



CHAPTER 2

Preparing the Cisco uBR7200 Series Router for Installation

This chapter describes the site requirements for installing the Cisco uBR7200 series universal broadband router and contains the following sections:

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- [Installation Tools, page 2-8](#)
- [Rack-Mount and Cable-Management Kit, page 2-9](#)
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Safety Recommendations

The following safety guidelines will help to ensure your safety and protect the equipment. This list does not cover all potentially hazardous situations, so *be alert*. Before installing, configuring, or maintaining the Cisco uBR7246, or Cisco uBR7246VXR routers, review the safety warnings listed in the *Regulatory Compliance and Safety Information for Cisco uBR7200 Series Universal Broadband Routers* at the following URL:

<http://www.cisco.com/en/US/docs/cable/cmts/ubr7200/regulatory/compliance/ub72rcsi.html>

The installation of your Cisco uBR7200 series universal broadband router should be in compliance with national and local electrical codes.

Other safety issues to be aware of:

- Never attempt to lift an object that might be too heavy for you to lift by yourself.
- Always turn all power supplies off and unplug all power cables before opening the chassis.
- Always unplug the power cable before installing or removing a chassis.
- Keep the chassis area clear and dust-free 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.
- For systems with installed AC-input power supplies, the Cisco uBR7200 series router ships with a 3-wire electrical grounding-type plug, which only fits into a grounding-type power outlet. This is a safety feature. The equipment grounding should be in accordance with local and national electrical codes.
- For systems with installed DC-input power supplies, the Cisco uBR7200 series router does not ship with any power cables. Use a minimum of 12 AWG (4 mm²) wire for the input to each DC-input power supply. The equipment grounding should be in accordance with local and national electrical codes.
- The Cisco uBR7200 series router operates safely when it is used in accordance with its marked electrical ratings and product usage instructions.

**Warning**

Only trained and qualified personnel should be allowed to install or replace this equipment.

Statement 1030

**Note**

For Australia and New Zealand, equipment is to be installed and maintained by service personnel only as defined by AS/NZS 3260 Clause 1.2.14.3 Service Personnel.

**Warning**

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

Statement 1040

**Warning**

There is the danger of explosion if the battery is replaced incorrectly. Replace the battery only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions. Statement 1015

Lifting the Cisco uBR7200 Series Router Safely

Before you install any of the routers, ensure that your site configuration is properly designed and prepared so that you can avoid having to move the router later to accommodate power sources and network connections.

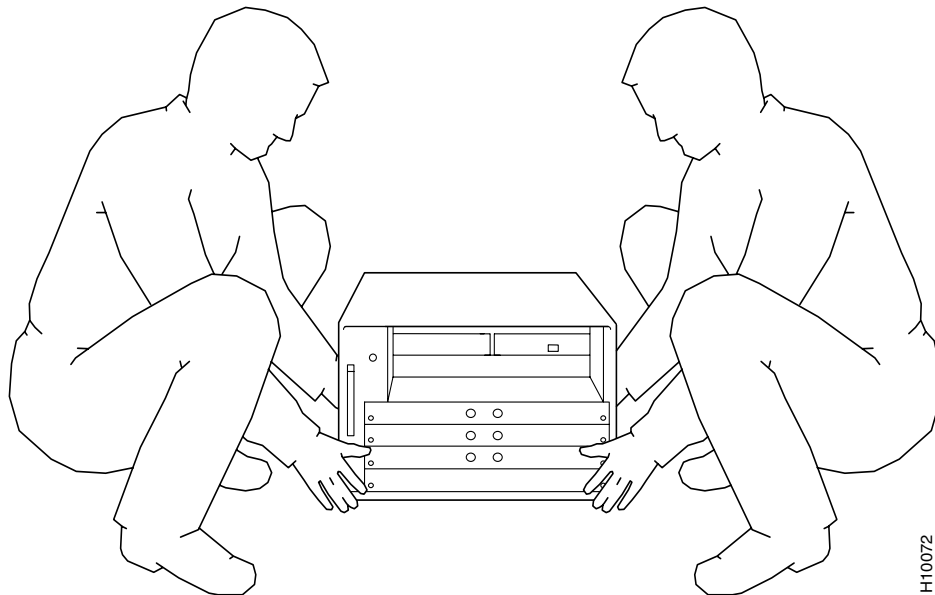
- A fully configured Cisco uBR7246 router weighs approximately 100 pounds (45.4 kilograms).
- A fully configured Cisco uBR7246VXR router weighs approximately 100 pounds (45.4 kilograms).

