) Receivers per port
 - Spectrum management (FFT)
- 6 DS RF ports
 - DS Frequency Range: 54 MHz - 1.218 GHz
 - 160 QAM per port
 - 6 OFDM min 24 MHz and max 192 MHz channel width per port
 - RF Monitoring: D3.0 Tuner/demod with RF power, MER, BER report
 - DOCSIS/Video de-jitter buffer (20 ms (+/-10 ms) at 60 Gbps)

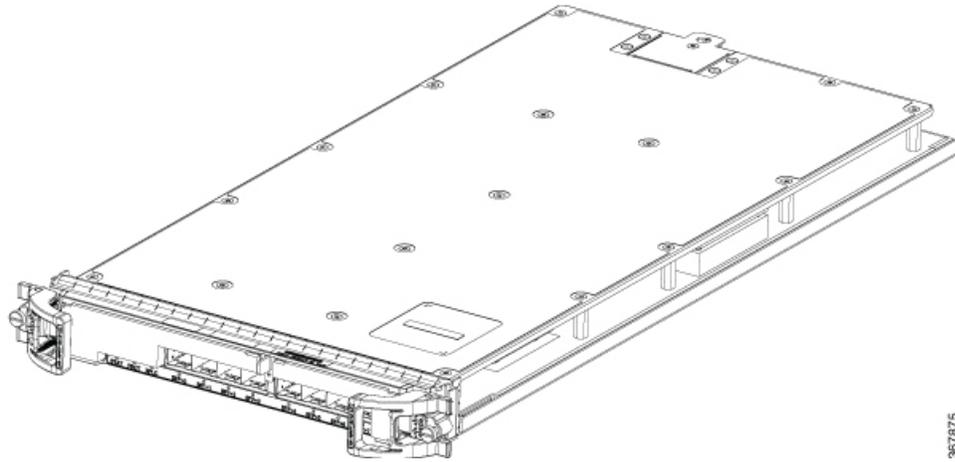
The RPD Data-plane provides a connection between the WAN side 10Gbps Ethernet and the HFC side RF ports.

Up to 40 Gbps of DS data enters through four of the SFP+ modules. The remaining four modules provide 1+1 redundancy. Their output is R-DEPI Ethernet packets which are forwarded to a de-jitter FPGA, providing buffering and rate shaping of video stream packets.

The R-DEPI packets are sent to the DS PHY chip which performs interleaving, FEC, symbol mapping, RF modulation and upconversion. Finally, the DS RF is amplified and filtered by the DS RF block at which point it exits the RPD to the RF PIC. For the US path, the RF enters the card from the PIC and is then filtered and amplified by the US RF circuitry. It is then demodulated by the PHY chip and converted to R-UEPI packets. These packets are sent to the dejitter buffer providing buffering for the SFP+ interfaces. Finally, the four active SFP+ transmit the packets to the remote MAC across the network.

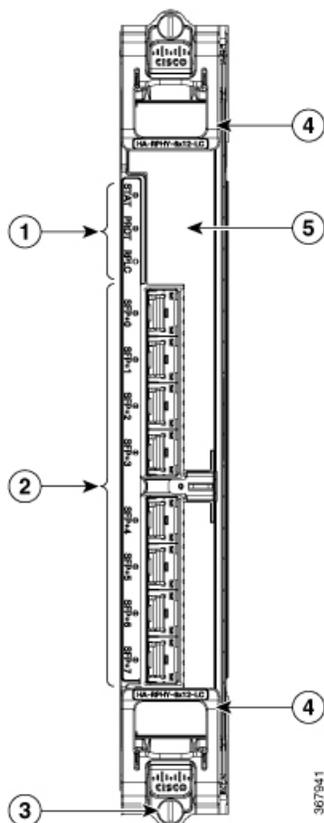
The following image shows an RPD.

Figure 10: RPD



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Figure 11: RPD Front view



1	Status LED's	2	8x SFP + Ports
3	Captive Screws	4	Ejector
5	Field Replaceable Air Filter (HA-RPHY-FILTER)		

The following table provides information on the RPD LED's.

Table 9: RPD Section LED's

Nomenclature	Color	Indication
STAT-Status	Off	U-boot corrupted or no power.
	Blinking green	U-boot is booting kernel.
	Solid green	Card is operational.
	Blinking yellow	Card is in U-boot.
	Solid yellow	Card is up, but HA fault has been detected.

Nomenclature	Color	Indication
PROT-Protect	Off	Line card is not a protection card, or no power.
	Solid green	Line card is a protection card, and is actively protecting (passing live traffic).
	Solid blue	Line card is a protection card, and the card is standing by to protect.
RPLC-Replace	Off	Line card does not require replacement.
	Solid white	Line card requires replacement.
SFP+ 0~7	Off	Link not up & SFP + module present or no power.
	Solid green	10G link is up
	Solid yellow	No SFP + module present

PIC

The PIC card uses solid-state switch to create a switching path between the dedicated protect RPD in slot 6 and the 12 other RPDs in the Cisco Remote PHY Shelf 7200 chassis. This is for US and DS. The switching path is configured by the shelf as part of the HA process. For example, a failure of RPD_4 would cause the Shelf Manager to configure the PIC switches to replace its RF I/O with that from the dedicated protect RPD. The PIC also has hardware to help check RF signal path integrity by both monitoring the DS and inserting an RF test signal on the US.

The PIC has a single point of failure. To maximize the MTTF of the PIC, it must be kept as simple as possible. The Cisco Remote PHY Shelf 7200 PIC uses solid-state switches in place of the mechanical relays used on previous generation PICs. Also, it does not have any programmable devices nor CPUs, but rather simple I2C I/O expanders. The new PIC has no firmware images to support.

Figure 12: Cisco Remote PHY Shelf 7200 PIC

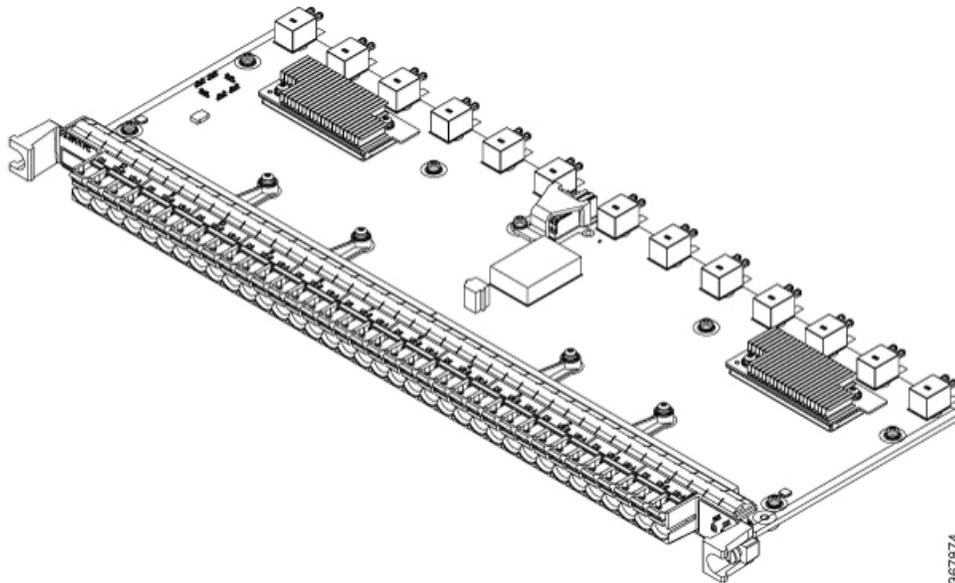


Table 10: Physical Specifications of the PIC

Unit	Dimensions
Width	17.36 in (44.09cm)
Height	0.82 in (2.08cm)
Depth	6.56 in (16.66cm)
Weight	3.1 lb (1.41 Kg)

The features of the Cisco Remote PHY Shelf 7200 PIC are:

- Surge protector
- Demodulator
- Power meter
- US test signal
- Solid-state switches 2:1, 6:1
- DS RF amp for better return loss matching
- MES in control of all PIC functions through I2C control
- Simplified power design and power sequencer
- DS at MCX connector meets the DOCSIS 3.1 RF specification
- ACT2 PID

- FLASH holding calibration data
- No firmware upgradeable images
- US and DS ports accept 75 Ohm compression type MCX connectors

Table 11: PIC Section LED's

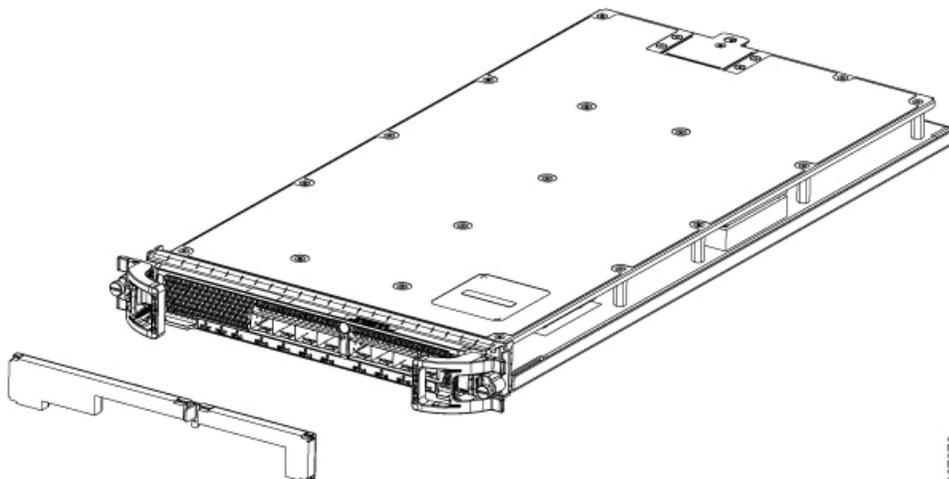
Function Label	Color	Description	Default State
Status	Green	Board is operating normally, no faults detected.	Off
Status	Amber	Card is up, but fault has been detected.	Off
Protect	Blue	Card is in Protect (failover) mode whereby the RF from the protect RPD is connected to the cable plant.	Off

PIC RF connections connect directly to the RPDs. The digital connections come from the MES through the Digital Midplane.

Air Filter

The Air Filter is a field replaceable unit on the Line Cards. It removes dust in the air that is drawn into the router by the cooling fans. We recommend that you examine the air filter at least once a month, or more frequently if required. Do not clean and re-use the Air Filters. They must be replaced when they are clogged or worn out.

Figure 13: Air Filter



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Note You can remove and install an Air Filter (HA-RPHY-FILTER) when the Cisco Remote PHY Shelf 7200 is powered-on and working. The air filters are located on the front of each RPD module.

NEBS Level 3 Compliance

The Cisco Remote PHY Shelf 7200 is designed to meet Network Equipment Building System (NEBS) Level 3 compliance.

How and What to Order

Table 12: Ordering Information for Cisco Remote PHY Shelf 7200 Router

Part Number	Product Description
HA-RPHY	Container PID for configuring the Cisco Remote PHY Shelf 7200
HA-RPHY-6X12-LC	RPD Line Card for Cisco Remote PHY Shelf 7200
HA-RPHY-CHASSIS	Cisco Remote PHY Shelf 7200 Chassis
HA-RPHY-FAN-MOD	Fan Module for Cisco Remote PHY Shelf 7200
HA-RPHY-FAN-TRAY	Fan Tray
HA-RPHY-PIC	RF-PIC for Cisco Remote PHY Shelf 7200 RPD Line card
HA-RPHY-FILTER	Air Filter for the Cisco Remote PHY Shelf 7200
HA-RPHY-AC-SHLF	AC Power Shelf for Cisco Remote PHY Shelf 7200
HA-RPHY-DC-SHLF	DC Power Shelf for Cisco Remote PHY Shelf 7200
HA-RPHY-LC-BLANK	RPD Line Card Blank for Cisco Remote PHY Shelf 7200
CBR-AC-PS	Cisco Remote PHY Shelf 7200 AC Power Supply
CBR-DC-PS	Cisco Remote PHY Shelf 7200 DC Power Supply
HA-RPHY-CBLMG-KIT	Rear cable management kit for Cisco Remote PHY Shelf 7200
HA-RPHY-OCMG-KIT	Front optical cable management kit for Cisco Remote PHY Shelf 7200

Part Number	Product Description
HA-RPHY-PS-BLANK	Power supply blank for Cisco Remote PHY Shelf 7200
HA-RPHY-ACC-KIT	Accessory kit for Cisco Remote PHY Shelf 7200
HA-RPHY-CABLE-RF	RF cable kit for one RPD of the Cisco Remote PHY Shelf 7200

How to Order

To place an order, visit the [Cisco Ordering Home Page](#).



CHAPTER 2

Cisco Remote PHY Shelf 7200 Solution Deployment

- [Design Considerations, on page 27](#)
- [Network Architecture, on page 27](#)
- [Network Topologies, on page 28](#)
- [Network Cables, on page 29](#)

Design Considerations

This section helps you prepare for deploying the Cisco Remote PHY Shelf 7200 solution.

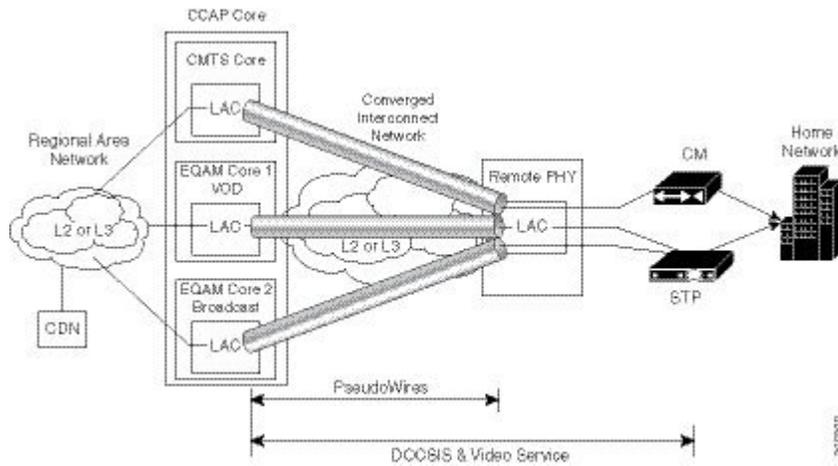
Prerequisites

- Ensure that a digital optical network is deployed between the Cisco Remote PHY Shelf 7200 and Cisco CMTS. The supported digital optical network is Metro Ethernet.
- Ensure that the data path is guaranteed between the Cisco CMTS and the Cisco Remote PHY Shelf 7200.
- Reserve sufficient bandwidth for the DOCSIS traffic.
- Network must support IPv4 multicast forwarding.
- Ensure that the maximum latency is as low as possible.
- Deploy or use the appropriate type of Cisco Remote PHY Shelf 7200 device that is based on the input type in the network.

Network Architecture

The Cisco Remote PHY Shelf 7200 solution supports the *Single Controller Sharing* architecture. In this architecture, multiple Cisco Remote PHY Shelf 7200 Shelves share the downstream and upstream channels of a Cisco RF line card in a Cisco cBR chassis.

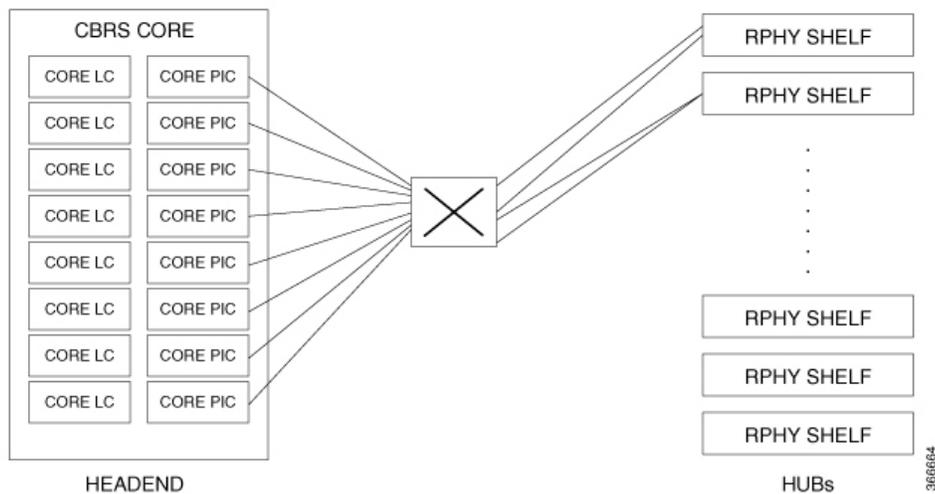
Figure 14: Single Controller Sharing Architecture



Network Topologies

The Cisco Remote PHY Shelf 7200 solution supports Ethernet Based Networking topology.

Figure 15: Standard Deployment



Network Cables

Table 13: Cable Types Supported for the Cisco Remote PHY Shelf 7200

Originating Device	Target Device	Cable Type	Connector Type
CMTS (10-Gigabit Ethernet SFP+ module on the Cisco CCAP line card)	Switch	Ethernet cables	RJ-45 connector
		Copper cables	RJ-45 connector
		Optical fiber	LC Fiber-Optic connector
Switch	Cisco Remote PHY Shelf 7200	Optical fiber	LC Fiber-Optic connector



CHAPTER 3

Preparing for the Installation

Before you install the Cisco Remote PHY Shelf 7200, consider the following:

- Power and cabling requirements that must be in place at your installation sites
- Equipment required to install the Cisco Remote PHY Shelf 7200
- Environmental conditions your installation site must meet to maintain normal operation



Note Do not unpack the equipment until you are ready to install it. Keep the equipment in the shipping container to prevent accidental damage until you determine an installation site.

- [Prerequisites and Preparation, on page 31](#)
- [General Safety Guidelines, on page 33](#)
- [Safety Instructions, on page 33](#)
- [Preventing Electrostatic Discharge Damage, on page 34](#)
- [Plant Wiring Guidelines, on page 35](#)
- [Electrical Equipment Guidelines, on page 35](#)
- [Unpacking and Verifying Shipping Contents, on page 36](#)
- [Chassis-Lifting Guidelines, on page 37](#)
- [General Rack Installation Guidelines, on page 38](#)
- [Site Planning, on page 41](#)
- [Tools and Equipment, on page 45](#)

Prerequisites and Preparation

Before you perform the procedures in this guide, we recommend that you:

- Read the safety guidelines in the next section and review the electrical safety and ESD-prevention guidelines in this guide.
- Ensure that you have all of the necessary tools and equipment.
- Ensure that the power and cabling requirements are in place at your installation site.
- Ensure that the equipment required to install the device is available.

- Ensure that your installation site meets the environmental conditions to maintain normal operation.

Before installing the device, you must consider power and cabling requirements that must be in place at your installation site, special equipment for installing the device, and the environmental conditions your installation site must meet to maintain normal operation.

The shipping package for the device is engineered to reduce the chances of product damage associated with routine material handling experienced during shipment:

- Device should always be transported or stored in its shipping package in the upright position.
- Keep the device in the shipping container until you have determined the installation site.



Note Inspect all items for shipping damage. If an item appears damaged, contact a Cisco customer service representative immediately.



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



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. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device. Statement 1071

SAVE THESE INSTRUCTIONS



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

General Safety Guidelines

Before you begin the installation or replacement procedure, review the safety guidelines in this section to avoid injuring yourself or damaging the equipment.

When you install any component in a chassis, observe all caution and warning statements mentioned in this chapter. For warning translations, see the regulatory compliance and safety documentation that came with this product.

The following guidelines will help ensure your safety and protect the equipment. However, these guidelines may not cover all potentially hazardous situations you may encounter during system installation, *so be alert*.

- Install your product in compliance with the national and local electrical codes. In the United States, this means the National Fire Protection Association (NFPA) 70, United States National Electrical Code. In Canada, Canadian Electrical Code, part I, CC22.1. In other countries, International Electrotechnical Commission (IEC) 364, part 1 through part 7.
- Review the safety warnings listed in the regulatory compliance and safety documentation before installing, configuring, or performing maintenance on the product.
- Disconnect power at the source before you install or remove a chassis.
- Do not attempt to lift an object you might find too heavy to lift safely.
- Keep the chassis area clear and as dust free as possible during and after installation.
- Keep 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.
- Use the product in accordance with its marked electrical ratings and product usage instructions.



