

casa systems

## C2200 CMTS Hardware Installation Guide

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## Safety and Regulatory Agency Compliance

The C2200 complies with the safety and regulatory agency standards listed below when installed in accordance with this guide.

#### **Product Safety**

Representative samples of this product have been evaluated by a Nationally Recognized Test Laboratory (NRTL) and meet the applicable U.S., Canadian, and International safety standards:

- ANSI/UL 60950-1 UL Standard for Safety for Information Technology Equipment Safety.
- EN/UL/IEC/CAN/CSA C22.2 No. 60950-1 Standard for Safety for Information Technology Equipment Safety.
- EN60950-1

#### Grounding

The AC-powered version of the product is grounded through the ground (GND) wire in the AC power cord. There is no separate grounding connection.

The DC-powered version of the product is grounded from the DC power module to the chassis; an external grounding point is present on the front of the chassis.



#### **Electrical Hazard**

Before powering up the DC-powered C2200, make sure the earth ground terminal on the power module is connected to the Protective Earth (PE) of the building.

#### EMC

The C2200 has been tested and meets the following requirements:

- EN-55022, Class A
- EN-55024
- FCC Part 15 Class A, CISPR Class A

#### FCC Declaration of Conformity

We declare under our sole responsibility that:

Product Name: C2200

To which this declaration relates, is in conformity with the following standards or other documents:

- ANSI C63.5-1992 Methods of Measurement
- Federal Communications Commission 47 CFR Part 15, Subpart B
- 15.107 (b) Class A Conducted Limits
- 15.109 (b) Class A Radiated Emission Limits

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with this guide, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Changes or modifications not expressly approved by Casa Systems, Inc. may void the users' authority to use this equipment.

#### **CE Declaration of Conformity**

Equipment: C2200

Name and address of applicant:

Casa Systems, Inc. 100 Old River Road Suite 110 Andover, MA 01810 USA

Name and address of manufacturer:

Casa Systems, Inc. 100 Old River Road Suite 110 Andover, MA 01810 USA

Rating and principal characteristics:

AC: 5A, 100-240V~, 60/50Hz

DC: -48VDC (X2), 9A

Model / Type Ref.: C2200

As sample of the product has been tested and found to be in conformity with the:

2006/95/EC (Low Voltage Directive) 2004/108/EC (EMC Directive)

Standards used:

EN60950-1

FCC Part 15, Subpart B, Class A

EN55022, Class A Conducted Emissions

EN55022, Class A Radiated Emissions

EN55024

EN-61000-3-2, Harmonics

EN-61000-3-3, Flicker

EN-61000-4-2, ESD

EN-61000-4-3, Radiated Susceptibility

EN-61000-4-4, Electronic Fast Transients

EN-61000-4-5, Surge

EN-61000-4-6, Conducted RF Susceptibility

EN-61000-4-11, Voltage Dips and Interruptions

We, herewith declare,

Casa Systems, Inc. 100 Old River Road Suite 110 Andover, MA 01810 USA

That the above listed product complies with the appropriate basic safety and health requirements of the EC Directive based on its design and type, as brought into circulation by us. In case of alteration of the product, not agreed upon by us, this declaration will lose its validity.

Date/Authorized Signature \_\_\_\_\_

Title of Signatory \_\_\_\_\_

Company: Casa Systems, Inc.

Year CE mark first applied: 2006

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## Preface

## About this guide

The *Casa Systems* – *C2200 CMTS Hardware Installation Guide* covers the initial hardware installation for the Casa C2200 CMTS. This guide is intended for system administrators, engineers, and operators who are responsible for installing and managing the C2200. Users who perform these tasks should also be familiar with power and protective earth (PE) cabling, electronic circuitry, wiring practices, and safety precautions.

For information on configuring the CMTS software running on the C2200, refer to the *Casa Systems – CMTS Software Configuration Guide*.

For information about	See
C2200 CMTS hardware	Chapter 1.
Installing the C2200	Chapter 2.
Connecting the hardware	Chapter 3.
Troubleshooting the system	Chapter 4.
Technical specifications	Appendix A.

#### **Revision history**

- 06.00.00\_A to C New issue of the Casa Systems C2200 CMTS Hardware Installation Guide.
- 06.01.02 July 2012; revised hardware specifications.
- 06.01.03.01 May 2013; revised CE declaration; updated SFP information.
- 06.01.03.02 August 2013; added power ON/OFF switch electical caution.

#### Casa C2200 software version

The C2200 operates with Casa software version 5.4.21. See the *Casa Systems – CMTS Release Notes* for software installation and other release information if you are upgrading the software image.

## Safety information and symbols

The following symbols that appear in this guide. Before working on equipment, be aware of the hazards involved with electrical circuitry and standard safety practices that can help prevent accidents.



**Warning:** This symbol means the task may present an electrical hazard that could cause bodily injury. Before you work on any equipment, you must be aware of the hazards involved with electrical circuitry, and familiarize yourself with standard practices for preventing accidents.



**Caution:** This symbol means that you must be careful. In this situation, performing tasks incorrectly could result in equipment damage or loss of data.



**Danger:** This symbol means that a task may present physical danger associated with lifting and moving physical equipment. This includes bodily injury and damage to system hardware.



**Note:** This symbol provides important or supplemental information about a task that you are performing.

## **Contacting Casa**

#### **Corporate facility**

Casa Systems, Inc. 100 Old River Road Andover, MA 01810 Tel.: 978-688-6706 World Wide Web: <u>www.casa-systems.com</u>

#### **Technical Support**

In the United States: Tel: 978-699-3045 E-mail: support@casa-systems.com

#### **Technical documentation**

Casa Systems provides the following documentation set in PDF format, viewable using Adobe Reader 5.0 or later. These PDF files are available from the Casa FTP site at <u>ftp://support.casa-systems.com.</u>

- Casa Systems C2200 CMTS Quick Installation
- Casa Systems C2200 CMTS Hardware Installation Guide
- Casa Systems C3200 CMTS Quick Installation
- Casa Systems C3200 CMTS Hardware Installation Guide
- Casa Systems CIG CMTS Quick Installation
- Casa Systems CIG CMTS Hardware Installation Guide
- Casa Systems C10G/C10200 CMTS Quick Installation
- Casa Systems C10G CMTS Hardware Installation Guide
- Casa Systems C10200 CMTS Hardware Installation Guide
- Casa Systems C100G CMTS Quick Installation
- Casa Systems C100G CMTS Hardware Installation Guide
- Casa Systems CMTS Software Configuration Guide
- Casa Systems CMTS Network Solutions Guide
- Casa Systems CMTS Troubleshooting and Diagnostics Reference

- Casa Systems CMTS Release Notes
- Casa Systems CIG/CIN CMTS Release Notes

**Note:** Casa Systems provides updates to the manuals on a regular basis. Log on to the Casa FTP site for the latest files in PDF format.