Whenever you lift a chassis or any heavy object, follow these guidelines:

- Always disconnect all external cables before lifting or moving the chassis.
- Do not attempt to lift the chassis by yourself; have someone assist you (see [Figure 2-1 on page 2-3](#)).
- 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.

Figure 2-1 Lifting the Chassis (Cisco uBR7246 Shown)



H10072



Warning

Two people are required to lift the chassis. Grasp the chassis underneath the lower edge and lift with both hands. To prevent injury, keep your back straight and lift with your legs, not your back. To prevent damage to the chassis and components, never attempt to lift the chassis with the handles on the power supplies or on the interface processors, or by the plastic panels on the front of the chassis. These handles were not designed to support the weight of the chassis. Statement 5

Safety with Electricity

Follow these basic guidelines when 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.
- Carefully examine your work area for possible hazards such as moist floors, ungrounded power extension cables, and missing safety grounds.
- Disconnect all power and external cables before installing or removing a chassis.
- 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.
- Do not work alone if potentially hazardous conditions exist.
- Never install equipment that appears damaged.



Caution

You *must* power down the system before removing or replacing the I/O controller, cable clock card, or network processing engine. The port adapters, cable interface line cards, and redundant power supplies are designed to be removed and replaced while the system is operating, without presenting an electrical hazard or damage to the system.

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



Warning

The telecommunications lines must be disconnected 1) before unplugging the main power connector and/or 2) while the housing is open. Statement 89



Warning

Before working on a chassis or working near power supplies, unplug the power cord on AC units; disconnect the power at the circuit breaker on DC units. Statement 246



Warning

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

- 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.

Preventing Electrostatic Discharge Damage

Electrostatic discharge (ESD) damage, which occurs when electronic cards or components are improperly handled, can result in complete or intermittent system failures. The network processing engine, I/O controller, each cable interface card, each port adapter, and the cable clock card consists of a printed circuit board that is fixed in a metal carrier. Electromagnetic interference (EMI) shielding, connectors, and a handle are integral components of the carrier. Although the carrier helps protect the boards, use an antistatic strap whenever handling the network processing engine, I/O controller, cable interface cards, port adapters, and the cable clock card. Handle the carriers by the handles and the carrier edges only; never touch the boards or connector pins.



Caution

Always tighten the captive installation screws on the network processing engine, I/O controller, cable interface cards, and the cable clock card. These screws prevent accidental removal, provide proper grounding for the system, and help ensure that the bus connectors are properly seated in the midplane.

Following are guidelines for preventing ESD damage:

- Always use an ESD wrist strap or ankle strap and ensure that it makes good skin contact.
- When handling a removed network processing engine, I/O controller, cable interface line card, port adapter, or cable clock card, make sure that the equipment end of your ESD strap is attached to an unfinished chassis surface of the router; *do not* touch the printed circuit board, and avoid contact between the printed circuit board and your clothing. Always place the network processing engine, I/O controller, cable interface card, port adapter, or cable clock card component side up on an antistatic surface or in a static shielding bag. If you are returning the item to the factory, immediately place it in a static shielding bag.

- Ensure that the I/O controller and network processing engine are fully inserted in their respective chassis slots and that their captive installation screws are tightened. The captive installation screws prevent accidental removal, provide proper grounding for the system, and help ensure that the bus connectors are seated in the midplane.
- Ensure that each port adapter is fully inserted in its chassis slot and the port adapter retention clip is in the locked position.
- Ensure that each cable interface card is fully inserted in its chassis slot and that its captive installation screws are tightened.
- Ensure that the cable clock card is fully inserted in its chassis slot and that its captive installation screws are tightened.

**Caution**

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

Site Requirements

To ensure normal operation and avoid unnecessary maintenance, plan your site configuration and prepare your site *before* installation. Take into account the following criteria:

- Verify that your cable network meets system requirements and DOCSIS or EuroDOCSIS downstream and upstream specifications.
- Select forward and reverse channel frequencies from the range specified in your channel plan.
- Make sure that the site maintains an ambient temperature of 32 to 104°F (0 to 40°C), and keep the area around the chassis as free from dust as is practical.