Warning

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

Safety Instructions



Note

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



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

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. 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.

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. As you continue to work on your system, periodically touch an unpainted metal surface on the computer chassis.

The 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.
- Handle line cards by faceplates and carrier edges only; avoid touching the card components or connector pins.
- When removing a module, place the removed module component-side-up on an antistatic surface or in a static-shielding bag. If the module is to 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 only on the body; ESD voltages on clothing can still cause damage.
- When transporting a sensitive component, place it in 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 ohms.

**Caution**

Always tighten the captive installation screws on all the system components when you are installing them. These screws prevent accidental removal of the module, provide proper grounding for the system, and help ensure that the bus connectors are properly seated in the backplane. To ensure proper grounding and mechanical support, the captive screws on the front cards should be tightened to 10-12 in-lbs and the rear PIC cards should be tightened to 6-8 in-lbs. Never use cordless or corded drills to tighten screws; power screwdrivers and hand tools are acceptable.

Plant Wiring Guidelines

When planning the location of the new system, consider the distance limitations for signaling, EMI, and connector compatibility, as described in the following sections.

**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.

When wires are run for any significant distance in an electromagnetic field, interference can occur between the field and the signals on the wires. This fact has two implications for the construction of plant wiring:

- Bad wiring practice can result in radio interference emanating from the plant wiring.
- Strong EMI, especially when it is caused by lightning or radio transmitters, can destroy the signal drivers and receivers in this equipment, and can even create an electrical hazard by conducting power surges through lines and into equipment. (Review the safety warnings.)

**Note**

To predict and remedy strong EMI, you may also need to consult experts in radio frequency interference (RFI).

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.

Electrical Equipment Guidelines

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 following guidelines 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 uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
- Use caution when installing or modifying telephone lines.



Warning **Statement 1001**—Work During Lightning Activity

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

Unpacking and Verifying Shipping Contents



Note Save the original Cisco box and packaging in which your equipment was sent and received in.

Before you begin

Read the safety guidelines and review the electrical safety and ESD-preventive guidelines.



Caution Ensure that you are properly grounded with an ESD-preventive wrist strap.



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

-
- Step 1** Inspect the box for any shipping damage. (If there is damage contact your service representative).
- Step 2** Carefully cut the packaging straps that secure the shipping container to the pallet and open the top of the outer shipping container.
- Step 3** Locate and remove the accessory kit. Set the accessory kit aside.
- Step 4** Remove the top foam cap.

- Step 5** Remove the screws that fasten the brackets that are used for attaching the chassis to the pallet using #2 Phillips screwdriver.
- Step 6** Slide the ESD plastic bag off the chassis.
- Step 7** Verify that you have received all of the required and ordered components.

Checking the Shipping Container Contents

Use the components list shown in the following table to check the contents of the Cisco Remote PHY Shelf 7200 shipping container. Do not discard the shipping container. You need the container if you move or have to ship the Cisco Remote PHY Shelf 7200 in the future.

Table 14: Cisco Remote PHY Shelf 7200 Shipping Container Contents

Component	Description
Chassis	Cisco Remote PHY Shelf 7200 is shipped configured as either AC or DC systems with up to 4 power modules.
Accessories Kit Note You must order the Accessories Kit separately if you order the Cisco Remote PHY Shelf 7200 chassis as a spare.	2 Installation Support Brackets 1 Grounding Lug, #4 straight 1 left and 1 right rear RF cable management brackets 8 DC Power Lugs, #4 AWG, 90 deg 2 RF PIC removal tools Sets of screw for: <ul style="list-style-type: none"> • ¼-20 screws for Grounding lug (2 screws (silver) with star washers)
Optional Equipment	Power cords if an AC power supplies were shipped. There are none for the DC power supply units.

Chassis-Lifting Guidelines

The chassis is not intended to be moved frequently. Before you install the system, ensure that your site is properly prepared so that you can avoid having to move the chassis later to accommodate power sources and network connections.

Each time you lift the chassis or any heavy object, follow these guidelines:

- 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.
- Ensure all installed components in the chassis are secured.
- Always disconnect all external cables before lifting or moving the chassis.

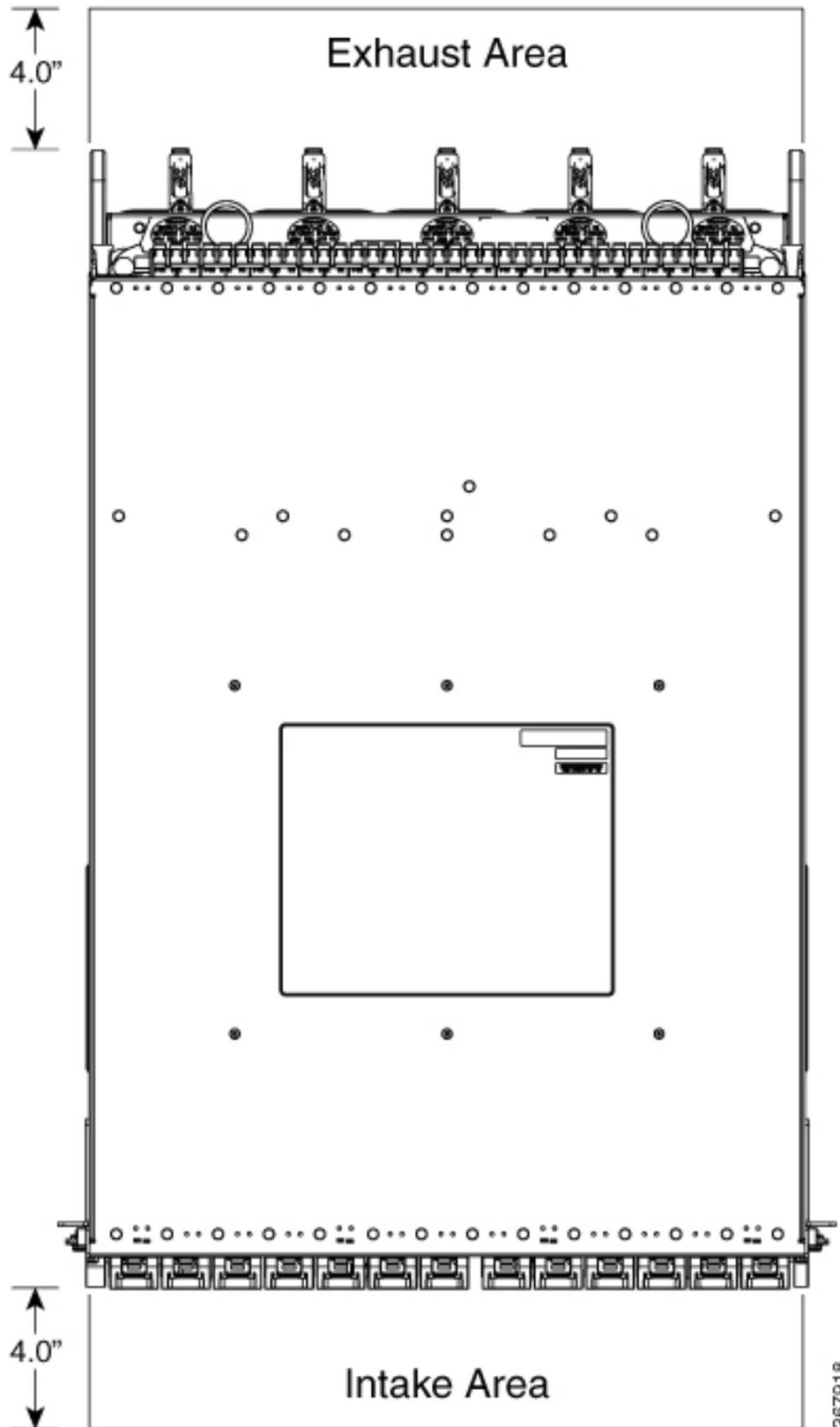
General Rack Installation Guidelines

The Cisco Remote PHY Shelf 7200 can be installed either front or mid rack-mount.

When planning your rack installation, consider the following guidelines:

- The Cisco Remote PHY Shelf 7200 requires a minimum of 7 rack units (12.25 inches or 31.12 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 clearance to remove field-replaceable units.
- Maintain a minimum clearance of 4 inches (10.16 cm) on the front and back sides of the chassis for the cooling air inlet and exhaust ports, respectively. Avoid placing the chassis in an overly congested rack. Also avoid placing large bundles of cables blocking air intakes or exhausts, or directly next to another equipment rack. The heated exhaust air from other equipment can enter the inlet air vents and cause an over temperature condition inside the device.

Figure 16: Minimum Clearance Area



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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 Remote PHY Shelf 7200 in an enclosed space that is not properly ventilated or air conditioned.

- Always install heavier equipment in the lower half of a rack to maintain a low center of gravity to prevent the rack from falling over.
- Install and use the cable-management accessories included with the router to keep cables organized and out of the way of the cards and processors. Ensure that cables from 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.
- Ensure that cables from 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.
- Provide an adequate chassis ground (earth) connection for your chassis.

Site Planning

This section contains site-planning information, and will help you plan for the installation of the Cisco Remote PHY Shelf 7200.

General Precautions

Observe the following general precautions when using and working with the Cisco Remote PHY Shelf 7200:

- 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 cable carefully. Route system cables and power supply cable and plug such 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.
- If you turn off your system, wait at least 30 seconds before turning it on again to avoid system component damage.

Consider the following best practices before installing the Cisco Remote PHY Shelf 7200.

- **Elevated Operating Ambient:** If installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack environment may be greater than room ambient. Therefore, consideration should be given to installing the equipment in an environment compatible with the maximum ambient temperature (T_{ma}) specified by the manufacturer.
- **Reduced Air Flow:** Installation of the equipment in a rack should be such that the amount of air flow required for safe operation of the equipment is not compromised.
- **Mechanical Loading:** Mounting of the equipment in the rack should be such that a hazardous condition is not achieved due to uneven mechanical loading.
- **Circuit Overloading:** Consideration should be given to the connection of the equipment to the supply circuit and the effect that overloading of the circuits might have on overcurrent protection and supply wiring. Appropriate consideration of equipment nameplate ratings should be used when addressing this concern.
- **Reliable Earthing:** Reliable earthing of rack-mounted equipment should be maintained. Particular attention should be given to supply connections other than direct connections to the branch circuit (For example, the use of power strips).



Note For proper installation and grounding of the antenna, refer to national and local codes (for example: U.S NFPA 70, National Electrical Code, Article 810, Canada: Canadian Electrical Code, Section 54).

Site Selection Guidelines

The Cisco Remote PHY Shelf 7200 requires specific environmental operating conditions. Temperature, humidity, altitude, and vibration can affect the performance and reliability of the device. The following sections provide specific information to help you plan for a proper operating environment.

Site Environmental Requirements

Environmental monitoring 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.

Environmental Requirements for the Cisco Remote PHY Shelf 7200

The table below lists the operating and non-operating environmental site requirements. The ranges listed are those within which the equipment continues to operate; however, a measurement that is approaching the minimum or maximum of a range indicates a potential problem. You can maintain normal operation by anticipating and correcting environmental anomalies before they approach a maximum operating range.

Table 15: Specifications for Operating and Non-operating Environments for the Cisco Remote PHY Shelf 7200

Specification	Minimum
Power Consumption	4200W facility power input to the Cisco Remote PHY Shelf 7200
Thermal Heat Dissipation	14330 BTU/hr

Specification	Minimum
Temperature Range	Nominal: 32 to 104°F (0 to 40°C)
	Maximum: 32 to 122°F (0 to 50°C)
Temperature Storage	-40 to 158°F (-40 to 70°C)
Relative Humidity Operational (Maximum)	5 to 90% Note Not to exceed 0.024 kg water per 1 kg of dry air.
Relative Humidity Storage	5 to 95% Note Not to exceed 0.024 kg water per 1 kg of dry air.
Operating Altitude	-200 to 13,700 ft (-60 to 4175m)

Electrical Circuit Requirements

Each Cisco Remote PHY Shelf 7200 requires a dedicated electrical circuit for each power module. If you equip it with multiple power supplies, you must provide a separate circuit for each power supply to avoid compromising the power redundancy feature.

The Cisco Remote PHY Shelf 7200 can be powered by a DC or AC source. Ensure that equipment grounding is present and observe power-strip ratings. Make sure that the total ampere rating of all the products plugged into the power strip does not exceed 80 percent of the rating.



Note The Cisco Remote PHY Shelf 7200 can support four AC or four DC power supplies. The Cisco Remote PHY Shelf 7200 does not support mixed AC and DC power supply units in the same chassis.

The following table contains specifications for DC-powered systems for the Cisco Remote PHY Shelf 7200.

Table 16: Cisco Remote PHY Shelf 7200 DC Power Supply System Input Requirements

System Input Rating (in A)	Circuit Breaker (in A)		AWG # Wire	
	Minimum	Maximum	Minimum	Maximum
60 A per DC Power Module	Always 60 A		AWG #4 or AWG #6	AWG #2 ²



Note If AWG #2 wire is used for DC power module connections, the chassis ground wire must also be upgraded to an AWG #2 wire and connector.

The following table lists AC and DC power supply system rating requirements for the Cisco Remote PHY Shelf 7200.

Table 17: AC and DC Power Supply Specifications for the Cisco Remote PHY Shelf 7200

Description	Specification
Power supply voltage range	AC = 180 to 264 VAC DC = -40 to -72 VDC
Power supply declared ratings	AC = 200 to 240 VAC DC = -48/-60 VDC
Line frequency rating	50/60 Hz for AC power supplies

Equipment Rack Guidelines

The placement of racks can affect personnel safety, system maintenance, and the system's ability to operate within the environmental characteristics. Choose a proper location for the Cisco Remote PHY Shelf 7200 by going through the guidelines that are listed in the following topics.

Locating for Safety

If the Cisco Remote PHY Shelf 7200 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's center of gravity is as low as possible.

Locating for Easy Maintenance

Maintain 4 inch of clearance from obstructions (or any cluttered cables) to the front intake and rear fan exhaust. This space ensures that you can remove the Cisco Remote PHY Shelf 7200 components and perform routine maintenance and upgrades easily.

Avoid installing the Cisco Remote PHY Shelf 7200 in a congested rack and consider how the routing of cables from other pieces of equipment in the same rack might affect access to the device.

The front and top 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 top of the chassis—At least 3 in. (7.6 cm)
- At the bottom of the chassis—At least 0.2 in. (5 mm)
- In front of the chassis and behind the chassis—4 in.

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** and the **show facility-alarm status** commands 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 Remote PHY Shelf 7200 off the floor and out of the areas that collect dust.

- Follow ESD-prevention procedures to avoid damage to equipment. Damage from static discharge can cause immediate or intermittent equipment failure.

Tools and Equipment

The following tools and equipment are recommended as the minimum necessary equipment to install the Cisco Remote PHY Shelf 7200. 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.

Table 18: Tools required for installation

Part	Tools Required
Chassis	<ul style="list-style-type: none"> • ESD-preventive wrist strap • #2 Phillips torque screwdriver
Power Shelf	<ul style="list-style-type: none"> • ESD-preventive wrist strap • T15 Torx driver
Power Module	<ul style="list-style-type: none"> • ESD-preventive wrist strap • 3/16" flat-blade or #2 Philips torque screwdriver
RPD, PIC, Fan Tray	<ul style="list-style-type: none"> • ESD-preventive wrist strap • 3/16" flat-blade torque screwdriver
Fan Module	<ul style="list-style-type: none"> • ESD-preventive wrist strap • No tools are required



CHAPTER 4

Installing the Cisco Remote PHY Shelf 7200

- [Installing the Chassis, on page 47](#)
- [Installing the Fan Tray, on page 63](#)
- [Installing the Power Shelf, on page 69](#)
- [Installing the Cisco Remote PHY Shelf 7200 PIC, on page 75](#)
- [Installing the RPDs, on page 78](#)

Installing the Chassis

The Cisco Remote PHY Shelf 7200 can be either mounted on the rack at the front or in the middle. Also, the router can be either mounted on a standard 19-inch wide four-post equipment rack unit or a two-post rack unit.



Note The Cisco Remote PHY Shelf 7200 fully configured system can weigh up to 271 lbs, components must be removed from the chassis to make the chassis lighter for rack installation. Remove all front power modules and front RPD cards for rack mounting to reduce the weight. The PIC cards and Fan Tray can remain in the system during rack mounting. For instructions on how to remove the components, see the monitoring sections.

Make sure that you place the cards and modules in an anti-static bag until you install the chassis in the rack.

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

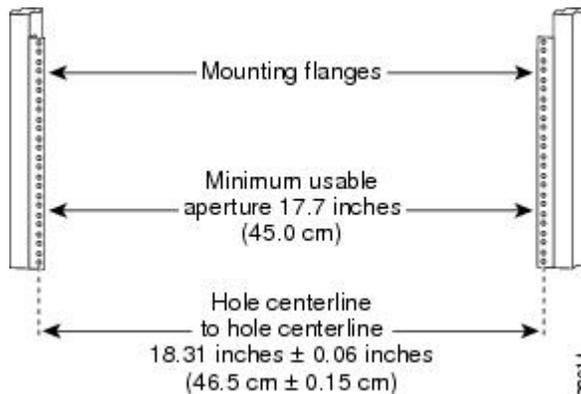
Required Tools and Equipment

- ESD-preventive wrist strap
- #2 Phillips torque screwdriver
- Flat-head screwdriver

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 the following figure.

Figure 17: Verifying Equipment Rack Dimensions



Step 1 Mark and measure the distance between 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 for 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.

Installing the Chassis Installation Brackets

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

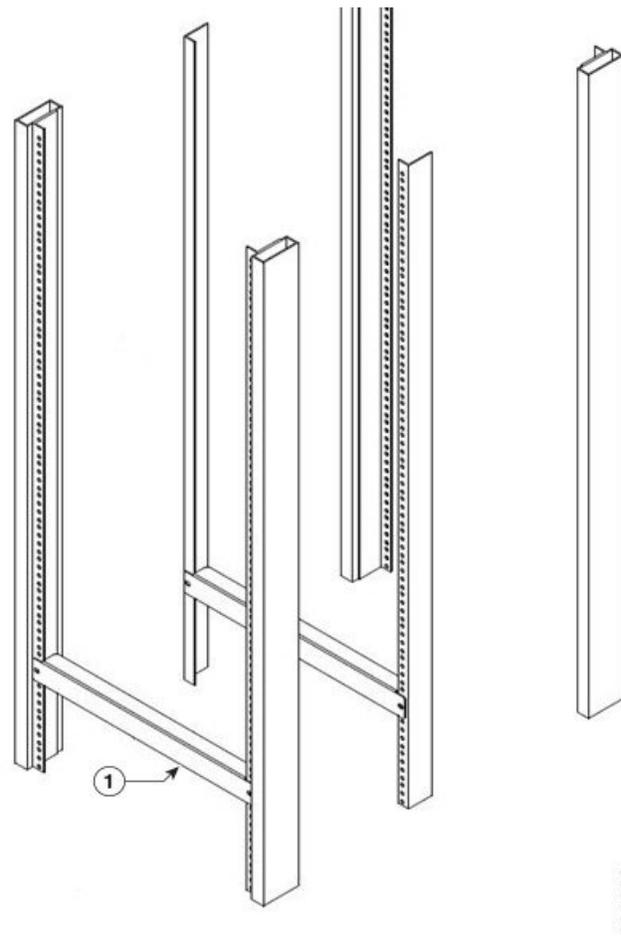
Step 1 Determine the position in the rack where you want to mount the chassis.

If you are mounting more than one chassis in the rack, start from the bottom or the center of the rack. Hold the chassis installation bracket, where the bottom of the chassis will be positioned vertically in the rack.

Step 2 Secure the chassis installation bracket to the front rails with rack-mount screws.

If a second internal rack rail is present which is not more than 23 inches from the front rail, position the second installation bracket to create a rear support for the chassis during installation.

Figure 18: Chassis Installation Bracket



1	Chassis Installation Bracket
---	------------------------------

Note After you install the chassis and secure it to the rack, remove the chassis installation brackets from the rack. The chassis does not need these brackets for supporting the weight, after all rack mount screws are secured.

Attaching the Chassis Rack-Mount Brackets

The chassis is shipped with the rack mount brackets pre-installed in the front position. The rack mount brackets can be removed and reversed in the mid-mounting location on the chassis.