## **Conventions used in Casa documentation**

#### Typographical conventions

Key Convention	Function	Example
Boldface font	Commands and keywords are in <b>boldface</b> .	Type abc, then press [ENTER]
Italic font	Emphasized or newly introduced terminology is in <i>italics</i> .	dynamic bonding change (DBC)
brackets [ ]	Elements in square brackets are optional.	[portNumber]
braces {x   y   z}	Indicates a required argument with a choice of values; choose one.	{enabled   disabled}
brackets [x   y   z]	Indicates an optional argument with a choice of values; choose one.	[abc   123]
vertical bar	Separates parameter values. Same as "or."	{TCP   TLS}
String	A non-quoted set of characters. Do not use quotation marks ("")around the string as the string will include the quotation marks.	abc
Screen font	CLI sessions and information the system displays are in screen font.	
Boldface screen font	Information you must enter is in boldface screen font.	
Italic screenfont	Arguments for which you supply values are in <i>italic screen</i> font.	number

Key Convention	Function	Example
٨	The symbol ^ represents the key labeled CTRL (control). The key combination ^D in a screen display means hold down the CTRL key while pressing the D-key.	
<>	Non-printing characters such as passwords are in angle brackets in contexts where italics are not available. Angle brackets are also used for variables.	
!,#	An exclamation point (!) or a pound sign (#) at the beginning of a line of code indicates a comment line.	# This is a comment.

#### Acronyms

Casa Systems manuals contain the following industry-standard and product-specific acronyms:

AAA	Authentication, Authorization, Accounting
ARP	Address Resolution Protocol
CMTS	Cable Modem Termination System
DBC	Dynamic Bonding Change
DCU	DOCSIS Control and Upstream
DDM	DOCSIS Data Manager
DOCSIS	Data Over Cable Service Interface Specification
DHCP	Dynamic Host Configuration Protocol
DQM	DOCSIS QAM module
GigE	Gigabit Ethernet
HFC	Hybrid fiber coaxial
ICMP	Internet Control Message Protocol
IP	Internet Protocol
MIB	Management Information Base
NTP	Network Time Protocol
PCMM	Packet cable multimedia

PIM	Protocol Independent Multicast
QAM	Quadrature Amplitude Modulation
SMM	Switch and management module (Casa Systems)
SNR	Signal to Noise Ratio
STB	Set Top Box
ТСР	Transmission Control Protocol
TOS	Type of service
UCC	Upstream channel change
UPS	Upstream
URL	Uniform resource locator
VoIP	Voice over IP
VLAN	Virtual local area network

# Chapter 1. Casa C2200 hardware overview

This chapter describes the Casa C2200 CMTS hardware and components.

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### C2200 system overview

The Casa Systems C2200 Cable Modem Termination System CMTS) is a new class of cable edge device that combines a third generation DOCSIS CMTS and an MPEG video edge-QAM in a high-density platform that allows cable operators to deliver digital video services in a compact form factor.

The C2200 provides DOCSIS-based IP applications, such as broadband access, VoIP, IPTV and video-over-IP etc., as well as digital video applications that include SDTV Broadcast over Cable, HDTV broadcast over Cable, video-on-demand (VOD), Network Digital Video Recorder (nDVR), interactive gaming, and switched digital video.

#### **Network capabilities**

The C2200 consists of a base system with three six slots for DOCSIS interface modules (downstream DQM QAM modules or upstream DCU modules). Any combination of downstream modules and upstream modules are supported by the platform to enable a flexible downstream to upstream channel ratio.

The DOCSIS QAM Module (DQM) provides DOCSIS packet processing and QoS, DOCSIS downstream MAC, PHY, and RF up-conversion. There are three versions of downstream modules: DQM04 (4-channel with 1 channel per port), DQM08 (8-channel; 2 channels per port), and DQM16 (16-channel; 4 channels per port). All downstream modules have four physical output ports.

The DOCSIS Control and Upstream module (DCU) includes DOCSIS packet processing, DOCSIS upstream MAC, and burst mode receivers. There are three versions of DCUs: DCU16 (16-channels in 8 ports), DCU-8 (8-channels in 8 ports), and DCU04 (4-channel in 4 ports).

A typical configuration for channel bonded deployment can be 32DSx32US or 1:1 channel ratio or 48DSx16US for 4:1 channel ratio. Each downstream QAM channel can be configured to support DOCSIS or MPEG/DVB-C video or a combination. In the minimum configuration, the C2200 can have one DQM04 downstream module (4 channels of QAM) and one DCU04 upstream module (4 channels of burst mode receivers).

For complete information on the C2200 features and capabilities, see the *Casa Systems C2200 CMTS Data Sheet*.

## C2200 chassis

The C2200 chassis is a 1RU enclosure that installs in a standard 19-inch equipment rack in both AC and DC power environments. Rack mounting flanges are included with the chassis to facilitate mounting in the many rack variations available today.

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#### Front and rear views

The C2200 front enclosure supports the AC and DC power modules, status LEDs, rack mounting brackets, and integrated SMM (with console RS-232 DB9 serial port, T1 external clock reference, 10/100 Ethernet management port, 4-port GigE copper or fiber SFP, and status LEDs), as illustrated in Figure 1-1 and Figure 1-2.

#### Figure 1-1. Casa C2200 CMTS front view (AC power)



#### Figure 1-2. Casa C2200 CMTS front view (DC power)



The C2200 rear enclosure provides access to the power connectors, DQM QAM downstream modules with F-connectors, DCU upstream module with F-connectors, as illustrated in Figure 1-3.

#### Figure 1-3. Casa C2200 CMTS rear view



#### Slot and port numbering

The C2200 contains four line-card slots located at the rear of the chassis. The slots can accept any combination of the two types of DOCSIS modules; DQM or DCU modules. Slots are numbered 0 to 3 from left to right, as illustrated in Figure 1-3.

At the RF output (downstream) and RF input (upstream) cable interfaces using the 75-ohm F-connectors, ports are numbered with <module> and <port> in the format <module>/<port>.

On the DQM QAM, ports are 0 to 3 counting from left to right on each module.

On the DCU upstream, the two rows of ports on each module are numbered 0 to 7 counting from left to right on the bottom row first, and then from left to right on the top row.