**Note**

To locate the most reliable channels for your downstream and upstream channel plans, we recommend that you perform a sweep of all available channels for at least a 24-hour period to verify the presence or absence of impulse or ingress noise.

AC Power

The AC-input power supply uses a power factor corrector that allows the Cisco uBR7200 series router to operate on input voltage and frequency within the ranges of 100 to 240 VAC and 50/60 Hz.

**Note**

We recommend an uninterruptable power source to protect against power failures at your site. The AC-input power supply has an electrical current rating of 7A for the Cisco uBR7426 and Cisco uBR7246VXR routers.

See [Appendix A, “Cisco uBR7200 Series Router Specifications,”](#) for system power specifications, including input voltage and operating frequency ranges.

DC Power

The DC-input power supply operates at –48 volts direct current (VDC) input voltage and supplies +3.5V, +5.2V, +12.2V, –12.2V, +16V, and –16V DC power to the router’s internal components through the router midplane.


Note

Each DC-input power supply has an electrical current rating of 14A, 700 VA. The power input must be protected by a 20A circuit breaker or fuse that is in compliance with your local electric regulations.

See [Appendix A, “Cisco uBR7200 Series Router Specifications,”](#) for system power specifications, including input voltage and operating frequency ranges.

Site Environment

[Table 2-1](#) lists the operating and nonoperating environmental site requirements. The following ranges are those within which the Cisco uBR7200 series universal broadband router 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 the minimum or maximum of an operating range.

To provide airflow through the Cisco uBR7200 series router, cooling air is drawn in through the air intake vent on the right side of the chassis (when viewing the router from the front) and is exhausted through the left side of the chassis. Keep the right and left side of the chassis clear of obstructions and away from the exhaust of other equipment.

Table 2-1 Specifications for Operating and Nonoperating Environments

Specification	Minimum	Maximum
Temperature, ambient operating	32°F (0°C)	104°F (40°C)
Temperature, ambient nonoperating and storage	–4°F (–20°C)	149°F (65°C)
Humidity, ambient (noncondensing) operating	10%	90%
Humidity, ambient (noncondensing) nonoperating and storage	5%	95%
Altitude, operating and nonoperating	Sea level	10,000 feet (3,050 meters)
Vibration, operating	5 to 200 Hz, 0.5 g (1 oct./min.)	–
Vibration, nonoperating	5 to 200 Hz, 1 g (1 oct./min.) 200 to 500 Hz, 2 g (1 oct./min.)	–

Site Configuration: Maintaining Normal Operation

Planning a proper location for the Cisco uBR7200 series universal broadband router and the layout of your equipment rack or wiring closet are essential for successful system operation. Equipment placed too close together or inadequately ventilated can cause system overtemperature conditions. In addition, chassis panels made inaccessible by poor equipment placement can make system maintenance difficult. Following are precautions that can help avoid problems during installation and ongoing operation.

General Precautions

Follow these general precautions when planning your equipment locations and connections:

- Use the **show environment** command regularly to check the internal system status. The environmental monitor continually checks the interior chassis environment; it provides warnings for high temperature and maximum and minimum voltages and creates reports on any occurrences. If warning messages are displayed, take immediate action to identify the cause and correct the problem.
- We recommend keeping the Cisco uBR7200 series router off the floor and out of any area that tends to collect dust, excessive condensation, or water.
- Follow ESD prevention procedures to avoid damage to equipment. Damage from static discharge can cause immediate or intermittent equipment failure.
- Ensure that the network processing engine, I/O controller, port adapters, any blank port adapters, cable clock card, blank cable clock card, cable interface line cards, any blank interface cards, power supplies, and any power supply filler plates are in place and secure. The fans direct cooling air throughout the chassis interior; a loose component or empty slot can redirect the airflow away from active components and cause overheating.

Power Considerations

Follow these precautions and recommendations when planning power connections to the Cisco uBR7200 series router:

- Check the power at your site before installation and periodically after installation to ensure that you are receiving clean power. Install a power conditioner and appropriate surge suppression if necessary.
- Install proper grounding to avoid damage from lightning and power surges.

Required Network Information

After you install the chassis, your system administrator must configure the individual and system interfaces before you connect your system to external networks. Refer to the following documentation for configuration information.