Note After you install the chassis in the rack, the rear RF cable-management brackets can be installed on the chassis.

Attach the rack-mounting brackets either in the front or the middle of the chassis.

- Front Rack-Mounting the system: The chassis is shipped with the rack-mount brackets installed in the front. Proceed to [Installing the Cisco Remote PHY Shelf 7200 in a Rack, on page 51](#).
- Mid Rack-Mounting the system: Install the mounting bracket in the middle of the chassis, so that you can access the chassis in the rack or install the chassis in a two-post rack unit.

To install the rack-mount brackets in the middle of the chassis, complete the following steps:

Before you begin

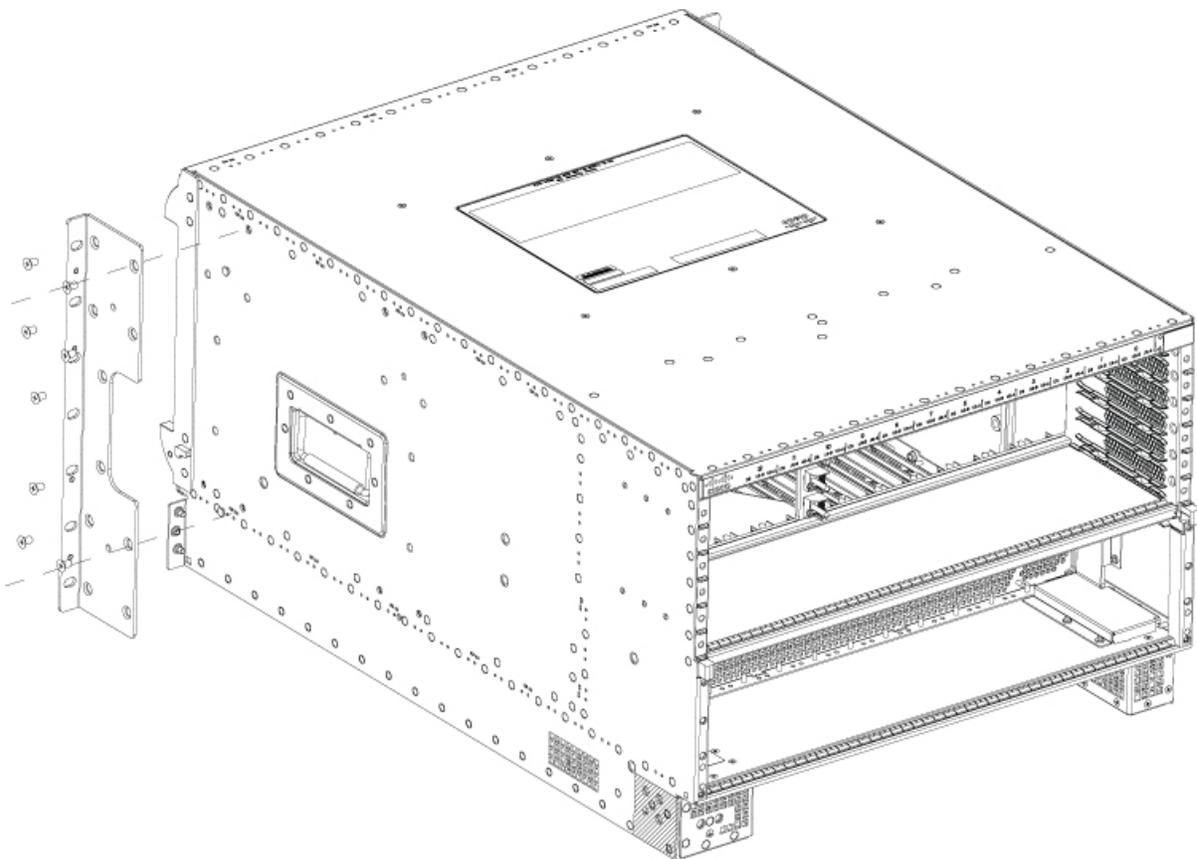
Required Tools and Equipment

- #2 Phillips torque screwdriver

Step 1 Remove the rack-mount brackets installed in the front of the chassis by unscrewing the M5 undercut flat-head screws using a #2 Phillips screwdriver.

Step 2 Locate the threaded holes at the middle on the side of the chassis that align with the holes in the rack-mount bracket.

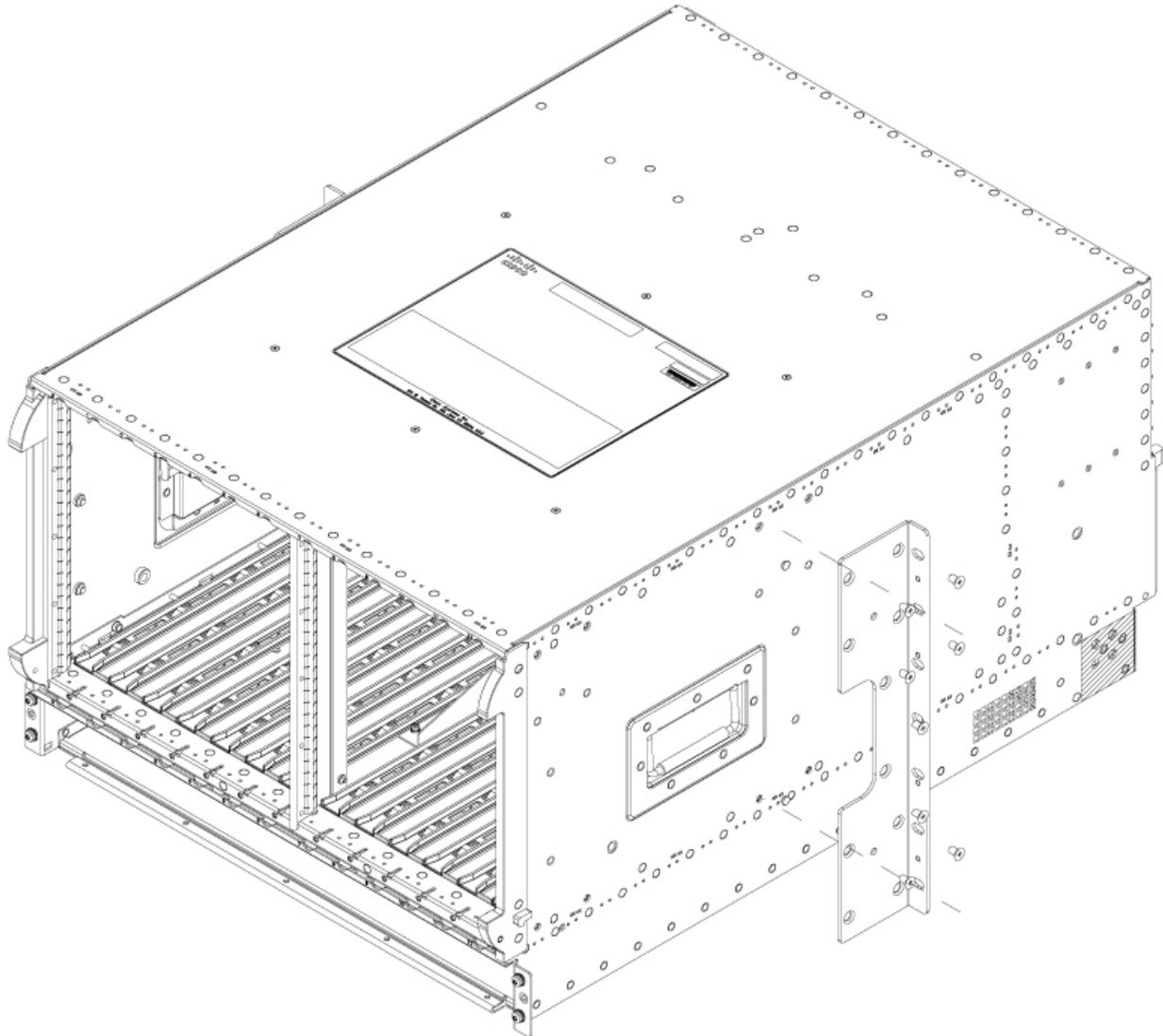
Figure 19: Installing Rack-Mount Brackets in the front position



Step 3 Install the 8 M5 undercut flat-head screws to secure each rack-mounting bracket to the chassis.

Note The bottom two holes on the rack-mount bracket in the power tray area are unused.

Figure 20: Installing rack-mount brackets mid mount



Step 4 Repeat the steps 1, 2, and 3 on the other side of the chassis.

Installing the Cisco Remote PHY Shelf 7200 in a Rack

You can install the chassis in either a four-post rack unit or a two-post rack unit.

Before you begin

1. Verify rack dimensions.
2. Install chassis installation brackets.
3. Attach the chassis rack-mount brackets.



Warning To prevent physical 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:

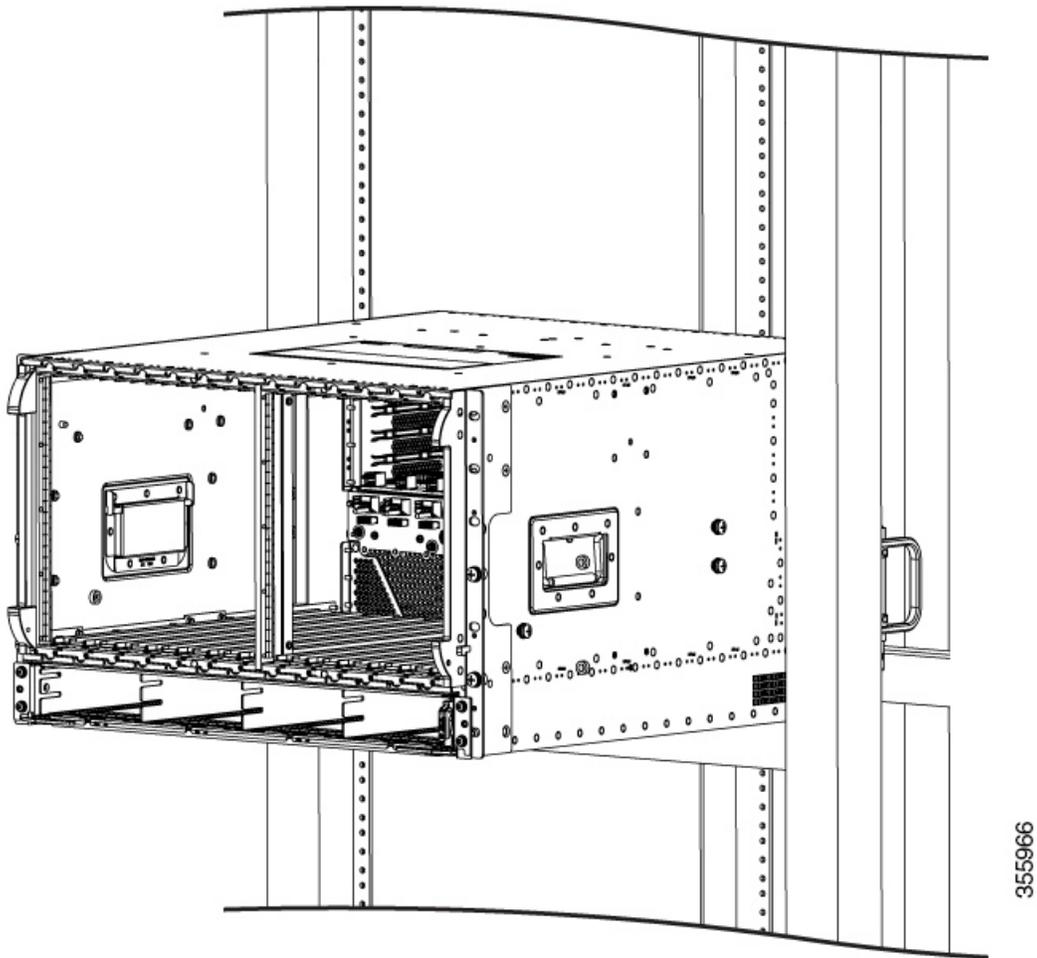
- If you have to mount only one unit in the rack, mount it at the bottom of the rack.
- When mounting this unit in a partially filled rack, load the rack from the bottom to the top with the heaviest component at the bottom of the rack.
- If the rack is provided with stabilizing devices, install the stabilizers before mounting or servicing the unit in the rack.

Procedure

	Command or Action	Purpose
Step 1	Rack mount the chassis by securing the rack-mount brackets to two posts or mounting strips in the rack.	Use at least four rack-mount screws on each side to fasten the two rack-mount brackets to the rack posts because the rack-mount brackets support the weight of the entire chassis.

Installing the Cisco Remote PHY Shelf 7200 in a Four-Post Rack

- Step 1** Ensure that all screw-fasteners on the installed components are securely tightened on the chassis. It is recommended to remove the front Power Supplies and RPD's to lighten the chassis weight prior to installation.
- Step 2** Ensure that your path to the rack is unobstructed.
- If the rack is on wheels, ensure that the brakes are engaged or the rack is stabilized.
- Step 3** With two or more people, lift the chassis (partially unloaded) into position between the rack posts and rest it on the chassis installation bracket.
- In addition to the bottom and edges of the chassis, the chassis can be lifted using the two side handles on the chassis and the two large fan tray handles on the rear of the chassis.
- Note** Ensure that the rear Fan Tray handles are secured to the chassis with their 4 captive screws on the handles.
- Step 4** After the rear weight of the chassis is resting on the installation bracket, one person can hold it in place when the second person moves to the rear of the rack to slide it into place and hold the weight while the rack mount screws are tightened.



Step 5 Position the chassis until the rack-mounting flanges are flush against the mounting rails on the rack.

- Step 6** Hold the chassis in position against the mounting rails and do the following:
- 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.
 - Insert a top screw into each side rack mount bracket and tighten the screw to the rack rail.
- Insert a minimum of four screws per bracket on both sides of the chassis.

Note Install a minimum of 4 screws through each sides rack mount into the rack rails for proper support.

What to do next

- If necessary, remove the chassis installation brackets after ensuring that all screws are tightly secured to the rack unit.
- [Attaching the Cable-Management Bracket, on page 57.](#)

Installing the Cisco Remote PHY Shelf 7200 in a Two-Post Rack

You can install the Cisco Remote PHY Shelf 7200 in a two-post 19-inch (48.26 cm) rack either as a front mount or a mid-mount if the spacing between rails is at least 17.70 inches (44.96cm) wide. If the rack rail opening is narrower than this you can only use the mid mount option for mounting the chassis into the two post rack.

The procedure for front mounting a chassis in a two-post rack is similar to the procedure for front mounting in a four-post rack, except that you cannot use the second chassis installation bracket.

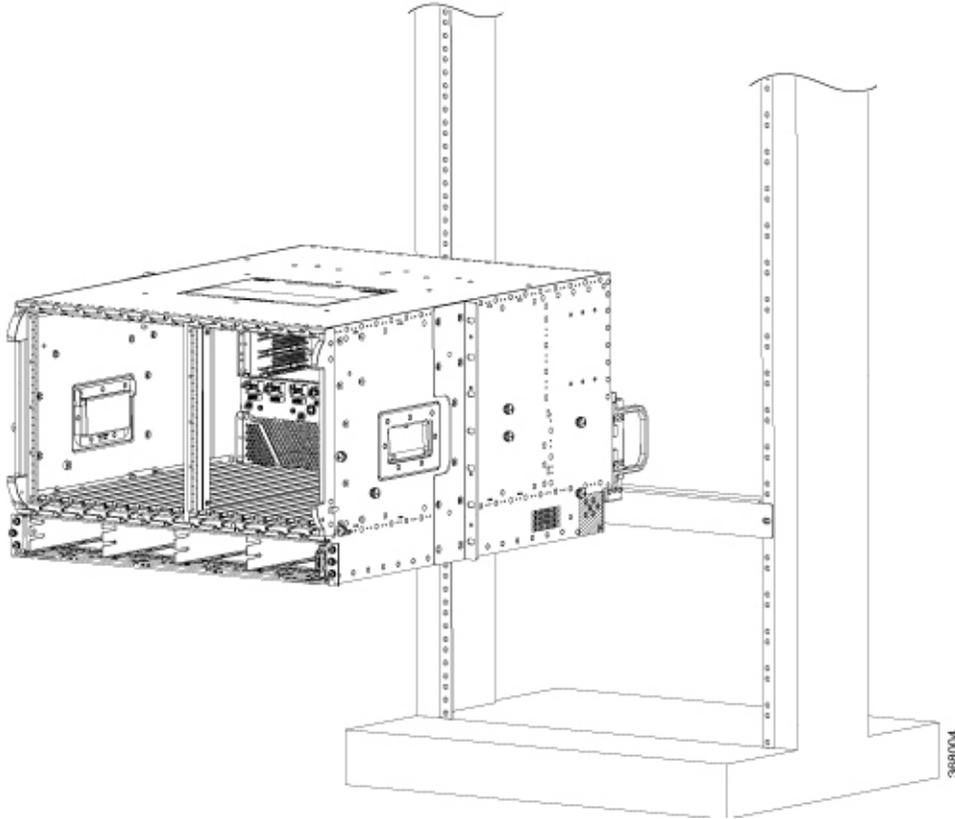


Caution If you are using a two-post rack, secure the rack to the floor surface to prevent tipping and physical injury, and avoid damage to the component.

To mid-mount the chassis, follow these steps:

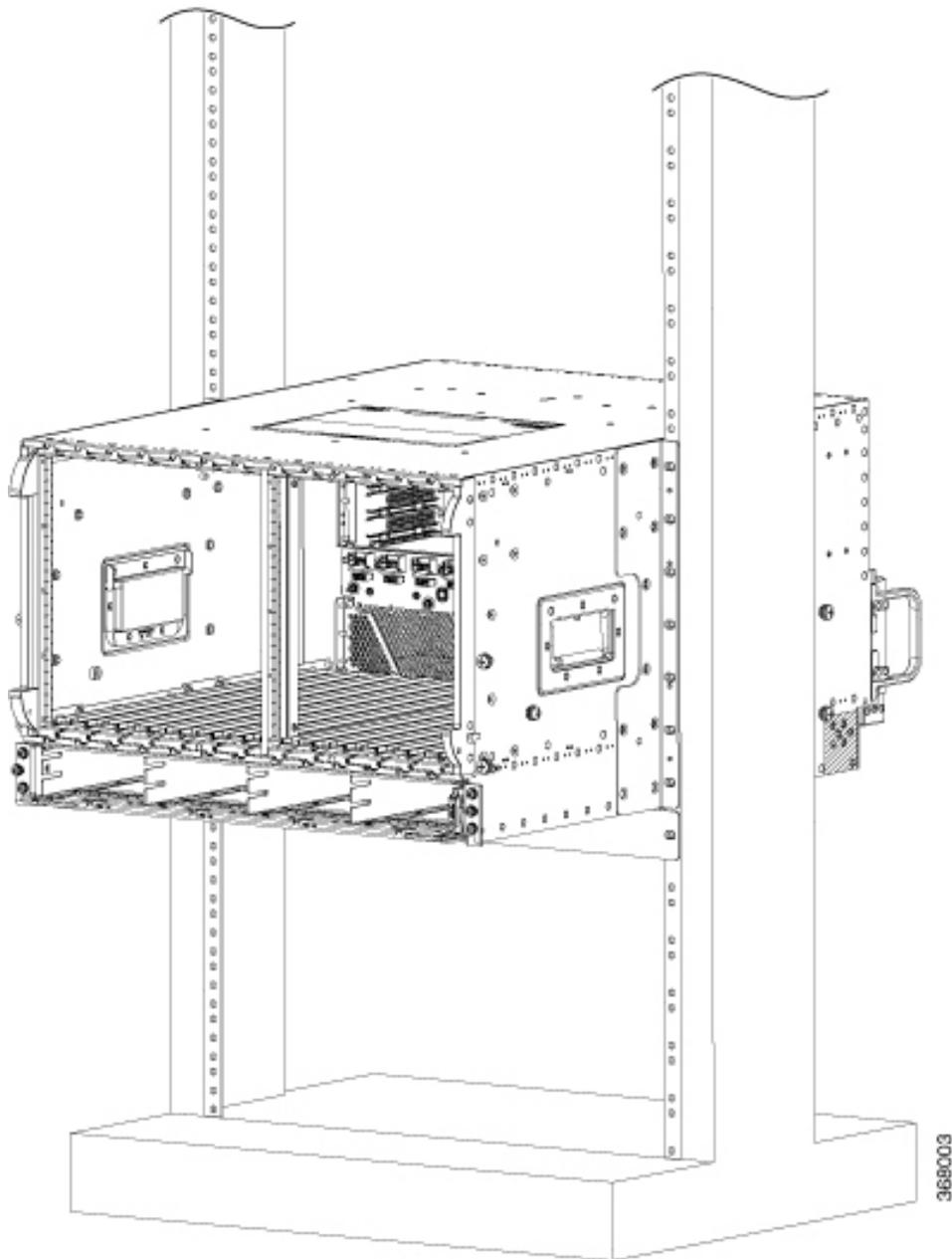
-
- Step 1** Ensure that all screw-fasteners on the installed components are securely tightened on the chassis. It is recommended to remove the front Power Supplies and RPD's to lighten the chassis weight prior to installation.
- Step 2** Ensure that your path to the rack is unobstructed.
- If the rack is on wheels, ensure that the brakes are engaged or the rack is otherwise stabilized.
- Step 3** Install the chassis installation bracket into the rack to support the chassis during installation when you secure it to the rack.
- Step 4** With two or more people, lift the chassis (partially unloaded) into position between the rack posts and rest it on the chassis installation bracket.
- The chassis can be lifted using the two large side handles and the rear Fan Tray Handles.
- Note** Ensure the rear Fan Tray handles are secured to the chassis with their 4 captive screws on the handles.
- Step 5** After the rear weight of the chassis is resting on the installation bracket, one person can hold it in place while the second person moves to the rear of the rack to help slide it into place and hold the weight while the rack mount screws are tightened.