## C2200 system components

This section describes the C2200 components. C2200 modules are field-replaceable units (FRUs) that are installed by Casa-trained personnel ONLY. The modules and their order numbers are listed in Table 1-1.

#### Table 1-1. C2200 components

Component	Order number
C2200 DC-powered chassis with integrated fan tray assembly, SMM, and DC power modules (2)	C2200-CHASSIS-DC
C2200 AC-powered chassis with integrated fan tray assembly, SMM, and AC power modules (2)	C2200-CHASSIS-AC
DOCSIS QAM (DQM)	C2200-DQM04 (4 channels) C2200-DQM08 (8 channels) C2200-DQM16 (16 channels)
DOCSIS Control and Upstream Module (DCU)	C2200-DCU-04 (4 channels) C2200-DCU-08 (8 channels) C2200-DCU-16 (16 channels)
C2200 DC power module	C2200-POWER-DC
C2200 AC power module	C2200-POWER-AC

#### **Pluggable devices**

GigE Small Form Factor Pluggable (SFP) 1000Base-T transceiver (RJ45 socket, copper, short reach)	SFP-CP
GigE Small Form Factor Pluggable (SFP) 1000Base-SX (LC socket, fiber optic, short reach)	SFP-LC
GigE Small Form Factor Pluggable (SFP) (LC socket, fiber optic, long reach)	SPF-LX

**Caution:** Casa C2200 is provided in sealed chassis. All C2200-related maintenance involving field-replaceable units are to be performed ONLY by Casa-trained personnel who have received hands-on instruction in C2200 maintenance. DO NOT open the unit and attempt to perform maintenance or upgrades yourself, as this will void the product warranty and possible service agreements.

Please contact Casa Technical Support for more information.

#### Integrated fan assembly

The fan tray is an integrated assembly that provides cooling air to the chassis. Four internal fans draw cooling air into the front of the chassis where the air is directed across the internal components. The air exits through openings at the rear of the chassis.

The fan tray is replaceable as a complete unit, installable by <u>Casa-trained personnel</u> ONLY.

#### AC and DC power supplies

The C2200 ships with a single AC or DC power supply, as illustrated in Figure 1-4. The DC power supply receives –36 to -60 VDC from two separate DC power sources. The AC power supply provides 90 to 264V to the chassis using the appropriate country cords. Both the AC and DC power modules have integrated cooling fans.



**Caution:** Before making any electrical connections to the C2200, ensure that the system power ON/OFF switch is set to OFF.

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#### Figure 1-4. C2200 AC and DC supplies



#### Integrated Switch & Management Module (SMM)

The integrated SMM performs Layer 3 packet routing and forwarding as well as system management functionality using the following components:

- Network interfaces using four GigE ports to accept and transmit video streams in the form of MPEG2 transport streams from a video-on-demand (VoD) server or from IP networks. Each port uses an industry-standard small form-factor pluggable (SFP) module.
- 10/100 Fast Ethernet port for Telnet and SSH remote network out-of-band management access.
- T1 downstream to upstream DOCSIS clock reference
- RS-232 local console serial port (with DB9 connector)

Figure 1-5. C2200 Switch and Management Module components



#### **DOCSIS** modules

In addition to the SMM, there are two types of DOCSIS modules that install into the C2200.

- DOCSIS QAM downstream (DQM)
- DOCSIS Control and Upstream (DCU)

The DOCSIS QAM Module (DQM) is a DOCSIS downstream processor that includes DOCSIS packet processing, QoS, DOCSIS downstream MAC, PHY, and RF up

conversion, serving as the RF downstream interface between the cable headend and DOCSIS-based cable modems.

The DQM is a single-slot module and supports 4, 8 or 16 QAM channels. It is a hot-swappable unit.

The DOCSIS Control & Upstream (DCU) Module is a DOCSIS upstream unit that includes RF burst receiving, signal demodulation, DOCSIS upstream MAC, PHY, as well as packet processing and QoS, serving as the RF upstream interface between the cable headend and DOCSIS-based cable modems. The DCU is a single-slot module and supports 8 DOCSIS burst receivers. It is a hot-swappable unit.

Figure 1-6 shows the DQM and DCU modules.

#### Figure 1-6. C2200 DQM (QAM) and DCU modules

DQM QAM downstream RF output



DCU upstream RF input

## System status LEDs

Status LEDs are present on the front of the system, as follows:

- Front panel SYS STAT
- Line card modules M1 to M4
- 10/100 Fast Ethernet Link and Activity
- GigE interfaces G1 to G4
- T1 external clock reference T1

#### Table 1-2. C2200 LED indications

Location	LED label	Color	Indication
Front panel	SYS STAT	Green	System turned on; running normally.
		Black (off)	No power condition; system off.
	M1 to M4	Green	Active; normal operation.
		Black	No line card installed in corresponding slot.
		Amber	Error condition detected on corresponding module.
10/100 Fast Ethernet	(L)ink status	Green	Ethernet link up and connected.
		Black (off)	Ethernet link down; no connection
	(A)ctivity	Green	Ethernet link is transmitting or receiving data.
		Black	No network activity currently present on link.
GBE ports G1 to G4	(L)ink status	Green	Ethernet link up and connected.
		Black (off)	Ethernet link down; no connection
	(A)ctivity	Green	Ethernet link is transmitting or receiving data.
		Black	No network activity currently present on link.
T1	(L)ink status	Green	T1 link up and connected.
		Black (off)	T1 link down; no connection

Location	LED label	Color	Indication
	(A)ctivity	Green	T1 link is transmitting or receiving data.
		Black	No network activity currently present on link.

#### Table 1-2. C2200 LED indications (continued)

## Chapter 2. Installing the C2200 hardware

This chapter covers the C2200 CMTS basic installation.

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## Safety guidelines for C2200 installation

This section provides general safety guidelines to prevent injury during equipment installation and operation. It includes the following:

- Electrical equipment guidelines
- Chassis lifting guidelines



**Warning:** Only trained and qualified personnel should install, replace, or service this equipment.

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 whether suitable grounding is available.

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

#### **Electrical equipment guidelines**

Be sure to follow these important electrical guidelines:



**Caution:** Before making any electrical connections to the C2200, ensure that the system power ON/OFF switch is set to OFF.

- Always unplug or disconnect the power cable before installing or removing a chassis.
- Locate the emergency power-off switch for the room in which you are working. If an electrical accident occurs, turn off the power immediately.
- Do not work alone if potentially hazardous conditions exist.
- Never assume that power is disconnected from a circuit. Always check.
- If an electrical accident occurs, proceed as follows:
  - Use caution; do not become a victim yourself.
  - Turn off power to the system.