Cisco uBR7200 Series Software Configuration Guide at the following URL:

<http://www.cisco.com/en/US/docs/cable/cmts/ubr7200/configuration/guide/cr72scg.html>

Cisco IOS CMTS Cable Software Configuration Guide at the following URL:

http://www.cisco.com/en/US/docs/ios/cable/configuration/guide/12_2sc/cbl_12_2sc_book.html

Cisco IOS CMTS Cable Command Reference Guide at the following URL:

http://www.cisco.com/en/US/docs/ios/cable/command/reference/cbl_book.html

Before You Begin

Be prepared with global (system-wide) parameters such as:

- Host names
- Passwords
- Routing protocols
- Configuration information for each interface, such as:
 - Addresses
 - Rates or speeds of operation
 - Routing protocol specifics

Following is information you might need, depending on the services you plan to offer:

- Host name for the router.
- Passwords to prevent unauthorized privileged-level access to the EXEC command interpreter and for individual virtual terminal lines.
- Protocols you plan to route.
- IP addresses and subnet masks, if you are routing IP.
- Dial-up access telephone numbers, usernames, and passwords for telco return operation.
- RADIUS security and accounting configuration.
- Gateway and gatekeeper zone configuration for your H.323 VoIP network.
- Gateway and call-agent configuration for your SGCP VoIP network.
- Zone names, network numbers, or node numbers for the new interfaces, if required.
- Operating speeds for specific interfaces—For example, serial interfaces operate at speeds of up to 2 Mbps. The speed of an interface often depends on the speed of the remote device to which it is attached.

Installation Tools

Your Cisco uBR7200 series universal broadband router chassis is fully assembled at the factory; no assembly is required. However you will need the following tools and equipment to install the chassis and the rack-mount and cable-management kit:

- Number 2 Phillips screwdriver
- 3/16-inch flat-blade screwdriver
- 7/16-inch flat-blade screwdriver
- 7/16-inch torque wrench for connecting coaxial cables to the cable F-connectors on the cable interface cards—Recommended torque is 20 inch-pounds (optional)
- 8-mm wrench or nut driver, or adjustable wrench (for connecting a grounding lug to a DC-input power supply only)
- 7-mm wrench or nut driver, or adjustable wrench (for connecting the DC-input power lead strain-relief cover to a DC-input power supply only)

- 12 AWG (4 mm²) cable with a minimum of three conductors rated for at least 140°F (60°C) (for DC-input power supply installations only)
- Standard wire stripper (for DC-input power supply installations only)
- Tape (for securing the handle of a DC circuit breaker in the OFF position when a DC-input power supply is powered down)
- Tape measure (optional)
- Level (optional)

Rack-Mount and Cable-Management Kit

The rack-mount and cable-management kit includes the following parts:

- Two rack-mount brackets for mounting the chassis in the rack.
- One cable-management bracket to relieve the strain on installed port adapter and cable interface line card interface cables.
- Eight M4 x 6-mm Phillips flathead screws to secure the rack-mount brackets to the chassis.
- Four M3 x 6-mm Phillips panhead screws to secure the cable-management bracket to the chassis.
- Four 10/32 x 3/8-inch slotted binderhead screws to secure the rack-mount brackets to the rack rails.



Note

You must install the cable-management bracket on the right side of the Cisco uBR7246 or Cisco uBR7246VXR chassis, when viewed from the front. If the cable-management bracket is installed on the left side of the chassis, where the internal fans are located, you will not be able to easily remove or replace the fan tray. If you install your Cisco uBR7246 or Cisco uBR7246VXR router, with the rack-mount brackets at the front of the chassis, you cannot install a cable-management bracket.

For more information on the rack-mount brackets and cable-management brackets, refer to the [“Cisco uBR7200 Series Chassis Rack-Mounting Options”](#) section on page 3-2.

Equipment Required to Verify Your Plant’s RF Setup

To verify your plant’s RF setup, you need the following:

- IF-to-RF upconverter
- RF spectrum analyzer
- For coaxial cabling:
 - Diplex filters/splitters
 - Coaxial cable crimping tool
 - New coaxial cable
 - Coaxial jumpers that are at least 2 to 3 feet long (maximum of 5 feet)
- For fiber networks, optical receivers for each upstream optical path
- Assorted RF attenuators (with at least two 20-dB attenuators)

**Note**

For headend RF and data setups, refer to [Chapter 4, “Connecting the Cisco uBR7200 Series Router to the Cable Headend.”](#) Refer to [Appendix F, “Manufacturers for Headend Provisioning Requirements,”](#) for a list of manufacturers. Refer to [Appendix C, “Cable Specifications,”](#) for coaxial cabling specifications.