Step 6 Position the chassis until the rack-mounting flanges are flush against the mounting rails on the rack.



Step 7 Hold the chassis in position against the mounting rails and do the following:

- 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.
- 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.



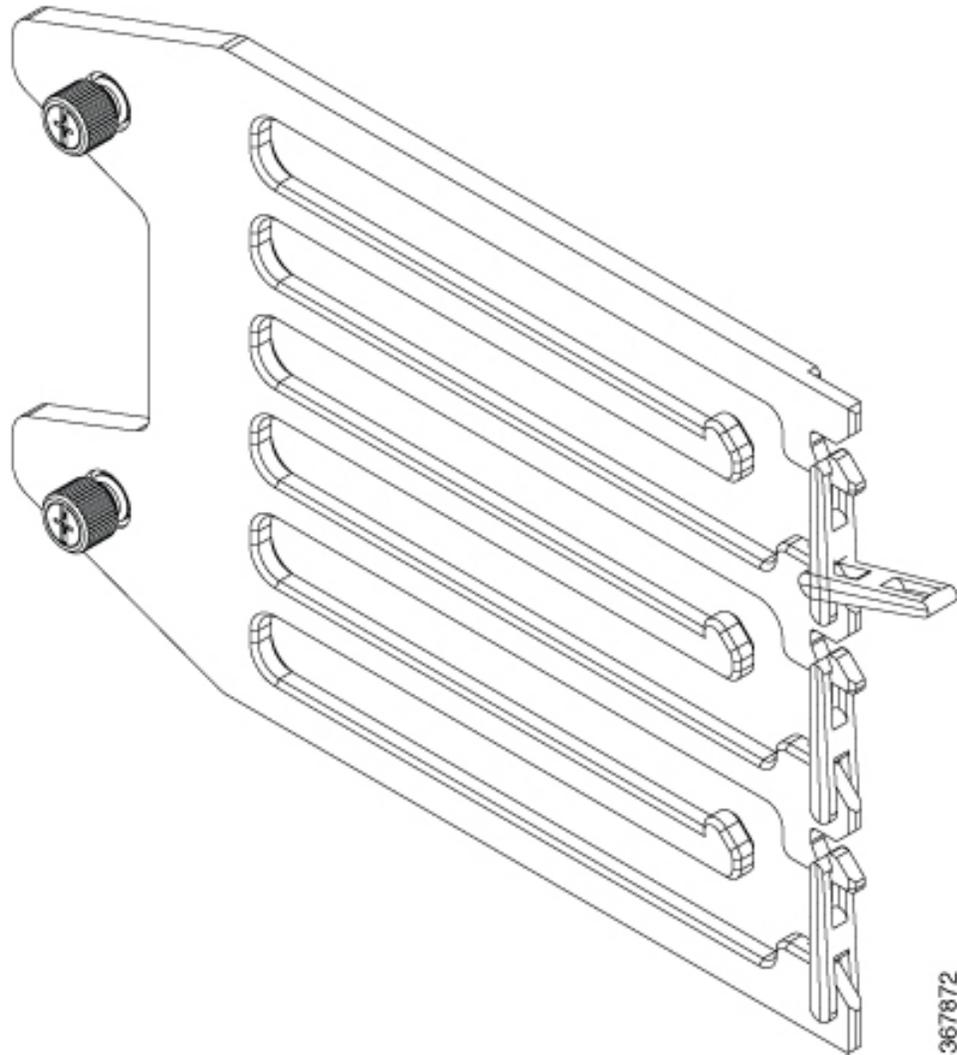
- Step 8** Ensure that all screws on each of the side rack-mount brackets are tightened to the equipment rack before the chassis installation bracket is removed from the rack.

What to do next

[Attaching the Cable-Management Bracket, on page 57.](#)

Attaching the Cable-Management Bracket

The rear RF cable management system is provided in the accessory kit. There is a right hand side and a left hand side for the chassis.

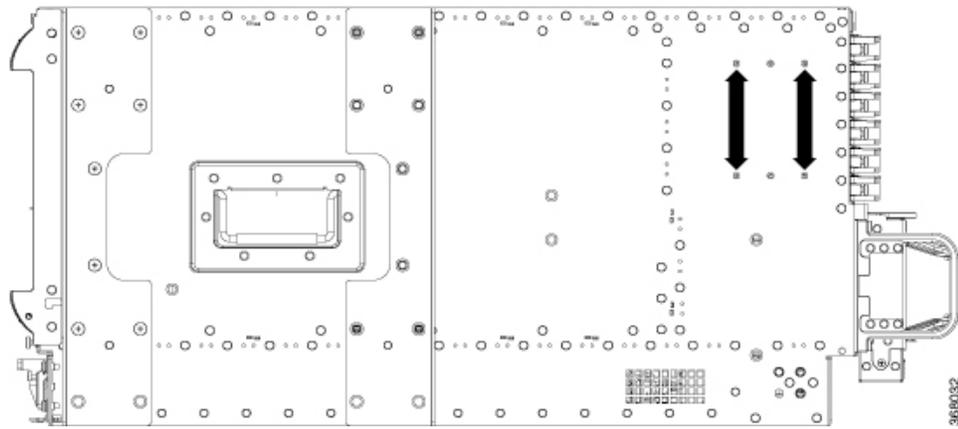


Note The chassis will not fit through a 19-inch rack rail opening with the cable management system pre-installed.

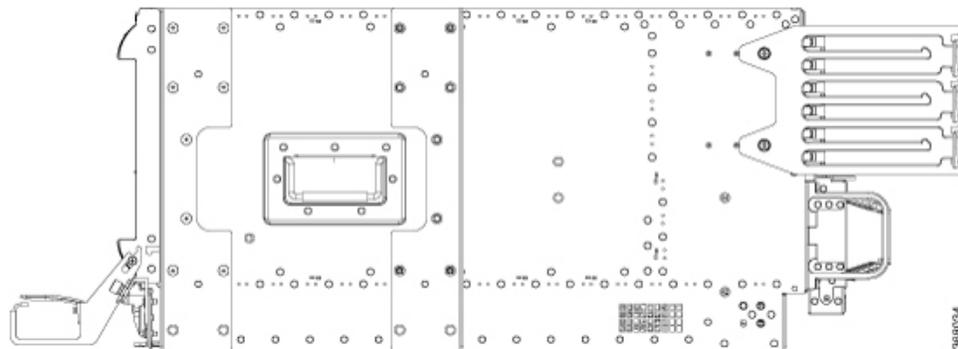
Complete the following steps to install the Cable-Management Bracket:

1. Install the chassis into the rack.
2. Align the RF left side RF cable management to a set of holes on the side of the chassis. There are three mounting positions on the chassis depending on the number of cables that are required to be supported.

Attaching the Cable-Management Bracket

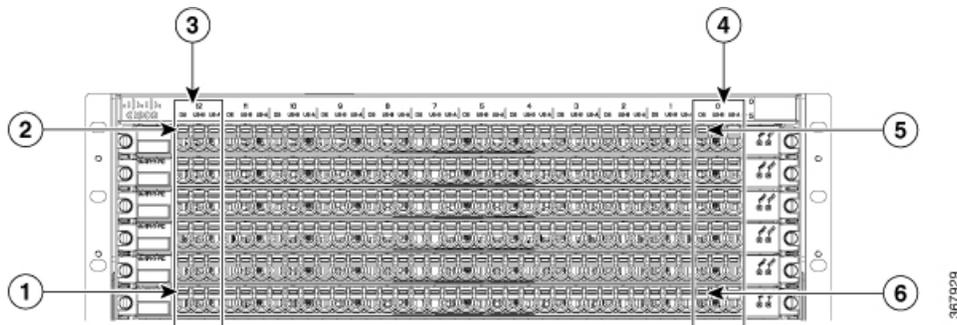


- Secure the left side RF cable management using the thumb screws on the bracket.



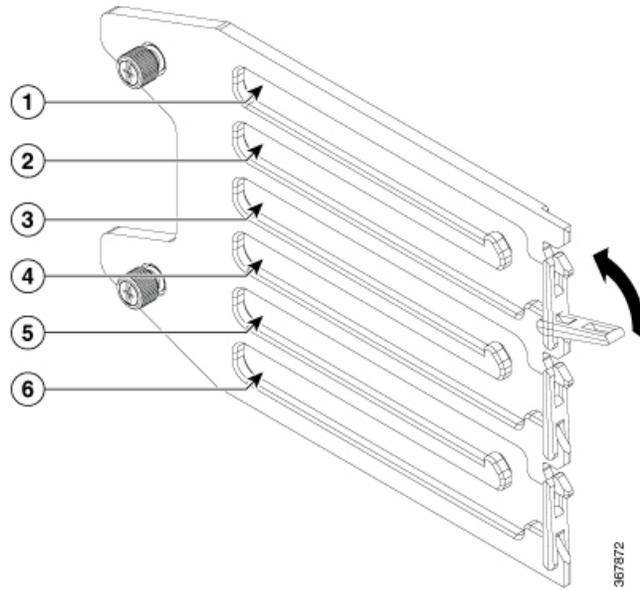
- Repeat steps 1-3 for the right side RF management bracket.

The Cisco Remote PHY Shelf 7200 has 216 ports, and the coax cable routing was designed for half the cables that are routed to either side of the system.



1	Slot12/DS5	2	Slot12/DS0
3	Slot 12	4	Slot 0
5	Slot0/DS0	6	Slot0/DS5

After routing the RF cables through the cable management, latches can be closed for retention of the cables. See the following image.



1	Cables from PIC0	2	Cables from PIC1
3	Cables from PIC2	4	Cables from PIC3
5	Cables from PIC4	6	Cables from PIC5

Attaching a Chassis Ground Connection

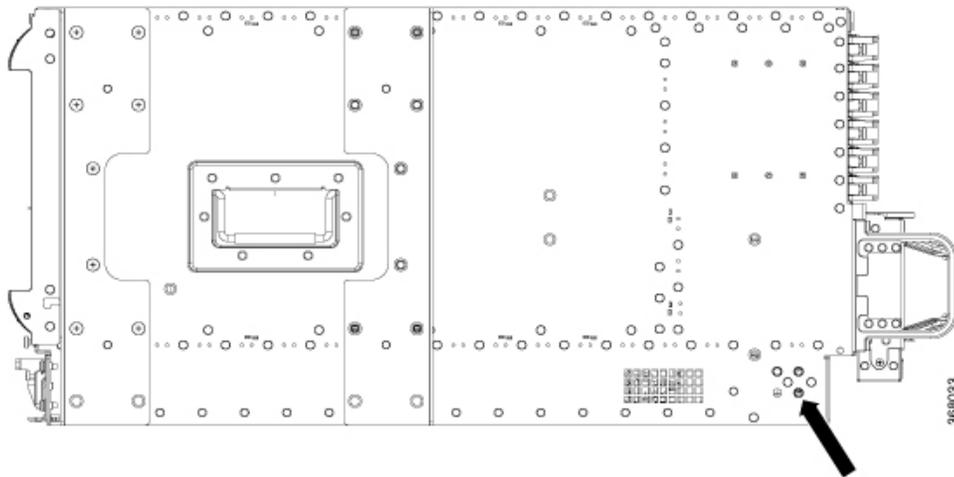
Before you begin



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 the chassis, you must provide an adequate chassis ground (earth) connection for the chassis. A chassis ground connector is available at the rear, left side of each Cisco Remote PHY Shelf 7200 chassis.



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

Required Tools and Equipment

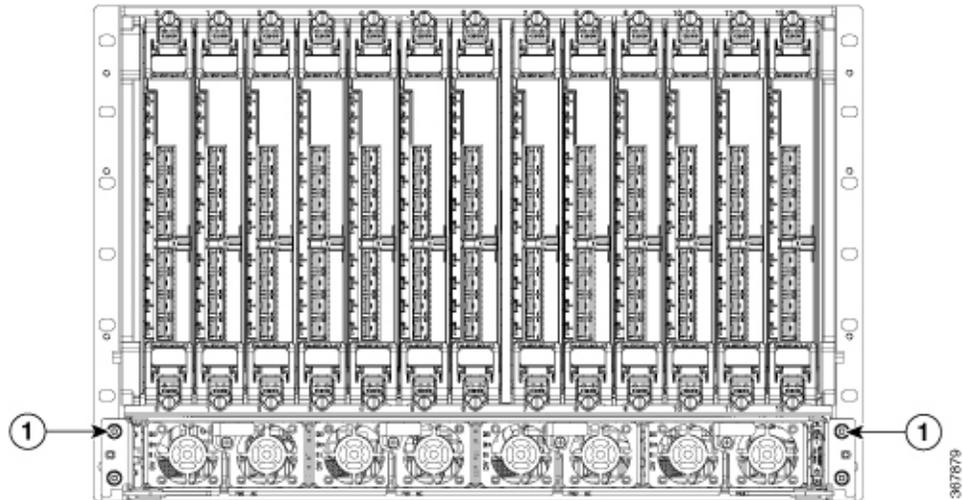
- Phillips Screwdriver
- ¼-20 Phillips pan head with a square cone lock washer (available in the accessory kit)
- 2 hole 4-AWG dual crimp compression lug (available in the accessory kit)
- 4 or 2 AWG grounding wire—The ground wire and lug must be always as large as the input gauge. For example, to use 2 AWG for the DC inputs, the ground lug and wire must be 2 AWG or bigger.
- Crimping tool for the ground lug

- Step 1** Use the wire stripper to strip one end of the AWG #4 wire approximately 1.12 inches (28.4 mm).
- Step 2** Insert the AWG #4 wire into the wire receptacle on the grounding lug.
- 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** Locate the chassis ground area on the rear lower left-side panel of your chassis.
- Step 5** Insert the two ¼-20 screws (available in the accessory kit) through the holes in the grounding lug, and tighten until the grounding lug is held firmly to the chassis.
- Note** The captive nuts are located on the rear lower left side of the chassis for attaching a two-hole ground lug. In addition, three nuts are available for attaching, so that you can mount the lug horizontally or vertically depending on the wire routing preferences.
- Step 6** Connect the opposite end of the grounding wire to the appropriate grounding point at your site to ensure an adequate chassis ground.

Installing the Optical Cable Management Kit (Optional)

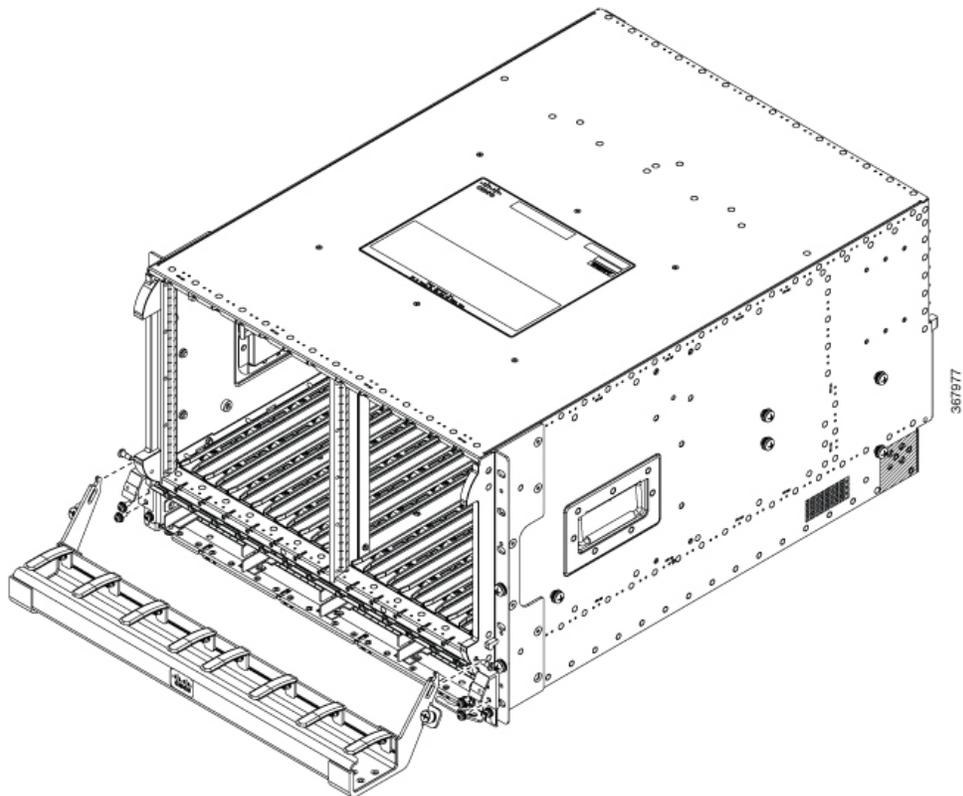
To install the optional Optical Cable Management (OCMG) Kit, complete the following steps:

1. Remove the top two screws from the power shelf flange ears. Keep the screws safe.

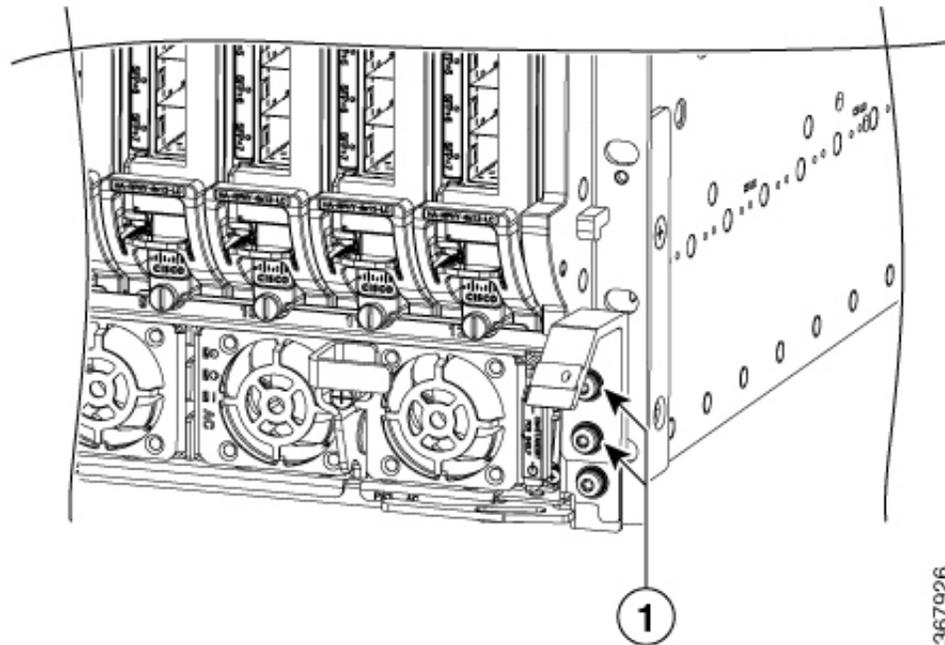


1	T15 Drive Screws
---	------------------

2. Align the Optical Cable Management Kit to the chassis.



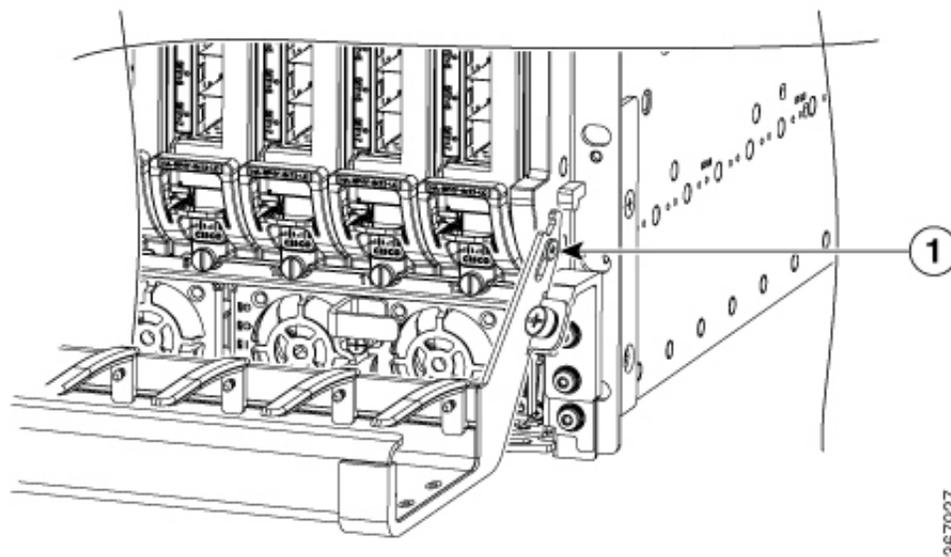
3. Install the right and left cable management support brackets onto the power shelf flanges as shown in the following image. Secure the bracket with four T15 Torx screws. Tighten to 6-8 Lb-In torque.