2-2

- If possible, send another person to get medical aid. Otherwise, assess the condition of the victim and then call for help.
- Determine whether the person needs rescue breathing or external cardiac compressions; then take appropriate action.

#### **Chassis lifting guidelines**

A fully-populated C2200 chassis weighs approximately 30 lbs and should not be moved frequently.

Before you install the C2200, plan the chassis placement to ensure that your site is properly configured. This will keep you from having to move the chassis later to accommodate power sources and network connections.

Whenever you lift the chassis, follow these guidelines:

- Always disconnect all external cables before lifting or moving the chassis.
- Ensure that your footing is solid, and balance the weight of the object 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 lower back muscles.
- Lift the chassis from the bottom; grasp the underside of the chassis exterior with both hands.

## **Required tools**

The following tools are necessary for C2200 installation:

- #2 Phillips screwdriver
- Wire strippers (for removing shielding from DC power cables)
- A small flat-tip screwdriver for securing connections to the DC power module Phoenix-type plug
- Nut drivers

## Unpacking the system

When the system arrives at your installation site, you will need to carefully unpack the system and other items included with the shipment. Check the shipping container for any exterior damage. The container may have a "shock watch" that will reveal if the container was mishandled during shipment.



**Note:** If damage is present, notify the shipping company and Casa Systems immediately for a return material authorization, if necessary.

The C2200 is shipped with all ordered components already installed in the chassis. The chassis weighs approximately 30 lbs. Follow the lifting guidelines covered earlier in this chapter.

#### **Shipping contents**

The following items are included with the C2200:

- Technical documentation CD-ROM
- Rack mounting hardware (brackets, screws, and spacers)
- Console cable for local system management
- AC power cables (as ordered for the destination country)
- Small form-factor pluggable (SFPs) modules for Ethernet connections at the SMM

If ordered, AC-to-DC power supplies with cabling are shipped separately. Contact Casa Systems for additional information.

## Installing the system in a rack

The C2200 is designed for installation in a standard 19-inch mounting rack using Casa-supplied rack mounting guides. If you installing are multiple systems in an unpopulated rack, install the first system at the bottom of the rack and work up. This

will prevent the rack from becoming top-heavy and unstable during equipment installation.,

**Caution:** Caution must be exercised when rack-mounting this or any other type of equipment. Ensure that all equipment is properly secured using the specified hardware. Equipment must be installed in a safe manner to prevent overloading, tipping over, or other unsafe conditions.

#### System ventilation at the installation site

When installing equipment, ensure adequate ventilation is available. Inadequate ventilation will result in higher than normal operating temperatures and may result in degraded operation. Always ensure the system receives sufficient airflow such that it will operate within the specified operating temperature range.

#### Installation procedure

Use the following procedure to install the chassis.

- 1. Locate the rack mounting hardware included in the shipping box. You will find slotted steel brackets (2), M4x10 screws (8), and plastic spacers (2).
- 2. From the back of the rack, install one slotted steel brackets to each side of the rack using corresponding mounting holes on each side (so that the chassis will be level when installed). Screws are not provided due to the many rack types available today.

Figure 2-1. Installing the steel mounting brackets



- 3. Locate the eight M4x10 screws and the two plastic spacers.
- 4. Install the rack mounting ears to the front the chassis using three screws to secure each mounting ear, as illustrated in Figure 2-2.
- 5. Attach the screws and spacers to the C2200 chassis (one set on the left and two sets on the right), as illustrated in Figure 2-2. Once attached, these become the guideposts that will engage the horizontal slots on the steel mounting brackets shown in Figure 2-1.
- 6. Install the two



#### Figure 2-2. Installing rack mounting ears and guideposts

7. Lift the chassis up to the desired height in the rack and maneuver the chassis into position.

**Caution:** Two people may be needed to position the chassis into a rack, depending on how high you are mounting it.

8. Align the guideposts that you just installed with the slots in the steel mounting brackets and carefully slide the chassis into the rack, illustrated in

9. At the front of the system, install four screws though the mounting ears to secure the system to the rack.

**Note:** You must provide the four screws that attach the C2200 CMTS to the rack since the requirements for these screws will vary depending on the specifications from the rack manufacturer.

Figure 2-4 illustrates a sample rack installation using multiple C2200 chassis'.

#### Figure 2-3. Aligning the chassis to the rack




- To populate rack, start from the first available postion from the bottom of the rack.
- 2. Install four screws (two per mounting ear) and turn clockwise to tighter

## Connecting the chassis to ground (DC systems)

Connecting the C2200 chassis to earth ground (GND) is required for all DC power installations. The chassis provides a shelf ground terminal at the front of the system just to the right of the DC power supply. The ground terminal provides a single point for connecting a ground terminal cable.



**Warning:** Electrical Hazard. Connecting the chassis to Protected Earth (PE) is mandatory prior to connecting power to the rack and chassis. It will minimize the potential for damage to your system and maximize safety at the system site.

The DC power supply is also equipped with an internal grounding point on the inside of the chassis to ensure adequate power and chassis GND connections.



**Note:** In a typical telecom environment, the RETURN (RTN) path of the -48 V supply is grounded to Protective Earth (PE) of the building.

The specification for the chassis ground connection cable is:

- Minimum required wire size: AWG 14
- Use #6 ring terminals large enough for AWG 14 wire

Figure 2-5 illustrates the chassis GND cable installation.

2-11





## 2-12 C2200 Hardware Installation Guide Connecting the chassis to ground (DC systems)

## Chapter 3. Connecting and starting the C2200

This chapter covers the procedures for connecting the C2200 and starting the system. It includes the following topics:

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Connecting the Ethernet cable to the SFP	3-4
Removing Ethernet cables and SFP modules from the SMM	3-4
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## **Connecting the Gigabit Ethernet ports**

The network uplink connections are made through the GigE Ethernet (GigE) ports.

The four GigE ports support IEEE 802.3z and IEEE 802.3ab specifications for 1000BASE-T/-X (1000 Mbps) transmission over fiber-optic cables and standard CAT5/CAT6 cables. These ports also support auto-sensing and auto-negotiation of the proper transmission mode (half duplex or full duplex) with an attached device.

Cables connect to the Ethernet ports using SFP (Small Form-factor Pluggable) modules.