In addition, you might need the following:

- Crossover Ethernet cable with RJ-45 connectors—If you plan to connect a computer directly to an Ethernet port on a PA-4E port adapter or a PA-8E port adapter installed in the Cisco uBR7200 series router, you need this type of cable.
- Data service unit (DSU) to connect each serial port to an external network.
- One serial port adapter cable for each serial port to connect the port with the remote device or network. (The operating speeds of the port interfaces, and other information specific to each port adapter, can be found in the respective port adapter configuration notes.)
- To connect a serial port to a T1 network, you need a T1 CSU/DSU that converts the High-Level Data Link Control (HDLC) synchronous serial data stream into a T1 data stream with the correct framing and ones density. (Some telephone systems require a minimum number of 1 bit per time unit in a data stream, called *ones density*.) Several T1 CSU/DSU devices are available as additional equipment, and most provide either a V.35, EIA/TIA-449, or EIA-530 electrical interface.
- Fast Ethernet transceiver.
- Cisco uBR900 series cable access router or DOCSIS-based STB and CPE devices to test full system functionality.

**Note**

The Cisco uBR900 is End of Life for some models.

**Note**

When the Cisco uBR7200 series router starts running, IF downstream output is generated. For more information, see the [“Powering On the Cisco uBR7200 Series Router”](#) section on [page 3-24](#).

Shipping Container Contents

When you receive your Cisco uBR7200 series universal broadband router, use the following procedure to check the contents of the shipping container. Use the [Cisco uBR7200 Series Router Installation Checklist](#) in [Table 3-1](#) or the [“Cisco uBR7246 and Cisco uBR7246VXR Component List”](#) section on [page 2-21](#) to ensure you received all the components that you ordered.

**Note**

Do not discard the shipping container. You will need the container if you move or ship your Cisco uBR7200 series router in the future.

Verifying the Shipping Container Contents

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- Step 1** Verify that the following are included in the shipping container (the accessories box might be separate):
- One Cisco uBR7200 series universal broadband router chassis containing all of the components you ordered for your system (except the rack-mount and cable-management kit)
 - One or more accessories boxes (some or all might be shipped separately)
- Step 2** Check the contents of the accessories box against the “Installation Checklist” and the packing slip to verify that you received all listed equipment, which should include the following:
- One modular power cable for an AC-input power supply. (If you purchased a Cisco uBR7246VXR, or Cisco uBR7246 router with a redundant power supply, you should receive two power cables.)
 - One rack-mount and cable-management kit (3 brackets and 16 mounting screws) for the Cisco uBR7246VXR and Cisco uBR7246 routers and two rack-mount and cable-management kits.
 - Optional equipment that you ordered, such as network interface cables, transceivers, or special connectors.
 - CNR or CSRC provisioning documentation, or both.
 - Cisco IOS software documentation, if ordered.
- Step 3** Verify that the port adapters installed in your Cisco uBR7200 series router match the port adapter types on the packing list.
- Step 4** Verify that the number of cable interface cards installed in your Cisco uBR7200 series router matches the number of cable interface cards that you ordered.
- Step 5** Refer to [Appendix G, “Site Log,”](#) then to the [“Cisco uBR7200 Series Chassis Rack-Mounting Options” section on page 3-2](#) to begin the installation.
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Provisioning the Cable Headend

This section describes the necessary preparations to make at the cable headend before you install the Cisco uBR7200 series universal broadband router.

Two-Way Data and VoIP

To prepare for two-way data operation, including digitized voice and fax, ensure that the following conditions are met:

- The cable headend equipment is properly aligned and certified for two-way transmission based on procedures provided by the manufacturers of the equipment and in accordance with DOCSIS or EuroDOCSIS RF Interface Specifications.
- The cable headend is wired for narrowcast downstream data transmission.
- The cable headend is wired to supply an RF feed from the upstream fiber-optic receivers to the Cisco uBR7200 series router.
- Upstream frequencies are allocated for data transmission.
- Upstream impairments are measured and understood, and comply with recommendations in DOCSIS or EuroDOCSIS RF Interface Specifications.