1	T15 Drive Screws
---	------------------

4. Install the shoulder screws through the cable management tray slots and into the chassis side bezel threaded holes. Secure the shoulder screw using a T10 Torx screwdriver, tighten to 5-6 Lb-In torque.

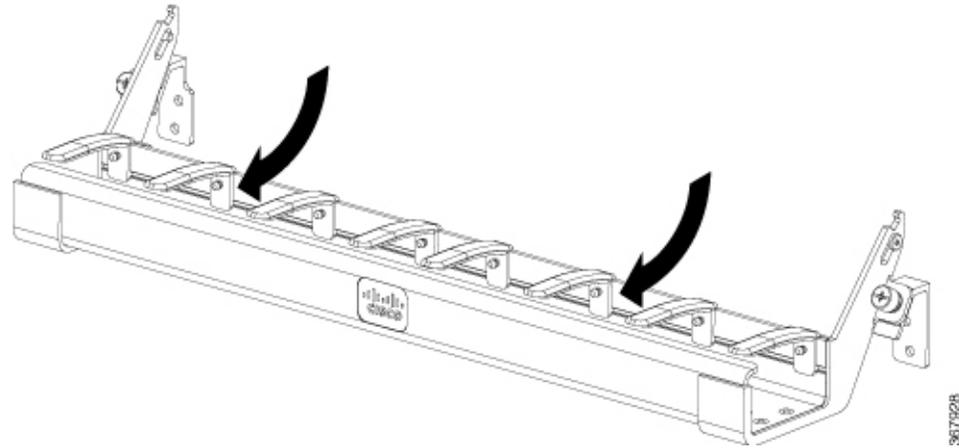
Figure 21:



1	Shoulder Screw
---	----------------

5. Orient the cable tray and secure the two captive screws to the support brackets by hand.

You can feed the optical cables into the tray through the tray retaining fingers as shown in the following figure. Cables can be routed left or right through the tray.



Installing the Fan Tray

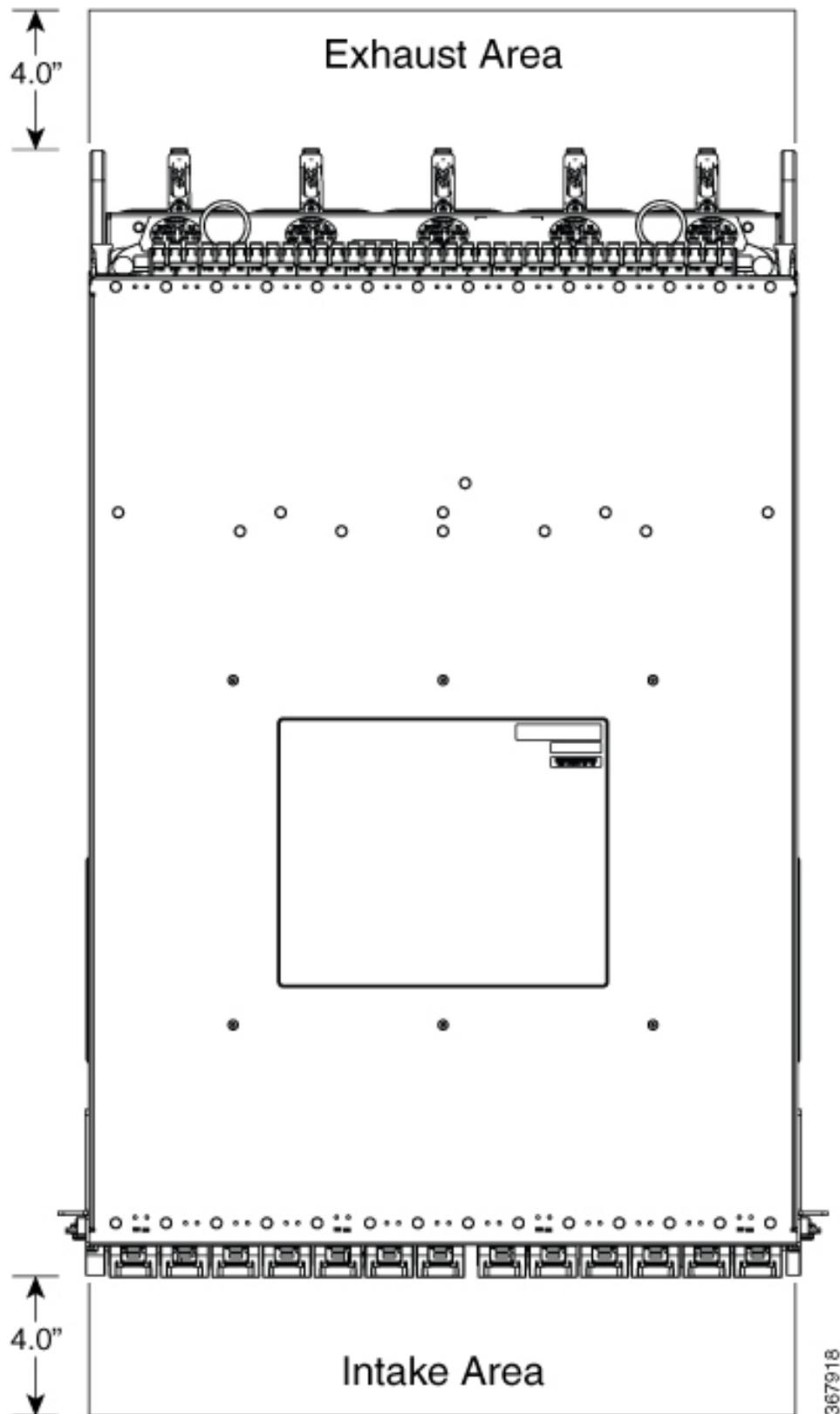
Before you begin

- Attach an ESD-preventive wrist strap to your wrist and connect the other end to the grounding lug connected to the chassis.
- **Minimum Keep Out Areas for Proper Cooling**

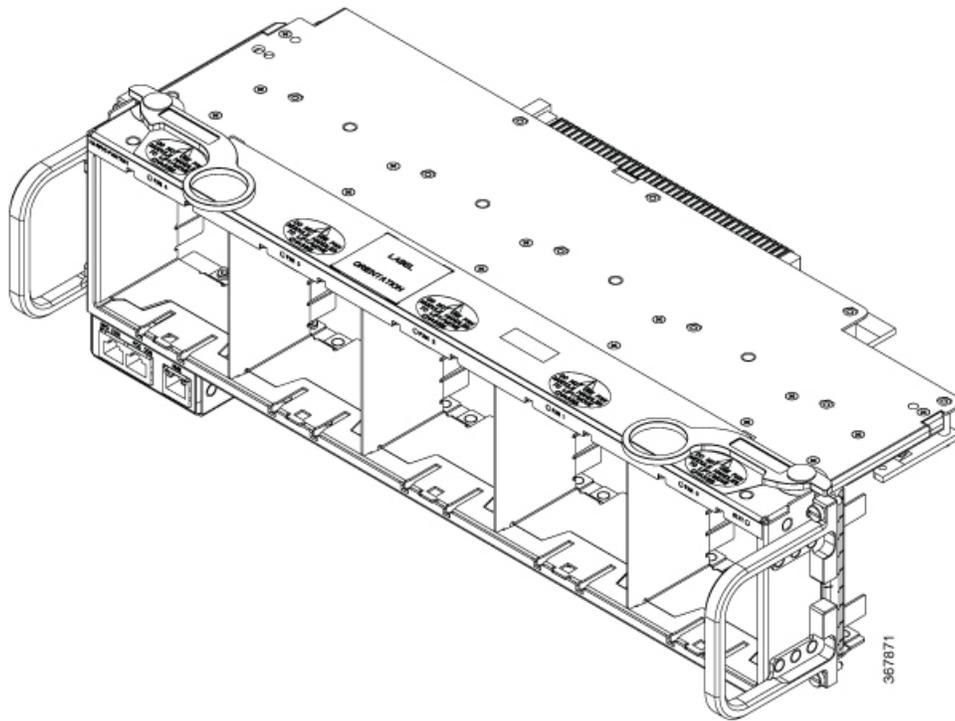
Air flows from the front to the rear of the chassis. Air enters through the chassis RDP front panels and power supply modules. Air is expelled from the rear of the chassis.

The keep-out areas are defined to ensure adequate space around the Cisco Remote PHY Shelf 7200 chassis. The space is necessary to ensure adequate air intake and exhaust. The figure shows the keep-out areas for the Cisco Remote PHY Shelf 7200 chassis.

Figure 22: Allow keep-Out Areas for the Cisco Remote PHY Shelf 7200 Chassis



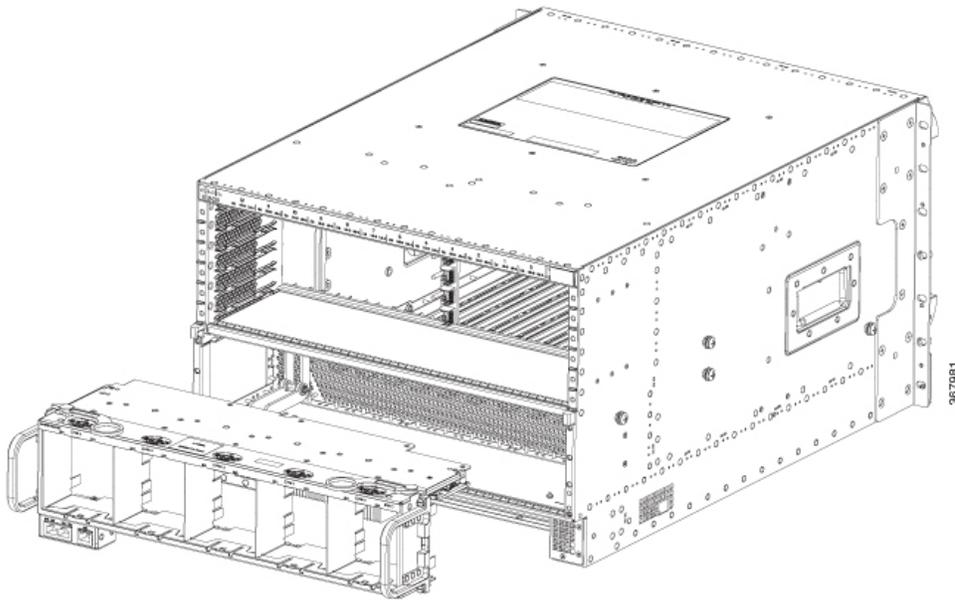
The Cisco Remote PHY Shelf 7200 Fan Tray is a Field Replaceable Unit without Fans.



Restrictions

- Do not boot the chassis unless all the Fan Modules are installed.
- Only one fan module should be removed at a time for servicing or replacement.
- Do not operate the chassis without the Fan Tray installed.

Step 1 Align the yellow Fan Tray sheetmetal tab to the chassis fan tray guides.

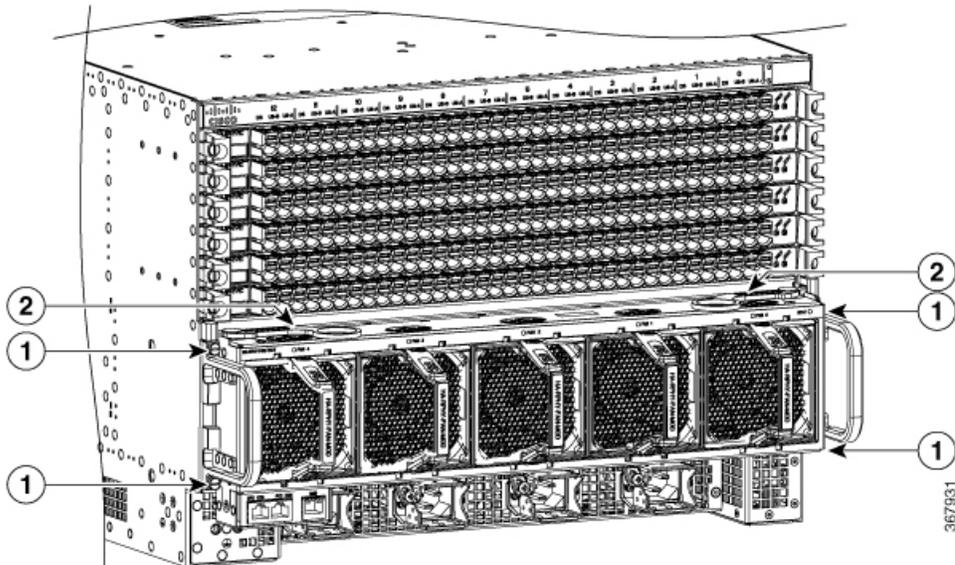


Step 2 Slide in the Fan Tray gently.

Step 3 Use both the ejectors at the same time to insert the Fan Tray.

Note Using only one ejector for Fan Tray installation could cause damage to the Fan Tray connector.

Step 4 Secure the 4 mounting screws on the Cisco Remote PHY Shelf 7200 Fan Tray to the chassis. Torque to 8 Lb-In.



1	Fan Tray Screws
2	Ejectors

Note The Cisco Remote PHY Shelf 7200 system should not be operating without a Fan Tray installed for more than 1-2 minutes or the system could experience thermal events, alarms, and potentially trip thermal protections that would shut down RPD cards.

What to do next

- Visually check if the fans are working.

Installing the Fan Module

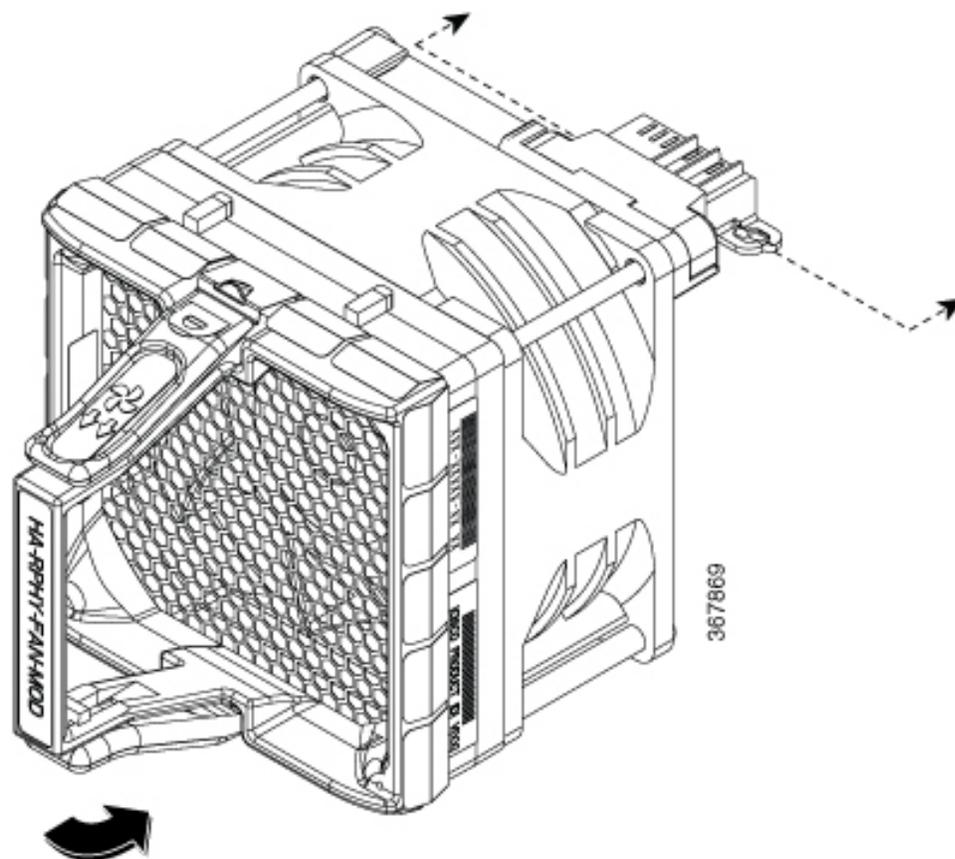
The Cisco Remote PHY Shelf 7200 Fan Module (HA-RPHY-FAN-MOD) is comprised of the fan, one handle structure, EMI containment, and connector to interface to the Cisco Remote PHY Shelf 7200 Fan Tray.

The Fan Module is keyed so it can only install in the proper orientation to the Fan Tray.

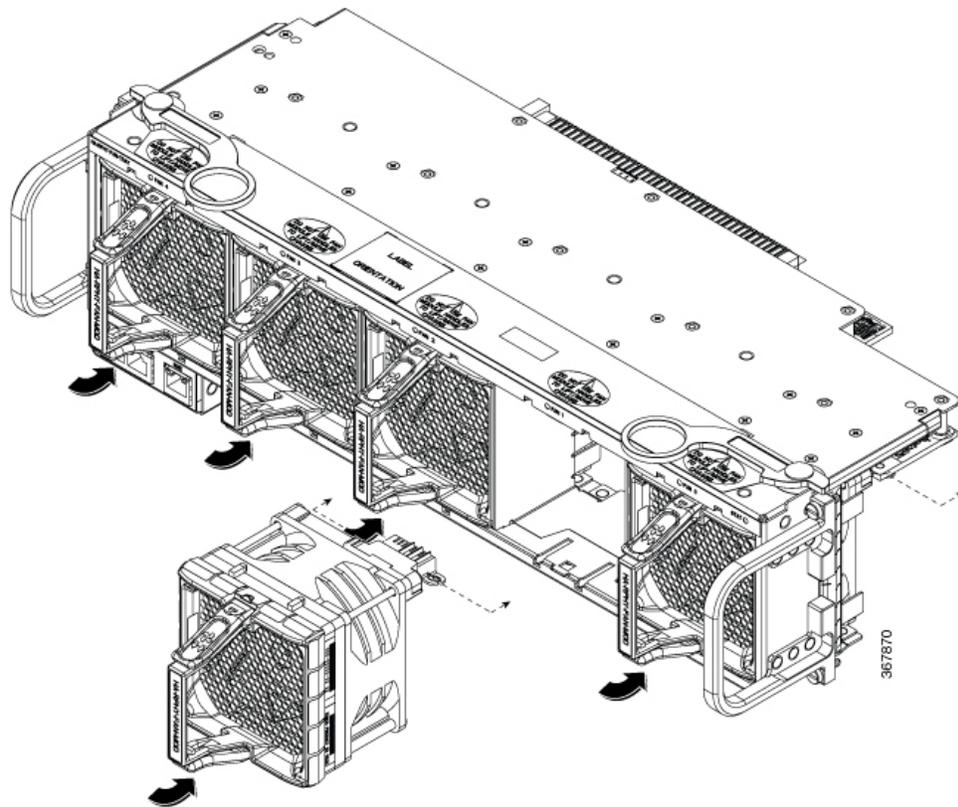
To install the Fan Module, complete the following steps:

1. Align the Fan Module to the Fan Tray.

Figure 23: Fan Module



2. Push the Fan Module into the Fan Tray bay until there are tactile and audible clicks of the Fan Module latches engaging to the Fan Tray top and bottom of the handle.