## Installing SFP modules

All GigE ports each require the insertion of an SFP module (SFP-CP copper, or SFP-LC or SFP-LX fiber), as illustrated in Figure 3-1. Refer to

The following warning applies to fiber-optic SFPs.

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





To insert an SFP module into a GigE slot:

3-2

3-3

1. Attach an ESD wrist strap, grounding the strap to bare metal on the rack or to the rack mounting ear on the chassis, as illustrated in Figure 3-2.

Warning: You must be properly grounded before handling this ESD-sensitive product. Otherwise, you could damage the SFP during handling.

#### Figure 3-2. Attaching an ESD strap to the C2200



2. For optical SFP modules, locate the transmit (TX) and the receive (RX) markings that identify the topside of the SFP module.



**Note:** On some modules, the TX and RX markings might be replaced by arrowheads. These point out of the module connector to signify the transmit direction, and into the connector to indicate the receive direction.

- 3. Aligning the back (receive) end of the module in to the front faceplate, insert the module into the Gigabit Ethernet port until you feel the connector snap into place.
- 4. Remove the dust plugs from the optical ports, and store them for later use.

#### Connecting the Ethernet cable to the SFP

To connect to the GigE Ethernet cable:

- 1. Insert the Ethernet cable into the front (transmit) end of the SFP module, as illustrated in Figure 3-3.
- 2. Repeat Step 1 for the other Gigabit Ethernet ports.

## Removing Ethernet cables and SFP modules from the SMM

To remove an SFP module:

- 1. Remove the cable from the front end of the SFP module.
- 2. To release the lock, pull the SFP module release lever down until it stops.
- 3. Slide the module out of the receptacle.
- 4. Replace the dust plugs on the optical ports for protection.

#### Figure 3-3. Connecting Gigabit Ethernet ports



## Connecting the Fast Ethernet Port to the management system

The C2200 provides an Ethernet 10/100BASE-T (Fast Ethernet) connection to a network management system over Telnet or SSH sessions. The Fast-Ethernet port uses an RJ45 connector that supports standard straight-through and crossover Category 5 UTP cable:

- Use Category 5 UTP straight-through cables when connecting to a hub.
- Use Category 5 UTP crossover cables when connecting directly to a PC or other Ethernet device.



**Note:** The Casa C2200 does not come with Category 5 UTP RJ45 cables. These cables are available commercially.

To connect the Fast-Ethernet port to an Ethernet network from remote C2200 management:

- 1. Attach one end of the Category 5 UTP straight-through or crossover cable directly to the Fast Ethernet port, as illustrated in Figure 3-4.
- 2. Connect the other end of the cable to the hub or other Ethernet device from which you will run a network-based interface such as Telnet or SSH to the C2200.

#### Figure 3-4. Connecting the 10/100 Fast Ethernet port



## Connecting to the console port

The SMM console port provides local administrative access to the C2200 and the command-line interface (CLI) over a serial EIA-561 RS232D connection with a DTE interface using a male RJ45 plug. Attaching a terminal or PC allows you to connect to the system CLI for initial setup at the installation site.

To connect a terminal or PC to the RJ45 console port, you need a DB-9 to DB-9 serial crossover cable and the supplied RJ45 to DB-9 adapter.

Figure 3-5 illustrates the RJ45 and lists the pin/signal information.



#### Figure 3-5. RS232 pinouts on console port

The console connection kit shipped with the C2200 system includes one DB-9-to-DB-9 serial crossover console cable (also called a null modem cable)

Connect the console port to a terminal or PC, as illustrated in Figure 3-6.

- 1. Connect one end of the DB-9-to-DB-9 cable to the serial RS232 port.
- 2. Connect the other end of the cable to the DB-9 serial port on the PC or terminal to complete the console port cable connection.
- 3. Power on the PC or terminal.
- 4. Configure the PC terminal emulation software or the terminal for the following default settings:

- 115200 baud
- 8 data bits
- No parity generation or checking
- 1 stop bit
- No flow control

## Figure 3-6. C2200 console port connections

DB-9 socket



## Connecting the RF I/O ports

Connect the RF I/O upstream and downstream ports to the HFC network, as illustrated in Figure 3-7:

- 1. Attach the 75-ohm F-connector on one end of the cable to the RF connector on the faceplate of RF I/O module.
- 2. Attach the other end of the cable to the equipment that acts as a gateway to the HFC network, using the appropriate type of connector for your HFC distribution equipment.

**Caution:** When connecting the cable F-connector to the RF connector on the RF I/O module, ALWAYS use a torque wrench to set the tightness to 15 inch-lbs (1.7 Newton-meters) Do not simply hand-tighten the F-connectors. F-connectors that are too loose can cause RF leakage. F-connectors that are too tight can damage the RF port electronics.

3-9

#### Figure 3-7. Connecting the upstream and downstream ports



## **DC** power sources and requirements

Follow the instructions in this document when connecting a DC power supply to the C2200. Power supplies that do not meet the requirements, or connections made under other configurations may cause circuit damage to the system.

### General cautions on DC power sources



Caution: General DC power

- The equipment is intended for connection to a suitable SELV rated DC power source by a qualified personal with adequately rated supply wire in accordance with local and national regulations.
- The equipment may have multiple power supply connections and hazardous energy may be present. To de-energize the unit, all connections must be removed from the power sources by the disconnection devices or switches.
- A suitably-rated and easily-accessible double pole DC power disconnect device shall be incorporated if the (+) lead of the power supply is not grounded. A single-pole disconnect device on the hot (-) lead will suffice if it is grounded. The device 'On' and 'Off' positions shall be marked. A disconnect device shall be used on each power source if multiple power sources are used.
- For power redundancy, each power source shall provide 2 separate feeds to the power module. The module has 4 terminals, -48A and RTN+, -48B and RTN+.
- Equipment's accessible non-current carrying conductive parts and outer conductor of the coaxial cable receptacle shall be reliably connected to protective earth/ ground.
- Bare conductors of DC input power are not allowed to be accessed by the end user due to energy hazards.

## Power supply usage requirements

The following power supply usage requirements apply to C2200 operations:



**Caution:** Before making any electrical connections to the C2200, ensure that the system power ON/OFF switch is set to OFF.