3. Ensure that the top and bottom Fan Module latches are engaged on every fan module to the fan tray sheetmetal bay.

Installing the Power Shelf

The chassis ships with an AC or DC Power Shelf installed depending on the configuration. In the future you may need to install a new Power Shelf or to swap the power system of the chassis.

Before you begin



Important

We recommend that you wire the chassis for the total 4200 W of power requirement from the facility.



Warning

If you are adding new hardware or upgrading the existing hardware, ensure that the power modules installed in the chassis are adequate to support the hardware.



Warning

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

- Be aware of the weight and size of the equipment. Handle it with care.

The chassis ships with the Power Module already installed.

Use this procedure to install the following modules in the chassis:

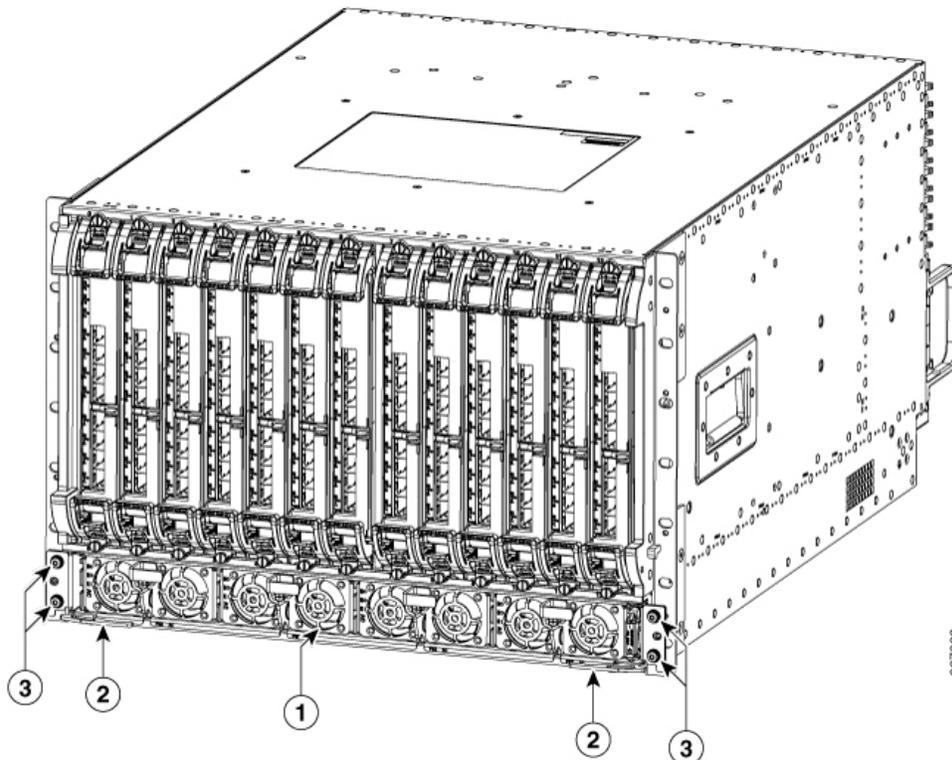
- AC Power Module
- DC Power Module

Required Tools and Equipment

- ESD-preventive wrist strap
- T15 Torx torque screwdriver

-
- Step 1** Turn off the system power switch on the front of the chassis in the lower front right corner of the power shelf.
- Step 2** Turn off power at the facility breaker panel and check that the connections are de-energized prior to accessing the power cables on the chassis.
- Step 3** Disconnect all power cables from the rear of the chassis.
- Step 4** Unfasten the captive screw on the front ejector lever of the power supply modules using a 3/16" flat head screwdriver or philips screw driver. Actuate the power supply ejector to remove each power supply in the system.

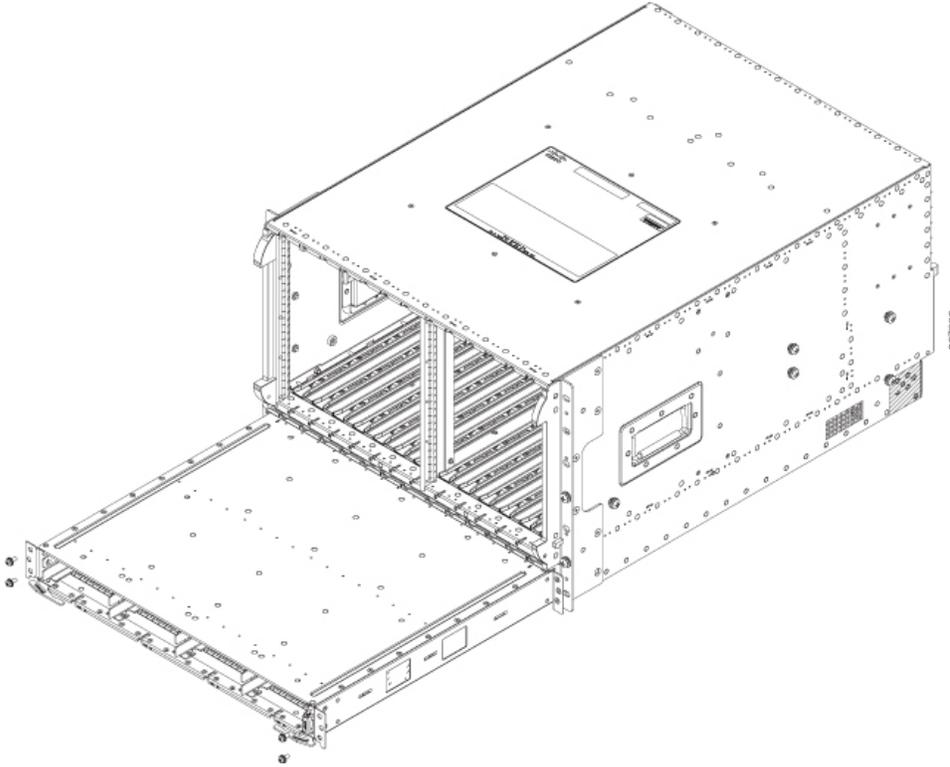
Figure 24: Removing the Front Power Shelf from the Chassis



1	4X AC or DC Power Modules	2	Power Shelf Ejectors
---	---------------------------	---	----------------------

3	Power Shelf T15 Securing Screws
---	---------------------------------

- Step 5** Loosen and remove the four T15 screws on the front power shelf chassis mounting ears using a T15 torx screwdriver. Save these screws for installation of the new power shelf.



- Step 6** Use the two Power Shelf ejectors to eject the Power Shelf from the chassis.

Note The Power Shelf to Power Modules are keyed AC modules to the AC Shelf and DC modules to the DC Shelf

Connecting Power to the AC-Powered Cisco Remote PHY Shelf 7200

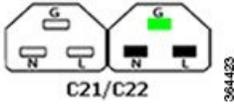


Warning Before connecting AC Power, the chassis ground connection must always be made first and disconnected last.



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

The HA-RPHY-AC-SHLF has four input connectors. Each input connector corresponds to the AC Power Module installed in the front of the chassis. They are IEC60320, C22 inlet connectors, which require facility power cords with a C21 style connector. These are similar to a standard C19/C20 combination, but they have chamfers in the upper corners, which are used to distinguish them as rated for 155C instead of the typical 70C used on the C19/C20.

Configuration Female/Male	Rated Current International	Rated Current North America	Wires	Poles	Inlet	Connector
	250 V 16 A	125/250 V 16 A	3	2	C22	C21

Description	Value
AC Power Modules per system	Up to four
Total AC input power per AC Power Module	3400 VAC facility input
Rated input voltage per AC Power Module	200-240 VAC nominal (range: 180 to 264 VAC) 220-240 VAC (UK)
Rated input line frequency	50/60 Hz nominal (range: 47 to 63 Hz) 50/60 Hz (UK)
Source AC service requirement	20 A North America; 16 A international; 13 A UK (IEC60320 C22 connector on the chassis input side)

Before you begin

- [Attaching a Chassis Ground Connection, on page 59.](#)

Required Tools and Equipment

- AC power cord
- #2 Phillips torque screwdriver

-
- Step 1** Ensure that the power switch on the front lower right of the chassis power shelf is in off (down) position.
- Step 2** Connect the AC power cord to the receptacle on the rear of the AC power shelf.
- Step 3** Tighten the Phillips-head screw on the cable retaining bracket using a #2 Phillips torque screwdriver with a torque of 8-10 in-lb (0.90-1.13Nm).
- Step 4** Connect the other end of the AC power cord to the AC source receptacle.
- Step 5** Repeat [Step 2, on page 72](#) to [Step 4, on page 72](#) for all power connections.
-

Connecting Power to the DC-Powered Cisco Remote PHY Shelf 7200



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



Warning Before connecting DC Power to the Cisco Remote PHY Shelf 7200 DC Power Shelf, the ground connection must always be made first and disconnected last.



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**

The DC Power Shelf provides terminal blocks for facility input connectivity. It has 4 sets of input terminal blocks to provide each power module with one facility connection.

The table below provides the common input range and circuit breaker requirements:

Table 19: Common DC Input Range and Circuit Breaker Requirements

DC Power	System Input Rating (in A)	Circuit Breaker (in A)		AWG # Wire	
		Minimum	Maximum		
DC	one feed of 60 A per DC Power Module	Always 60		AWG # 4 or AWG # 6	AWG # 2 ¹

¹ If AWG #2 wire is used for DC power module connections, the chassis ground wire must also be upgraded to an AWG #2 wire and connector .

Before you begin

- [Attaching a Chassis Ground Connection, on page 59.](#)
- 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 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 (+), can be used for each DC Power Module. These cables are available from any commercial cable vendor. All input power cables for the chassis must have the same wire gauge.

- Each DC input power cable is terminated at the rear of the Power Shelf on the terminal block 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 1/4-20 terminal studs on 0.625 in (15.88 mm) centers and have a maximum tongue width of 0.6 inches.



Note DC input power cables must be connected to the Power Shelf terminal studs in the proper positive (+) and negative (-) polarity. Some 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 measuring the voltage, the positive (+) lead and the negative (-) lead must always match the (+) and (-) labels on the power distribution unit.

- 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, ensure to insulate the lugs according to the manufacturer's instructions.



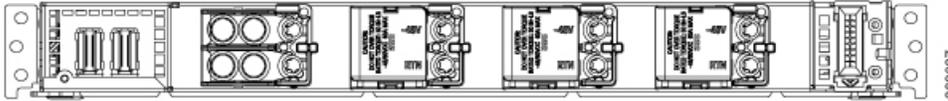
Caution Before installing the DC cable lugs, insulate the entire 90 degree portion of the lugs where the wire is crimped to avoid hazardous conditions where DC input power is accessible through the terminal block cover of the DC Power Shelf.

Required Tools and Equipment

- Insulating sleeving
- Torque wrench
- 7/16" hex socket
- Lugs for the cables
- Cables for positive and negative leads
- Crimping tool

-
- Step 1** Ensure that the power switch on the DC power shelf is in off (down) position.
- Step 2** Attach the lug to the lead cable. Carefully crimp the receptacle around the cable using the crimping tool. Insulate the entire 90 degree portion of the lug with shrink sleeving for each lead wire.
- Step 3** Remove the terminal block cover on each terminal block by pushing down on the bottom tab then pivoting the bottom out.
- Step 4** Loosen the 1/4-20 terminal bolts using a torque wrench and 7/16" hex socket and remove them.

- Step 5** Connect the negative lead cable and secure it in place with the 1/4-20 terminal bolts using a torque wrench and 7/16" hex socket with a torque of 45-50 in-lb (5.08-5.65 Nm).
- Step 6** Connect the positive lead cable and secure it in place with the 1/4-20 terminal bolts using a torque wrench and 7/16" hex socket with a torque of 45-50 in-lb (5.08-5.65 Nm).
- Step 7** Repeat [Step 5, on page 75](#) and [Step 6, on page 75](#) for each terminal block connection.
- Step 8** Reinstall the terminal block covers by clipping them on the top edge of the terminal block housing and then rotating them down until they snap into place.



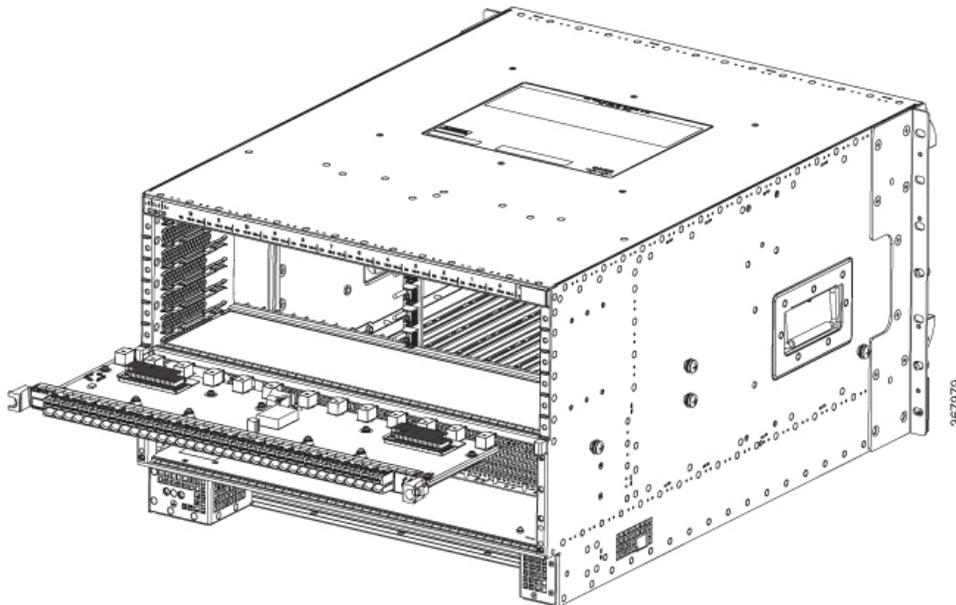
Installing the Cisco Remote PHY Shelf 7200 PIC



Note The Cisco Remote PHY Shelf 7200 PIC should be handled gently and carefully, to avoid damage to the RF connectors.

Complete the following steps to install the Cisco Remote PHY Shelf 7200:

1. Align the Cisco Remote PHY Shelf 7200-PIC PCB to the chassis PIC guides.



2. Insert the Cisco Remote PHY Shelf 7200-PIC PCB into the chassis guides and fully seat the faceplate against the chassis.
3. Secure PIC by tightening its faceplate captive screws.

4. Tighten captive screws to 8 Lb-In torque.
5. Install the RF cables into the port holes of the RF PIC.

The recommended cables and connectors to be used with the PIC cards are listed in the following table:

Connector/Cable	Description
75 Ohm compression MCX connectors	<ul style="list-style-type: none"> • AMPHENOL 919-400P-71S • MOLEX 73366-6530
Conductor mini quad cable	<ul style="list-style-type: none"> • It is recommended to use a 3 conductor cable (one red conductor and two blue). • AMPHENOL Times Fiber PN 075I99V12ZS41500ABR1
75 Ohm compression F connector for mini quad cable	<ul style="list-style-type: none"> • AMPHENOL ASFPSLCQ • MOLEX 73356-3260

Installing the Connectors into the PIC Connector Latches

To install the connector into the PIC connector latch, complete the following steps:

1. Hold the cable 0.5-1" back of the rear of the compression connector.

Figure 25: Installing the connector into the PIC connector latches

2. Gently wiggle and push the connector into the panel port hole.
3. The latch will snap closed when the connector is fully seated.

Installing the RPDs

There are 13 RPD slots in the front of chassis on a 1.26" pitch (12+1).

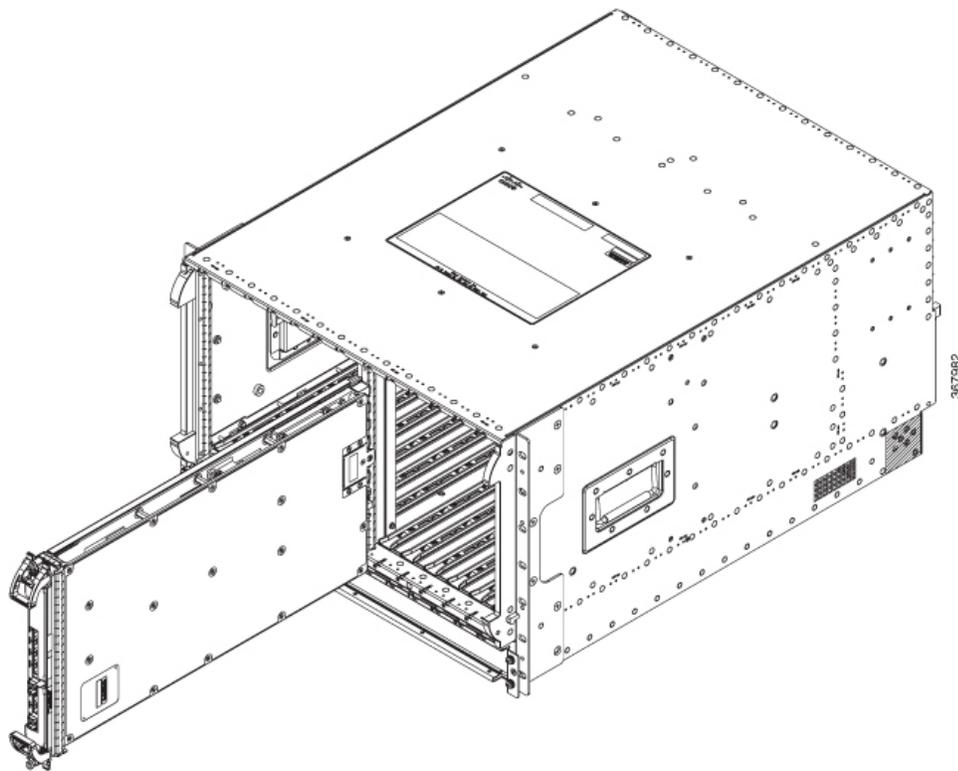


Note

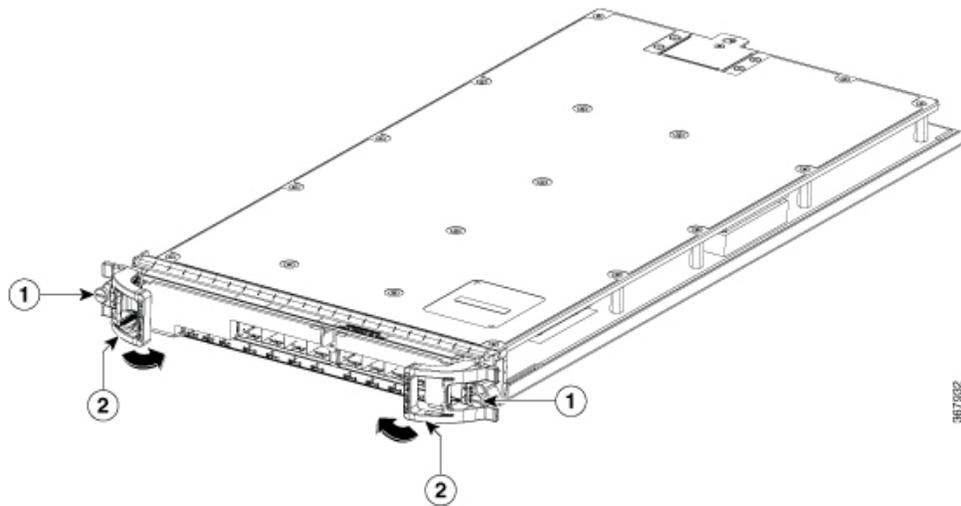
The connectors overhang the rear of the board. Handle the Line Cards with care so as to avoid damage to the RF and digital connectors on the rear of the card.