1. A power supply must have floating outputs so that OUT (+) can be grounded.

- 2. A power supply that has only GND and OUT (+) cannot be used for C2200.
- 3. A power supply that has OUT (-) internally grounded cannot be used for C2200.
- 4. A power supply that has only +48v output pin and a ground pin cannot be used.
- 5. For a power supply with only -48v output pin and a ground pin, the (-) terminal (-48v) on the power supply connects to the -48 on C2200; the (+) terminal of the power supply connects to the (+) terminal (RTN) on the C2200.
- 6. To make this connection, the C2200 is supplied with a Phoenix-type mating plug to the connector on the C2200. This plug contains four positions. Each position provides a contact and a screw to secure each wire.
- The C2200 operates using -48VDC power, and operates on less than 9A amps and less than 400W (nominal). Casa recommends a power supply rated to provide -48VDC at 12A. Two power supply circuits are provided for optional redundancy. Each power feed is equipped with a slow-acting fuse rated at 12A.
- 8. The power supply wires to the unit should be a minimum of AWG 16 wire. The power connector will hold a maximum AWG 12 wire.
- **9.** In multiple power feed situations, precautions should be taken to protect against overloading the power supply, and that the supply wiring is of sufficient size to provide the required load to all devices.

It is recommended that all equipment and racks be properly grounded to eliminate shock hazards and prevent any unintended voltage offsets among devices. To ensure continuous compliance, the GND connection must be made using a ring terminal suitable for AWG 14 gauge wire and properly double-crimped using the appropriate tool. See Chapter 2, "Installing the C2200 hardware" for information on the GND connection.

**Note:** In a typical telecom environment, the RETURN (RTN) path of the -48 V supply is grounded to Protective Earth (PE) of the building.

## Using the optional AC-to-DC power supply

Casa Systems offers an optional AC-to-DC power supply that you can use to power the C2200. This power supply is provided in a 1U rack-mountable chassis:

• Lineage Power® J85480S shelf with CP2000AC54PE power modules

- Input voltage: 120VAC to 240VAC
- Number of power modules/voltage inputs: 4
- Output power per 240VAC voltage input: 2000W per power module (8000W total)
- Output power per 120VAC voltage input: 1200W per power module (4800W total)

#### Figure 3-8. Lineage Power J85480S shelf



## Configuring the optional power unit

To ensure adequate DC power to the C2200, you will need to connect CP2000 modules as follows:

- For 240VAC power sources, you will need <u>one AC voltage input</u> to provide an output of 2000W. The three remaining AC inputs, if connected, will provide power redundancy within the CP2000AC54PE. This means that 8000W would be available to power the C2200.
- For 120VAC power sources, you will need a <u>one AC voltage input</u> to provide an output of 1200W. The three remaining AC input, if connected, will provide power redundancy within the CP2000AC54PE should the one AC input fails. Using all four AC voltage inputs provides 4800W of power the C2200.

Follow the instructions supplied with the power rectifier for information on rack mounting and cabling to your AC power source.

## **Connecting the DC power supplies**

Before making the connections to the C2200 power supplies, as shown in Figure 3-10, be sure that the cables from the DC power source meet the following specifications:

#### **Power cables**

- Minimum wire size: AWG12
- Maximum length: 2.0 to 2.5 meters
- Suitable for 30A at 50° C ambient temperature

## Connecting non-redundant DC power

Perform the following steps to connect non-redundant DC power from a source having floating outputs and a ground pin.

1. Attach facility and/or power supply ground to C2200 ground stud using a star washer, #6 ring terminal, split washer, and nut. Figure 3-9 illustrates the chassis GND cable installation.

#### Figure 3-9. Attaching the GND cable to DC chassis terminal stud



- 2. On each of the wires coming from the power supply, strip off approximately 10mm of insulation.
- 3. Insert the wire from the (-) output of the power supply into the terminal corresponding to -48A pin on the Phoenix power plug. Using a small flat-ti screwdriver, tighten the corresponding screw on the power plug to a torque of 0.5Nm. Ensure that there is no bare wire exposed.



#### Figure 3-10. Connecting non-redundant DC power

- 4. Insert the wire from the (+) terminal of the power supply into the terminal corresponding to the RTN pin on the power plug. Using a small flat-tip screwdriver, tighten the corresponding screw on the power plug to a torque of 0.5Nm. Ensure that there is no exposed wire.
- 5. Connect and secure the Phoenix plug to the C2200.

#### **Connecting redundant DC power sources**

To connect redundant DC power sources, perform the following steps:

- 1. Attach facility and/or power supply ground to C2200 ground stud using star washer, #6 ring terminal, split washer and nut. Figure 3-9 illustrates the chassis GND cable installation.
- 2. On each of the wires coming from the power supply, strip off approximately 10mm of insulation.
- **3.** Insert the wire from the (-) output of **power supply A** into the terminal corresponding to -48A pin on the power plug. Using a screwdriver, tighten the corresponding screw on the power plug to a torque of 0.5Nm. Ensure that there is no exposed wire.
- 4. Insert the wire from the (+) terminal **of power supply A** into the terminal corresponding to the first RTN pin on the power plug. Using a screwdriver, tighten the corresponding screw on the power plug to a torque of 0.5Nm. Ensure that there is no exposed wire.
- 5. Insert the wire from the (-) output of **power supply B** into the terminal corresponding to -48B pin on the power plug. Using a screwdriver, tighten the corresponding screw on the power plug to a torque of 0.5Nm. Ensure that there is no exposed wire.
- 6. Insert the wire from the (+) terminal of **power supply B** into the terminal corresponding to the second RTN pin on the power plug. Using a screwdriver, tighten the corresponding screw on the power plug to a torque of 0.5Nm. Ensure that there is exposed wire.



#### Figure 3-11. Connecting redundant DC power

- 4. Connect the Phoenix plug to the C2200 DC power module.
- 5. Tighten the locking screws to secure the Phoenix plug.

## **Connecting AC power**

Perform the following steps to connect an AC power source to the C2200, as shown in Figure 3-12. The system includes the appropriate country cord for your installation site.

- 1. Ensure that the C2200 power ON/OFF toggle switch is in the OFF position.
- 2. Connect the AC power plug into the AC power receptacle in the front of the chassis.
- 3. Connect the other end of the cable to the AC power source.

Figure 3-12. Connecting AC power to the C2200



See the next section, "Starting the C2200 CMTS."

## Starting the C2200 CMTS

After installing the C2200 and connecting the required cables, perform a visual check of all connections and then check that:

- All network interface cables are connected.
- The console terminal is turned on.

You are now ready to power on the system for the first time using the procedures below. The first time you power the system on, the system software will automatically upload the default configuration to the C2200.

## For AC-powered C2200 systems



**Note:** The AC power supply has an internal 15A fuse to allow operation at low-input voltages. At higher input voltages, it might be desirable to put a lower-rated fuse (8A) between the C2200 and the wall or UPS outlet.

- 1. After connecting the AC power cord to the chassis and to the power source/outlet, press the toggle switch to the ON position. Listen for the fans. You should immediately hear them operating. The green LED on the front of the module will come on.
- 2. Verify all LEDs are lighting properly. The green SYS STAT LED on the system front panel should be lit. The line-card modules M1 to M4 transition from off to amber, then to green. See Table 3-1.

The console screen should display a system banner followed by a system prompt:

CASA-C2200>

## For DC-powered C2200 systems

- 1. Turn on the switch at the power supply that provides the DC power for the chassis.
- 2. At the C2200, press the toggle switch to the ON position. Listen for the fans. You should immediately hear them operating. The green power status LEDs will light up.
- **3.** Verify all LEDs are lighting properly. The green SYS LED on the system front panel should be lit. The line-card modules M1 to M4 transition from off to amber, then to green. See Table 3-1.

The console screen should display a system banner followed by a system prompt:

CASA-C2200>

Location	LED label	Color	Indication
Front panel	SYS STAT	Green	System turned on; running normally.
		Black (off) No power condition; system off.	
	M1 to M4	Green Active; normal operation.	
		Black	No line card installed in corresponding slot.
		Amber	Error condition detected on corresponding module.
10/100 Fast Ethernet	(L)ink status	Green Ethernet link up and connected.	
		Black (off)	Ethernet link down; no connection
	(A)ctivity	y Green Ethernet link is transmitting or receiving da	
		Black	No network activity currently present on link.
GBE ports G1 to G4	(L)ink status	Green Ethernet link up and connected.	
		Black (off)	Ethernet link down; no connection
	(A)ctivity	Green	Ethernet link is transmitting or receiving data.
		Black	No network activity currently present on link.
T1	(L)ink status	.)ink Green T1 link up and connected.	
		Black (off)	T1 link down; no connection
	(A)ctivity	Green	T1 link is transmitting or receiving data.
		Black	No network activity currently present on link.

#### Table 3-1. C2200 LED indications

## Setting up a test network topology

Figure 3-13 illustrates a sample lab network for testing the C2200 prior to deployment.

Building the network consists of the following steps:

- 1. Connect a DHCP/TFTP server to an Ethernet switch in your lab.
- 2. From the Ethernet switch, connect to a GigE port on the C2200 SMM.
- **3.** With a DQM module and 4-port RF downstream module in slot 0, connect and combine ports 0 and 1 to an RF splitter. Using a second splitter, combine ports 2 and 3. See Figure 3-13.
- 4. With a DCU module and 8-port upstream module in slot 2, connect and combine ports 0 and 1 to an RF splitter. Using a second splitter, combine ports 2 and 3. See Figure 3-13.
- 5. Connect the four splitters to two diplexer modules. The downstream splitters connect to the HIGH signal ports using a 20dB in-line attenuator; the upstream splitters connect to the LOW signal ports. See Figure 3-13.
- 6. Connect the COMMON signal port from each diplexer to a multi-port cable splitter. Use a 10dB in-line attenuator on these connections. See Figure 3-13.
- 7. From the multi-port cable splitter, connect a cable modem.
- 8. Connect the cable modem to a desktop or laptop personal computer.

After setting up this topology, refer to the *Casa Systems – CMTS Software Configuration Guide* for information on configuring the CMTS for this network.

#### Figure 3-13. Sample C2200 test network topology



## Chapter 4. System troubleshooting

The Casa C2200 CMTS is provided in sealed chassis. This means that any maintenance to the system must only be performed by Casa-trained personnel or by customers who have received C2200-specific training. Breaking the seal and opening the chassis will void the system warranty and possible service agreements.

Contact Casa Technical Support for information on C2200 training or if the system requires special servicing.

## **DC** power diagnosis

The C2200 DC power module is protected by two fuses that are present on the front of the module. After the system is turned on, the LEDs labeled A, B, or A/B (both) should be ON depending on whether you have redundant or non-redundant DC power connections.

If the LED associated with a particular feed does not come on, a problem is present. In addition to incorrect wiring from the DC power source, the voltage may be too high (greater than -69V), too low (less than 39V), or the module may be damaged where fuses are being blown. A damage DC power module will require replacement. Contact Casa Technical support for information.

For continued protection against risk of fire, replace only with a fuse of the same type and having the same electrical rating, as follows:

• Littel Fuse P/N 0481012, 12A, 125VDC, or equivalent

# Appendix A. C2200 hardware specifications

This appendix covers the hardware specifications for the Casa C2200 CMTS and all installed components. For additional specifications related to DOCSIS and IP features, refer to the *Casa Systems C2200 CMTS Data Sheet*.

Торіс	Page
Physical, electrical, and environmental	A-2
Safety and regulatory compliance	A-3
Chassis components and capacities	A-4
C2200 component ordering	A-6
DOCSIS QAM Module (DQM)	A-7
DOCSIS Control and Upstream Module (DCU)	A-8
Switch and Management Module (SMM)	A-8

## Physical, electrical, and environmental

Parameter	Specification	
Physical		
Dimensions	Height: 1.75 in. (44.4 mm) Width: 19 in. (482 mm) Depth: 23.5 in. (597 mm)	
Mounting standard	1 RU, 19 inches	
Weight	30 lbs (13.62 kg) fully loaded	
Electrical		
Input AC power	<400W nominal	
Voltage	90 to 264 VAC	
Frequency	50-60 Hz	
Current	5A maximum at 100VAC	
Connector	IEC 320 standard commector, 10A current rating	
Input DC power	370W typical	
Voltage	-36 to -60VDC (redundant)	
Current	10A maximum	
Environmental		
Temperature	Operating: 0° to 50° C Storage: -40° to 70° C	
Humidity	Relative: 5%° to 95% Storage: 5% to 95%	
Altitude	Operating: Sea level to 6562 ft (2000M) Storage: Sea level to 15,748 ft (4800M)	

#### Table A-1. C2200 CMTS specifications

## Safety and regulatory compliance

The C2200 complies with the safety and regulatory agency standards listed below when installed in accordance with this guide.

## **Product safety**

Representative samples of this product have been evaluated by a Nationally Recognized Test Laboratory (NRTL) and meet the applicable U.S., Canadian, and International safety standards:

- ANSI/UL 60950-1 UL Standard for Safety for Information Technology Equipment Safety.
- EN/UL/IEC/CAN/CSA C22.2 No. 60950-1 Standard for Safety for Information Technology Equipment Safety.
- EN60950-1

## Grounding

The AC-powered version of the product is grounded through the ground (GND) wire in the AC power cord. There is no separate grounding connection.