To install the RPD, complete the steps:

1. Align the rear carrier guide edges on the RPD to the yellow carrier guides in the chassis.
2. Gently slide the RPD into the chassis. Ensure that there is no binding of the card during installation.



3. Actuate the two ejectors together to finish the connector engagement of the RPD to the chassis.
4. Secure by tightening the two Captive Screws to 6-8 Lb-in torque.



1	Captive Screw	2	Ejector
---	---------------	---	---------

Installing the Air Filter

Required Tools and Equipment

- Air filter for the line card
- ESD-preventive Wrist Strap

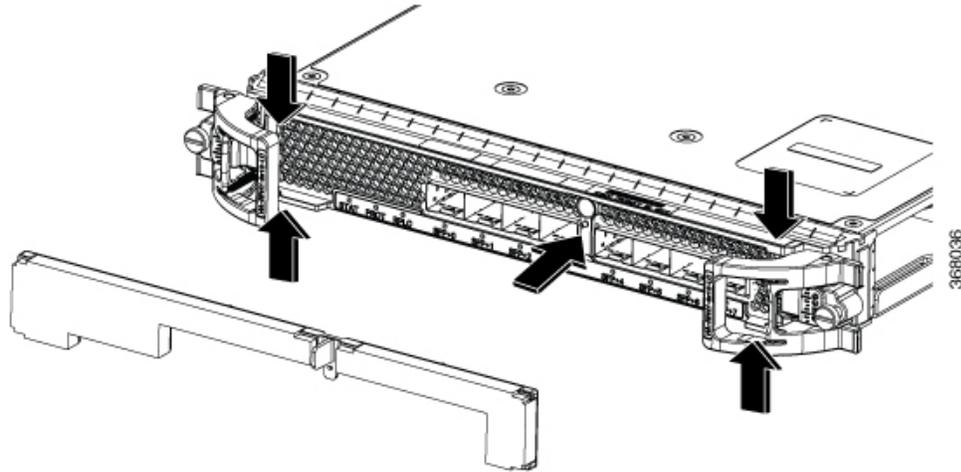


Note Attach an ESD-preventive wrist strap to your wrist and connect its end to the grounding lug that is connected to the chassis.

To install the Air Filter to the RPD, do the following steps:

1. Slide the Air Filter top and bottom into the slots on the RPD front panel bezels behind the ejectors.

Figure 26: Installing the Air Filter for the RPD



2. Locate the Form Hole beside the Pull Tab on the Air Filter. Gently press the Form Hole onto the faceplate protrusion feature.
3. Manipulate and tuck the Air Filter and frame around the SFP modules on the RPD faceplate.



CHAPTER 5

Powering up the Cisco Remote PHY Shelf 7200

- [Powering up the Cisco Remote PHY Shelf 7200 Chassis, on page 81](#)

Powering up the Cisco Remote PHY Shelf 7200 Chassis

After all the interfaces and other cables are connected, perform a visual check of all connections and check that:

- The ejector levers on each line card are in the locked position.
 - All the captive screws on all the modules are securely fastened.
 - All network interface cables are connected.
 - The console terminal is turned on.
1. Ensure that you have a chassis ground connection. Go through the topic [Attaching a Chassis Ground Connection, on page 59](#).
 2. Verify if the LEDs on the front Power Modules is green to indicate input voltage presence is within correct range.
 3. Toggle switch (AC or DC) on the lower front right corner of the chassis to ON position.
 4. Verify if the LEDs on the front Power Modules are green to indicate output voltage presence is enabled.



CHAPTER 6

Monitoring the Cisco Remote PHY Shelf 7200

- [Verifying the Cisco Remote PHY Shelf 7200 Using the CLI, on page 83](#)

Verifying the Cisco Remote PHY Shelf 7200 Using the CLI

To verify the Cisco RPD status and configuration, use the **show cable rpd group** command. For more information, see the [Cisco CMTS Cable Command Reference](#) guide.



CHAPTER

7

Maintaining the Cisco Remote PHY Shelf 7200

- [Removing the Power Module, on page 85](#)
- [Removing the Fan Tray, on page 86](#)
- [Removing the Fan Module, on page 87](#)
- [Removing the PIC, on page 89](#)
- [Removing the RPD, on page 95](#)
- [Removing the Air Filter, on page 95](#)

Removing the Power Module

Before you begin

- Attach an ESD-preventive wrist strap to your wrist and connect the other end to the grounding lug connected to the chassis.
- Be aware of the weight and size of the equipment. Handle it with care.

Restrictions

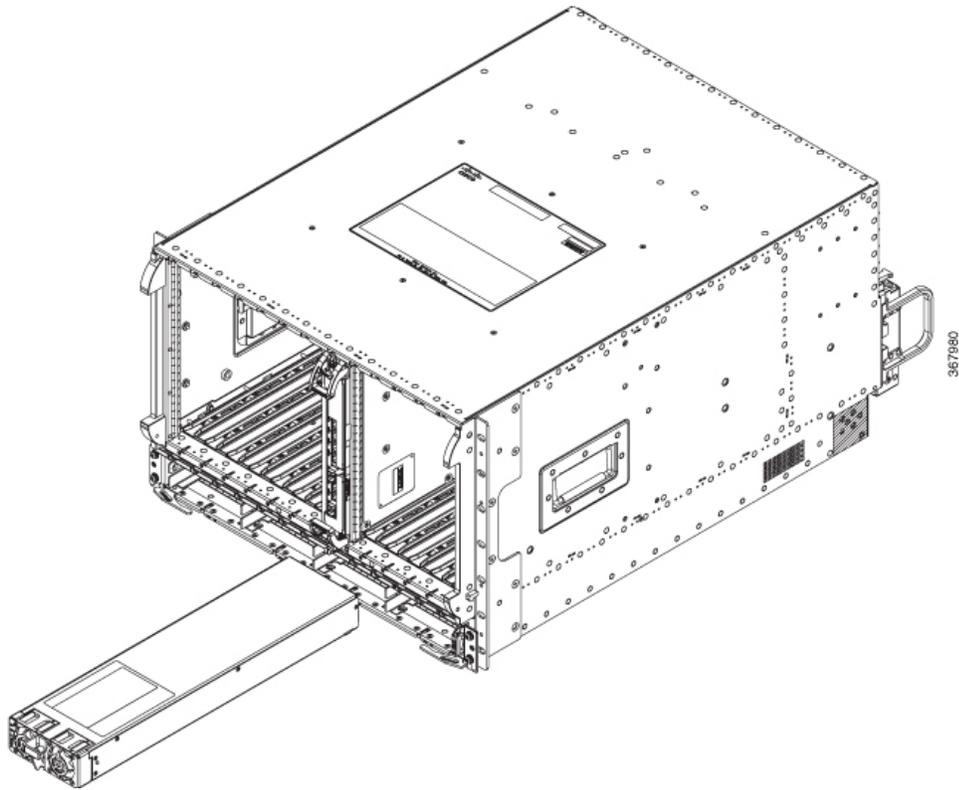
- For the DC-powered Cisco Remote PHY Shelf 7200 with 2+2 redundancy, ensure that the chassis has at least two operational DC Power Modules for the chassis to be functional.
- For the AC-powered Cisco Remote PHY Shelf 7200 with 2+2 redundancy, ensure that the chassis has at least two operational AC Power Modules for the chassis to be functional.

Required Tools and Equipment

- ESD-preventive wrist strap
- 3/16" flat-blade torque screwdriver
- Antistatic bag

To remove the Power Module, complete the following steps:

1. Loosen the screw on the Power Module ejector using a 3/16" flat-blade torque screwdriver.
2. Pull the handle down to disengage the Power Module from the chassis.
3. Slide the Power Module out of its bay with one hand while supporting the base of the module with your other hand.



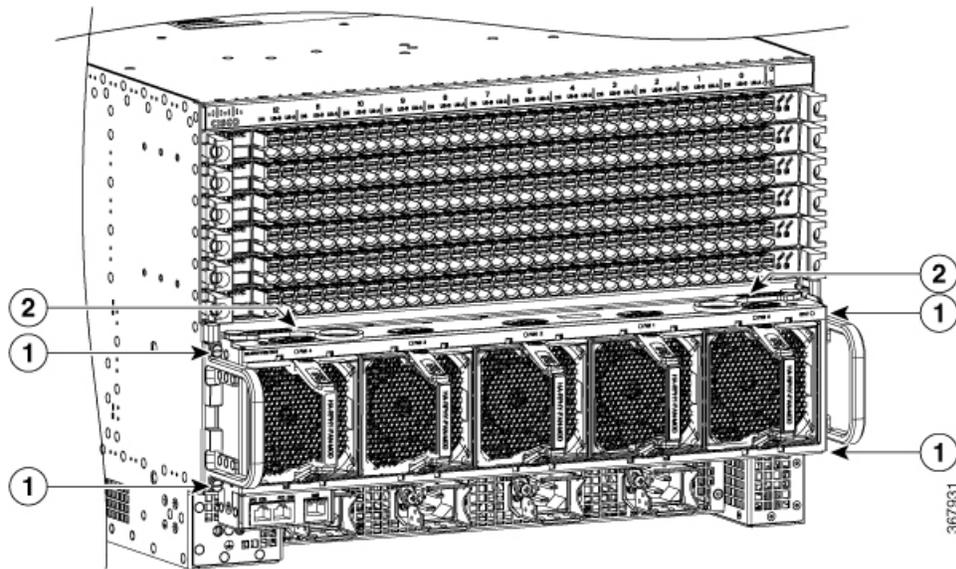
4. Place the removed Power Module in an antistatic bag.

Removing the Fan Tray

The fan tray is a Field Replaceable Unit which can be replaced on the site when required.

Complete the following steps to replace a fan tray:

1. Unscrew the four Fan Tray-to-chassis securing screws.



1	Fan Tray Screws
2	Ejectors

2. Actuate both ejectors on the Fan Tray to pull out the Fan Tray for about 0.5 inch.
3. Wait for the fan blades are stopped.



Rotating fan blades can cause serious injury during fan tray removal or replacement.

4. Pull out the Fan Tray completely and replace it with a new Fan Tray.

The shelf system should not be operating without a Fan Tray installed for more than 1-2 minutes or the system could experience thermal events, alarms, and potentially trip thermal protections that would shut down RPD cards.

Removing the Fan Module

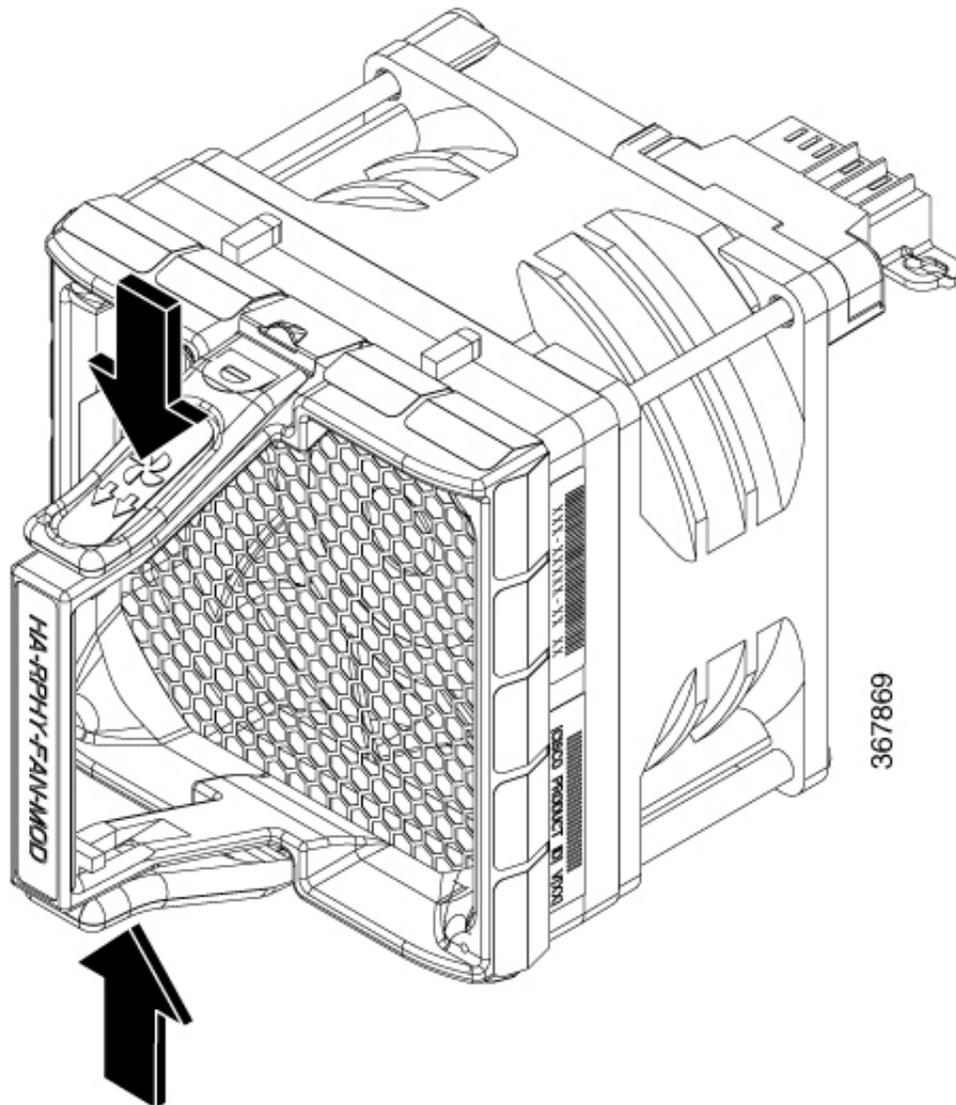
The Fan Module can be OIR from the Fan Tray while the Cisco Remote PHY Shelf 7200 system is operational. The HA-RPHY-FAN-MOD is comprised of only the fan, handle structure, EMI containment, and connector to interface to the Cisco Remote PHY Shelf 7200 Fan Tray.

**Danger**

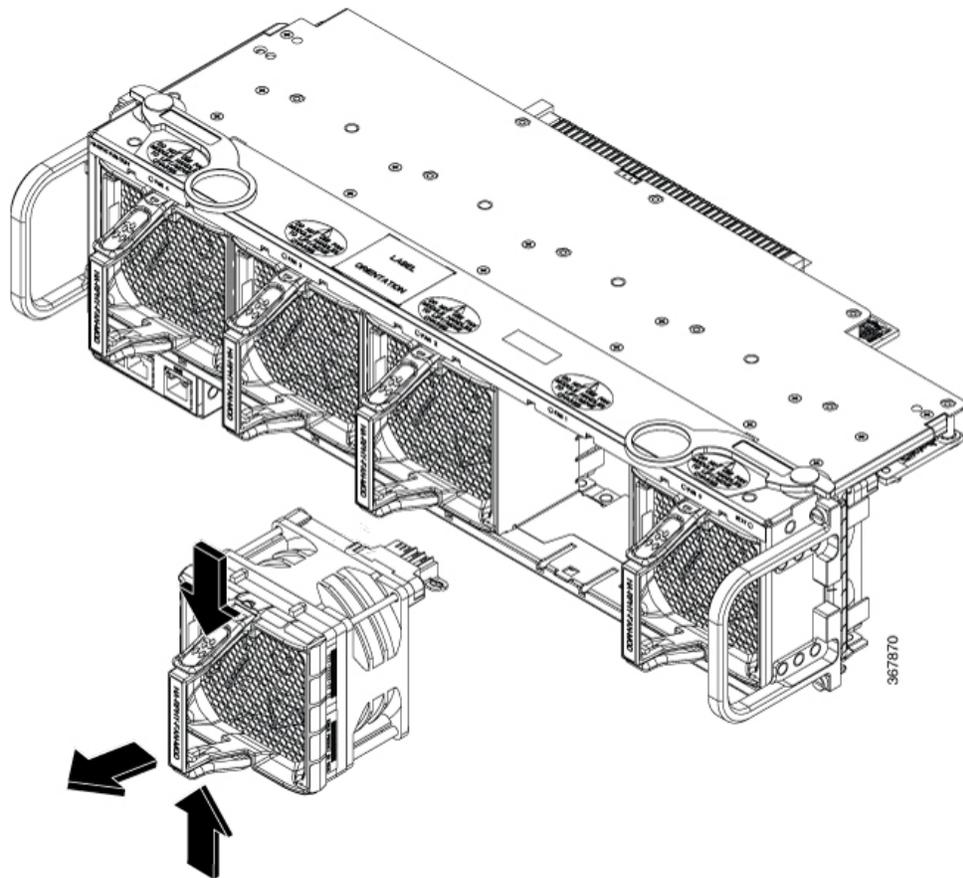
Rotating fan blades can cause serious injury during fan tray removal or replacement.

To remove the Fan Module from the Fan Tray, complete the following steps:

1. Firmly and fully depress the top and bottom fan module latches on the pastic handle.



2. Gently pull the Fan Module while continually depressing the latches on the handle to remove the Fan Module from the Fan Tray.



Removing the PIC

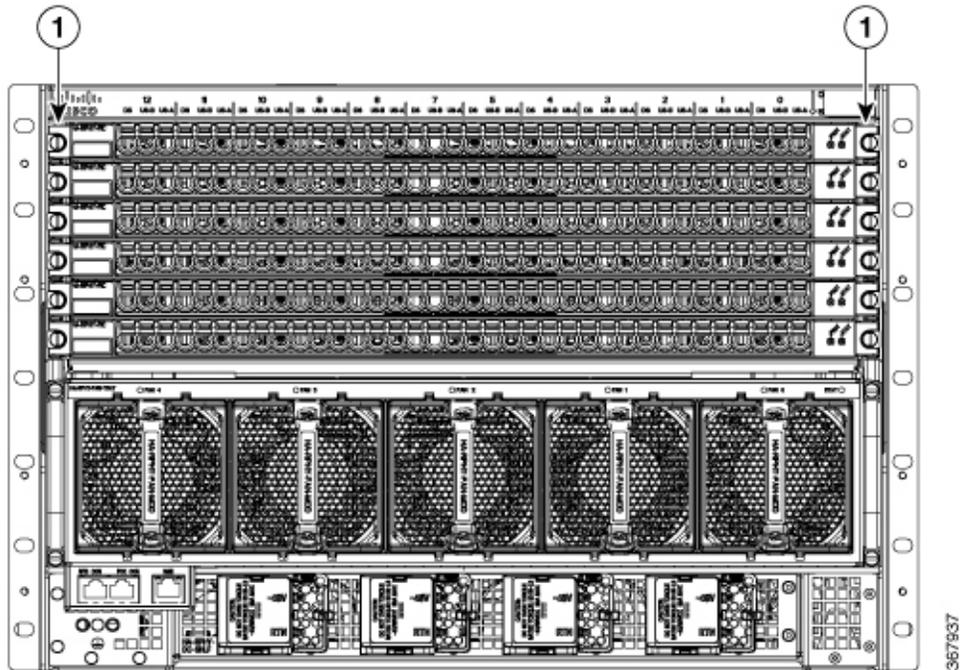
The Cisco Remote PHY Shelf 7200 PIC should be handled gently and carefully, to avoid damage to the RF connectors.

Complete the following steps to remove the PIC:

1. Remove the cables from the specific RF PIC by actuating each port plastic latch vertically and pulling out the cables horizontally.

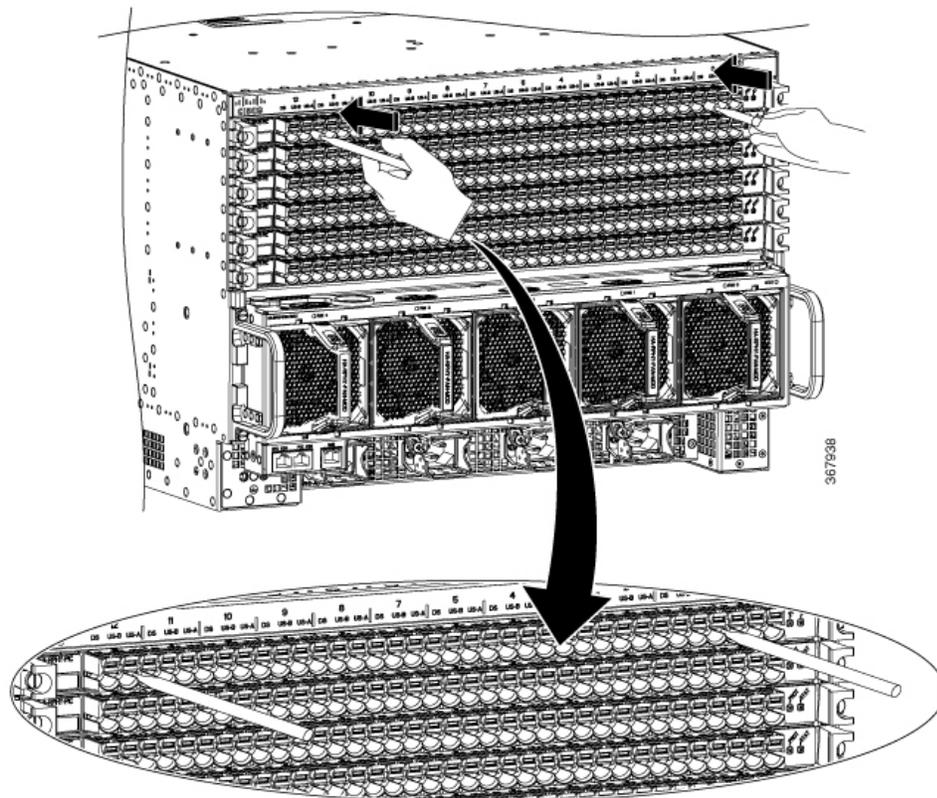
Figure 27: Actuating the latch to remove the cable

2. Unfasten the two captive screws on either side of the RF PIC faceplate.



1	Captive Screws on the faceplate
---	---------------------------------

3. Insert the PIC removal tools into the cable ports until the plastic latch engages.



4. Use the PIC removal tools as handles to pull the RF PIC card out of the system.

Opening the PIC Connector Latches

The PIC connector latches are springs designed to close automatically when cables are patched into them. When opened they want to spring back closed.

You can choose to actuate the latch using your fingers or by using a tool.

- You can actuate the latches with your fingers. There is no end detent that keeps them open. To actuate the latch, gently lift the latch upward.

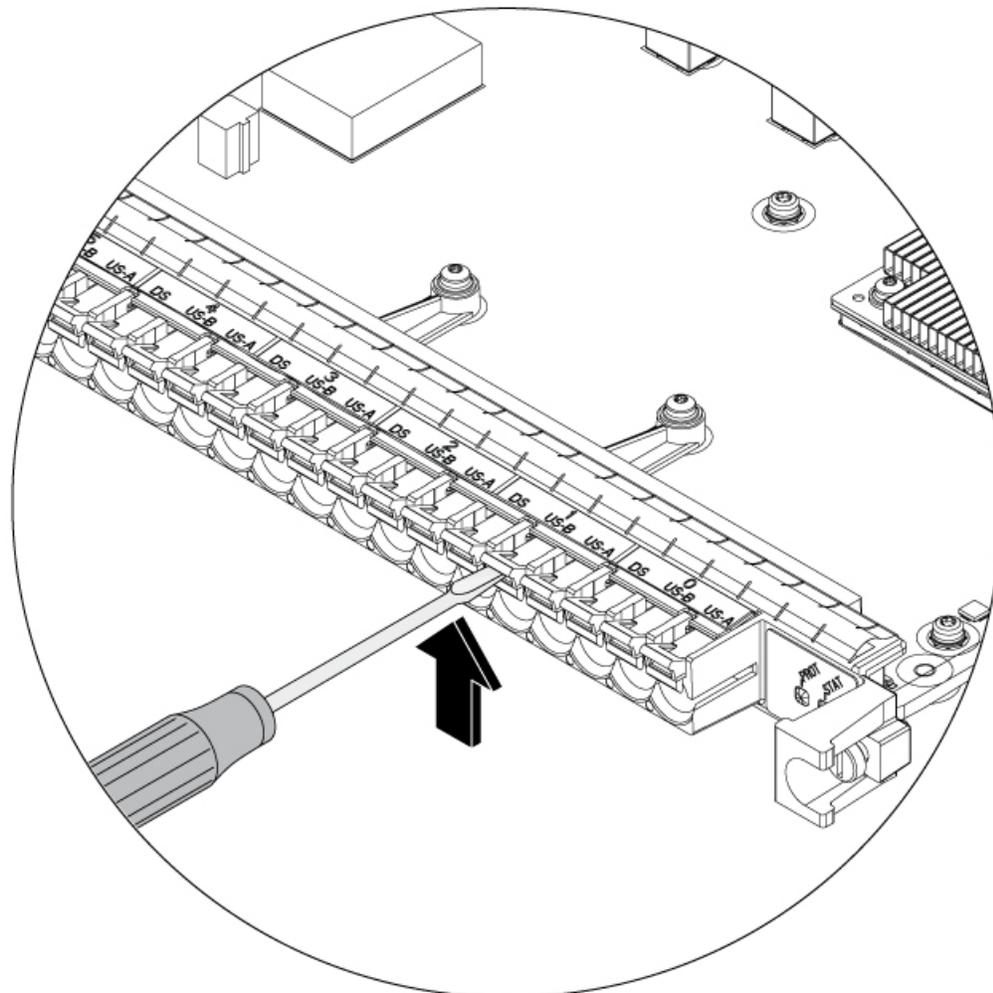
Figure 28: Actuating the latch with your fingers



Note Do not try to actuate the latch by pushing backward into the panel.

- You can also lift the latch upward with the tool. It only takes 3.5lbs of force to open the spring latch, 6lbs will bring the latch to the top of its extraction point for replacement. You can actuate the latches with use of a 3/16 screwdriver or a similar tool.

Figure 29: Actuating the latch with a tool



355985

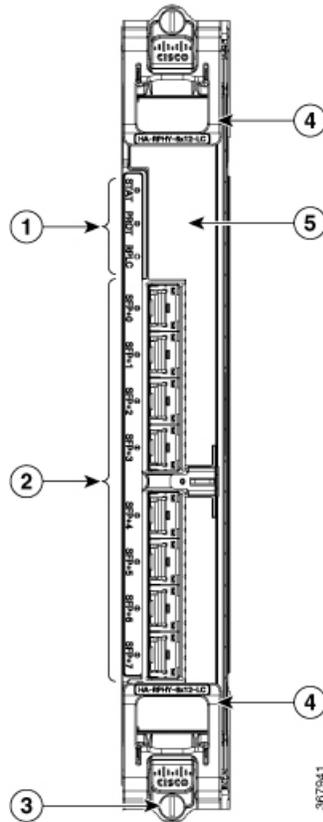


Note Do not push the latch straight back inward excessively with the tool.

Removing the RPD

To remove the RPD, complete the following steps:

1. Unfasten the two faceplate captive screws.



1	Status LED's	2	8x SFP + Ports
3	Captive Screws	4	Ejector
5	Air Filter		

2. Actuate both ejectors at the same time to pull the card out of the chassis.
3. Gently pull on the ejectors to slide the card out of the chassis.

Removing the Air Filter

Required Tools and Equipment

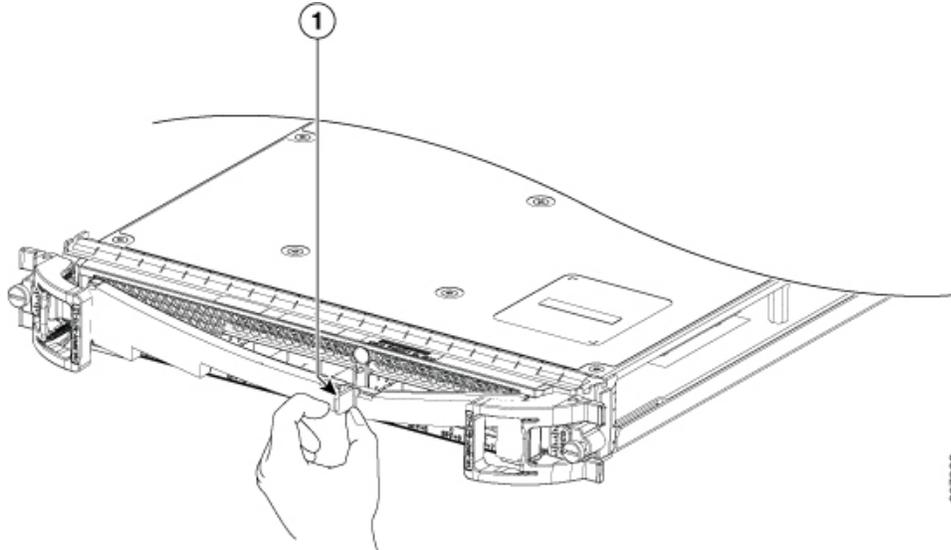
- ESD-preventive Wrist Strap

Attach an ESD-preventive wrist strap to your wrist and connect its end to the grounding lug that is connected to the chassis.



Note Removal of the Air Filter can be done while the RPD is in service or outside the system.

1. Hold the Air Filter Pull Tab located on center of the Air Filter and gently pull the tab for the Air Filter removal.



1

Air Filter Pull Tab

2. Pull the left and right ends of the Air Filter out from behind the ejector levers.



Note Removal can be done while the RPD is in service, or outside the system.



CHAPTER 8

Online Insertion and Removal of Cards on the Cisco Remote PHY Shelf 7200

- [About OIR, on page 97](#)
- [What Does an OIR Do?, on page 97](#)
- [Guidelines for Performing an OIR, on page 98](#)
- [OIR on Cisco Remote PHY Shelf 7200, on page 98](#)
- [How Do I Perform an OIR?, on page 98](#)
- [Verifying Status after an OIR, on page 99](#)

About OIR

Online Insertion and Removal (OIR) was developed to enable you to replace faulty parts without affecting system operation. When a card is inserted, power is available on the card, and it initializes itself to start working.

Hot swap functionality allows the system to determine when a change occurs in the unit's physical configuration, and reallocate the unit's resources to allow all interfaces to function adequately. This feature allows interfaces on the card to be reconfigured while other interfaces on the router remain unchanged. The interrupt routine must ensure that the interrupt line has reached a stable state.

The software performs the necessary tasks involved in handling the removal and insertion of the card. A hardware interrupt is sent to the software subsystem when a hardware change is detected, and the software reconfigures the system:

- When a card is inserted, it is analyzed and initialized in such a way that the end user can configure it properly. The initialization routines used during OIR are the same as those called when the router is powered on. System resources, also handled by software, are allocated to the new interface.
- When a card is removed, the resources associated with the empty slot must either be freed or altered to indicate the change in its status.

What Does an OIR Do?

When an OIR is performed, the router:

1. Rapidly scans the backplane for configuration changes.

2. Initializes all newly inserted interfaces and places them in the administratively shut down state.
3. Brings all previously configured interfaces on the card back to the state they were in when they were removed. Any newly inserted interfaces are put in the administratively shut down state.

The only effect on the routing tables is that routes through a removed interface are deleted, as are routes learned through that interface. The Address Resolution Protocol (ARP) cache is selectively flushed, and routing caches are completely flushed.

If a card is reinserted into the same slot from which it was removed, or if an identical card is inserted in its place, many of the control blocks from the previous installation are reused. This is necessary due to the implementation by Cisco IOS-XE software of certain control blocks, and has the benefit of saving the configuration from the previously installed card.

Guidelines for Performing an OIR

It is always safer to power down the router when you perform any hardware changes, but here are some recommendations if you need to perform an OIR. The system may indicate a hardware failure if you do not follow proper procedures.

- Insert only one card at a time; you must allow the system time to complete the preceding tasks before you remove or insert another interface processor. If you disrupt the sequence before the system completes its verification, it can cause the system to detect spurious hardware failures.
- Insert the cards swiftly and firmly, but do not shove them in.
- If present, be sure to use the little plastic levers on the side of the card to lock the card in.
- If the OIR is successful, there is absolutely no need to schedule a reload of the router.

If you get a LONGSTALL message after an OIR, or a CPUHOG during the OIR process, but encounter no other problems, you may safely ignore those messages.

OIR on Cisco Remote PHY Shelf 7200

OIR is supported on the following FRUs in a Cisco Remote PHY Shelf 7200:

- Interface PIC

How Do I Perform an OIR?

It is always safer to power down the router when you perform any hardware changes, but here are some recommendations if you need to perform an OIR. The system may indicate a hardware failure if you do not follow proper procedures.

- Insert only one card at a time; you must allow the system time to complete the preceding tasks before you remove or insert another interface processor. If you disrupt the sequence before the system completes its verification, it can cause the system to detect spurious hardware failures.
- Insert the cards swiftly and firmly, but do not shove them in.

- If present, be sure to use the little plastic levers on the side of the card to lock the card in.
- If the OIR is successful, there is absolutely no need to schedule a reload of the router.
- Check the Active/Standby state of the PIC, which will perform OIR, by using the **show redundancy** command.
- Use the **redundancy force-switchover** command if the location of the PIC is on the active slot.
- Perform OIR.

When you perform an OIR, the power supply to the corresponding PIC is cut off.

If you are performing an OIR on a standby PIC, the Cisco Remote PHY Shelf 7200 might show error messages, which you can ignore. When you insert the PIC the next time, the card will function properly.

Verifying Status after an OIR

Execute the **show platform** command to check the status.

Before Removing the Line Card

```
Router#show platform
Chassis type: HA-RPHY-CHASSIS
```

Slot	Type	State
LC0	HA-RPHY-6x12-LC	OK
LC1	HA-RPHY-6X12-LC	OK
LC2	HA-RPHY-6X12-LC	OK
LC3	HA-RPHY-6X12-LC	OK
LC4	HA-RPHY-6X12-LC	OK
LC5	HA-RPHY-6X12-LC	OK
LC6	HA-RPHY-6X12-LC	OK
LC7	HA-RPHY-6X12-LC	OK
LC8	HA-RPHY-6X12-LC	OK
LC9	HA-RPHY-6X12-LC	OK
LC10	HA-RPHY-6X12-LC	OK
LC11	HA-RPHY-6X12-LC	OK
LC12	HA-RPHY-6X12-LC	OK
PIC0	HA-RPHY-PIC	OK
PIC1	HA-RPHY-PIC	OK
PIC2	HA-RPHY-PIC	OK
PIC3	HA-RPHY-PIC	OK
PIC4	HA-RPHY-PIC	OK
PIC5	HA-RPHY-PIC	OK
P0	CBR-AC-PS	OK
P1	CBR-AC-PS	OK
P2	CBR-AC-PS	OK
P3	CBR-AC-PS	OK
FAN0	UNKNOWN	NORMAL
FAN1	UNKNOWN	NORMAL
FAN2	UNKNOWN	NORMAL
FAN3	UNKNOWN	NORMAL
FAN4	UNKNOWN	NORMAL

After Removing the Line Card

Line Card has been removed on a Cisco Remote PHY Shelf 7200 (Remove RPD_12):

```
Router#show platform
Chassis type: HA-RPHY-CHASSIS
```

Slot	Type	State
LC0	HA-RPHY-6x12-LC	OK
LC1	HA-RPHY-6X12-LC	OK
LC2	HA-RPHY-6X12-LC	OK
LC3	HA-RPHY-6X12-LC	OK
LC4	HA-RPHY-6X12-LC	OK
LC5	HA-RPHY-6X12-LC	OK
LC6	HA-RPHY-6X12-LC	OK
LC7	HA-RPHY-6X12-LC	OK
LC8	HA-RPHY-6X12-LC	OK
LC9	HA-RPHY-6X12-LC	OK
LC10	HA-RPHY-6X12-LC	OK
LC11	HA-RPHY-6X12-LC	OK
PIC0	HA-RPHY-PIC	OK
PIC1	HA-RPHY-PIC	OK
PIC2	HA-RPHY-PIC	OK
PIC3	HA-RPHY-PIC	OK
PIC4	HA-RPHY-PIC	OK
PIC5	HA-RPHY-PIC	OK
P0	CBR-AC-PS	OK
P1	CBR-AC-PS	OK
P2	CBR-AC-PS	OK
P3	CBR-AC-PS	OK
FAN0	UNKNOWN	NORMAL
FAN1	UNKNOWN	NORMAL
FAN2	UNKNOWN	NORMAL
FAN3	UNKNOWN	NORMAL
FAN4	UNKNOWN	NORMAL

After Inserting the Line Card

Line Card has been inserted on a Cisco Remote PHY Shelf 7200, and is booting (Re-insert RPD_12):

```
Router#show platform
Chassis type: HA-RPHY-CHASSIS
```

Slot	Type	State
LC0	HA-RPHY-6x12-LC	OK
LC1	HA-RPHY-6X12-LC	OK
LC2	HA-RPHY-6X12-LC	OK
LC3	HA-RPHY-6X12-LC	OK
LC4	HA-RPHY-6X12-LC	OK
LC5	HA-RPHY-6X12-LC	OK
LC6	HA-RPHY-6X12-LC	OK
LC7	HA-RPHY-6X12-LC	OK
LC8	HA-RPHY-6X12-LC	OK
LC9	HA-RPHY-6X12-LC	OK
LC10	HA-RPHY-6X12-LC	OK
LC11	HA-RPHY-6X12-LC	OK
LC12	UNKNOWN	BOOTING
PIC0	HA-RPHY-PIC	OK
PIC1	HA-RPHY-PIC	OK
PIC2	HA-RPHY-PIC	OK
PIC3	HA-RPHY-PIC	OK
PIC4	HA-RPHY-PIC	OK
PIC5	HA-RPHY-PIC	OK

P0	CBR-AC-PS	OK
P1	CBR-AC-PS	OK
P2	CBR-AC-PS	OK
P3	CBR-AC-PS	OK
FAN0	UNKNOWN	NORMAL
FAN1	UNKNOWN	NORMAL
FAN2	UNKNOWN	NORMAL
FAN3	UNKNOWN	NORMAL
FAN4	UNKNOWN	NORMAL

Line Card has been inserted on a Cisco Remote PHY Shelf 7200, and has completed booting (Re-insert RPD_12):

```
Router#show platform
Chassis type: HA-RPHY-CHASSIS
```

Slot	Type	State
LC0	HA-RPHY-6x12-LC	OK
LC1	HA-RPHY-6X12-LC	OK
LC2	HA-RPHY-6X12-LC	OK
LC3	HA-RPHY-6X12-LC	OK
LC4	HA-RPHY-6X12-LC	OK
LC5	HA-RPHY-6X12-LC	OK
LC6	HA-RPHY-6X12-LC	OK
LC7	HA-RPHY-6X12-LC	OK
LC8	HA-RPHY-6X12-LC	OK
LC9	HA-RPHY-6X12-LC	OK
LC10	HA-RPHY-6X12-LC	OK
LC11	HA-RPHY-6X12-LC	OK
LC12	HA-RPHY-6X12-LC	OK
PIC0	HA-RPHY-PIC	OK
PIC1	HA-RPHY-PIC	OK
PIC2	HA-RPHY-PIC	OK
PIC3	HA-RPHY-PIC	OK
PIC4	HA-RPHY-PIC	OK
PIC5	HA-RPHY-PIC	OK
P0	CBR-AC-PS	OK
P1	CBR-AC-PS	OK
P2	CBR-AC-PS	OK
P3	CBR-AC-PS	OK
FAN0	UNKNOWN	NORMAL
FAN1	UNKNOWN	NORMAL
FAN2	UNKNOWN	NORMAL
FAN3	UNKNOWN	NORMAL
FAN4	UNKNOWN	NORMAL



CHAPTER 9

Troubleshooting the Cisco Remote PHY Shelf 7200

- [Troubleshooting: The cable modems are not in init\(\) state, on page 103](#)

Troubleshooting: The cable modems are not in init() state

Problem The cable modems are not in init() state.

Possible Cause PTP is not aligned.

Solution Use the `show ptp clock running` command to check ptp clock state.

```
NG13#show ptp clock running
                PTP Ordinary Clock [Domain 0]
      State      Ports      Pkts sent      Pkts rcvd      Redundancy Mode
  PHASE_ALIGNED  1                1666420        5051243        Hot standby

                PORT SUMMARY

                PTP Master
Name      Tx Mode  Role      Transport  State  Sessions  Port Addr
slave-from-903 unicast  slave      Lo1588    Slave    1         10.90.3.93
```

Troubleshooting: The cable modems are not in init() state