The DC-powered version of the product is grounded through the DC power module; an external grounding point is also present on the front of the DC power module.

#### EMC

The C2200 has been tested and meets the following requirements:

- EN55022, Class A
- EN55024
- FCC Part 15 Class A, subpart B, CISPR Class A

#### Immunity

• EN61000-4

## **Chassis components and capacities**

Table A-2.	C2200	capacities
------------	-------	------------

Component	Description	
Chassis	1 rack unit (RU), industry standard 19-inch rack mountable	
AC power supply (1)	90 to 264V power supply module	
DC power supply (1)	-39 to -72 VDC dual-input power supply module	
Front panel LEDS	Status for system, management port, GigE ports, QAM downstream channel, DQM upstream	
Rear panel LEDs	RF port status	
Fan tray assembly	<ul> <li>Integrated four 2.50-inch diameter fans; diverter on sheet metal for directing air over system slot 3</li> </ul>	
	Dual-speed for operating at normal/high temperatures	
	<ul> <li>Multiple fans provide redundancy and prevent single failure</li> </ul>	
	Status LEDs indicate single for multiple fan failure	
	No service interruption during timely module replacement	
Switching and Management	Integrated with C2200 chassis	
Module (SMM)	<ul> <li>Four GigE interfaces (Copper or fiber SFP) with Link and Activity LEDs</li> </ul>	
	<ul> <li>One Fast Ethernet 10/100 BASE-T management port (RJ45) with Link and Activity LEDs</li> </ul>	
	<ul> <li>One RS-232 console port (DB-9); max serial data rate at 115 Kbps</li> </ul>	
	4x2 Gbps switching capacity	
	<ul> <li>Status for system, management port, GigE ports, QAM downstream channel, DQM upstream</li> </ul>	

Component	Description
DOCSIS QAM Module (DQM)	Up to three modules per chassis
	Four ports per module
	• 4 QAM downstream channels on DQM04; 1 channel/port
	• 8 QAM downstream channels on DQM08; 2 channels/port
	<ul> <li>16 QAM downstream channels on DQM16; 4 channels/ port</li> </ul>
	Channel bonding: all channels on DQM
	<ul> <li>QAM mode         <ul> <li>Annex A: 8 MHz</li> <li>Annex B: 6 MHz</li> <li>Annex C: 6 MHz</li> </ul> </li> </ul>
	<ul> <li>QAM constellation: Annex A &amp; C: 64, 128, 256 Annex B: 64, 256</li> </ul>
DOCSIS Control & Upstream	Up to three modules per chassis
Module (DCU)	<ul> <li>4 QAM upstream channels in 4 ports (DCU04)</li> </ul>
	8 QAM upstream channels in 8 ports (DCU08)
	16 QAM channels in 8 ports (DCU16)
	Channel bonding: all channels on DCU
	16 upstream burst receivers
	<ul> <li>Each receiver can be configured to many logical upstream channels</li> </ul>
	Modulation: QPSK, 16,32,64, QAM

## Table A-2. C2200 capacities (continued)

## C2200 component ordering

This section describes the C2200 modular components. C2200 modules are field-replaceable units (FRUs). The modules and their order numbers are listed in Table A-3.

Table A-3. C2200 modular components

Component	Order number
C2200 AC-powered chassis with integrated SMM and fan assembly	C2200-CHASSIS-AC
C2200 DC-powered chassis with integrated SMM and fan assembly	C2200-CHASSIS-DC
DOCSIS QAM (DQM)	C2200-DQM04 (4 channels) C2200-DQM08 (8 channels) C2200-DQM16 (16 channels)
DOCSIS Control and Upstream Module (DCU)	C2200-DCU-04 (4 channels) C2200-DCU-08 (8 channels) C2200-DCU-16 (16 channels)
GigE Small Form Factor Pluggable (SFP) 1000Base-T transceiver (RJ45 socket, copper, short reach)	SFP-CP
GigE Small Form Factor Pluggable (SFP) 1000Base-SX (LC socket, fiber optic, short reach)	SFP-LC
GigE Small Form Factor Pluggable (SFP) (LC socket, fiber optic, long reach)	SPF-LX

## **DOCSIS QAM Module (DQM)**

#### Table A-4. DQM specifications

Component/Parameter	Specification
Number of ports	4 per module
DQM04	4 channels, 1 channel/port
DQM08	8 channels, 2 channels/port
DQM64	16 channels, 4 channels/port
QAM modulation	Annex A, B or C
QAM constellations	64, 128, & 256 QAM
Data rates (DOCSIS)	27 Mbps @ 64 QAM 38 Mbps @ 256 QAM
Data rates (EuroDOCSIS)	36 Mbps @ 64 QAM 56 Mbps @ 256 QAM
Connector	F-type, 75 ohm
Frequency range (edge)	48 to 1002 MHz
Frequency accuracy	+/- 5 ppm
Frequency step size	5 kHz
Channel width	6 to 8 MHz (tunable)
Maximum output per channel	61 dBmV @ 1-ch/port 57 dBmV @ 2-ch/port 53 dBmV @ 4-ch/port
Output step size	0.1 dB
Return loss	50 ~ 870 MHz, 14 dB 870 ~ 1002 MHz 10 dB
Modulation error rate	44 dB (equalized)
Wideband noise	-73dBc

## **DOCSIS Control and Upstream Module (DCU)**

Component	Specification
DCU04	4 channels in 4 ports
DCU08	8 channels in 8 ports
DCU16	16 channels in 8 ports
Modulation	QPSK, 8, 16, 32 and 64 QAM
Data rate/channel	0.32 - 30.72 Mbps
Input frequency range	5 - 42 MHz (DOCSIS) 5 - 65 MHz (EuroDOCSIS) 5 - 55 MHz (J-DOCSIS)
Input range	-16 to 34 dBmV

#### Table A-5. DCU specifications

## Switch and Management Module (SMM)

Table A-6. S	MM spec	ifications
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Component	Specification
Ethernet GigE	Four interfaces per SMM SFP socket (copper or fiber) RJ-45 copper (1000BASE-T) LC fiber (1000BASE-X) Link and Activity LEDs
Ethernet 10/100 Fast Ethernet management port	1 interface per SMM RJ-45 copper (100BASE-T) Link and Activity LEDs
RS-232 local management port	DB-9 socket
LEDs	Status for system, management port, GigE ports, QAM downstream channel, DQM upstream


## casa systems

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## C2200 CMTS Hardware Installation Guide

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