- Upstream ports are configured as appropriate to support frequency agility.
- Downstream frequencies are assigned.
- Internet connectivity is established.
- Internet addresses are obtained and allocated.
- All RF connectivity is verified.

**Note**

For a VoIP system using H.323, ensure that the CMTS has been properly provisioned with equipment such as VoIP gateways and gatekeepers. For SGCP-based VoIP systems, ensure that the CMTS has been properly provisioned with equipment such as VoIP gateways and call-agents.

Headend Certification

The cable headend plant must pass both analog and digital certification:

- In the United States, the Federal Communications Commission (FCC) mandates minimum technical performance requirements for cable systems.
- For international requirements, consult with local agencies for certification requirements.

The digital certification process is described in [Chapter 4, “Connecting the Cisco uBR7200 Series Router to the Cable Headend.”](#)

IF-to-RF Upconverter

To be compatible with cable television system frequency division multiplexing, install an external IF-to-RF upconverter that translates the Cisco uBR7200 series cable interface line card downstream IF signal to the desired downstream RF carrier frequency.

Upconverters are available from many manufacturers and can be found in configurations ranging from a fixed number of ports to flexible multislot, multiport models. Install and configure enough upconverter ports to support the number of downstream cable interface card ports installed in each Cisco uBR7200 series router you are installing. The number of upconverter units needed depends on the upconverter manufacturer. [Appendix F, “Manufacturers for Headend Provisioning Requirements,”](#) lists upconverter manufacturers, websites for more information on upconverter products, and models of upconverters that are compatible with the Cisco uBR7200 series router.

The upconverter is installed between the Cisco uBR7200 series router and the combiner. (See [Figure 4-3 on page 4-5](#) and [Figure 4-4 on page 4-6](#).)

Depending on the channel plan you are employing, your upconverters must support different functionality. In a North American channel environment, your upconverter needs to receive a 44-MHz downstream IF transmission from cable interface line cards in the Cisco uBR 7200 series router and transmit 6-MHz RF digitally modulated carriers in the 88 to 860 MHz range. In an 8-MHz EuroDOCSIS environment, your upconverter needs to receive a 36.125-MHz downstream IF transmission from cable interface line cards in the Cisco uBR7200 series router and transmit 8-MHz RF digitally modulated carriers in the 108 to 862 MHz range.

Refer to the documentation that ships with your upconverter for details on upconverter operation and configuration. See the [“Connecting and Configuring the Downstream” section on page 4-4](#).

**Note**

An analog channel modulator with external IF loops is not suitable for use as a digital quadrature amplitude modulation (QAM) upconverter. These units typically do not have the phase noise performance levels required for 64- and 256-QAM digital signals, and they might cause degraded performance and possible system failure.

**Note**

The combiner refers to all cables, amplifiers, and passive components (splitters, directional couplers, taps, and commercially manufactured combining networks) at the headend or cable distribution center that connect the Cisco uBR7200 series router to the hybrid fiber-coaxial (HFC) network.

Diplex Filters

For coaxial cabling, diplex filters must be installed in the RF path between the cable interface cards in the Cisco uBR7200 series universal broadband router and cable interfaces and STBs. Diplex filters separate the downstream signals from the upstream signals.

**Note**

For fiber optics, laser transmitters and optical receivers handle the frequency separation of upstream and downstream. Refer to the [“Receivers” section on page 13](#).

High-frequency signals flow in the downstream direction from the Cisco uBR7200 series router to cable interfaces and STBs. Low-frequency signals flow in the upstream direction from the cable interfaces to the Cisco uBR7200 series router.

A diplex filter has three ports: low, high, and common. The downstream attaches to the high port because it runs at high frequency. The upstream attaches to the low port because it runs at a low frequency. The common port attaches to a splitter attached to one or more cable interfaces and STBs.

In two-way cable networks, the diplex filter takes the upstream and downstream and combines them on one cable for the cable interface. The downstream output signal from the Cisco uBR7200 series router runs through the upconverter and then enters the high filter port of the diplex filter. The signal exits the common port of the filter and is distributed to the cable interfaces. The upstream signal from the cable modem enters the common port of the diplex filter and flows to the upstream receive ports of the Cisco uBR7200 series cable interface line cards via the diplex filters low port.

**Note**

[Appendix F, “Manufacturers for Headend Provisioning Requirements,”](#) provides a list of diplex filter manufacturers and websites for more information.

Receivers

If the upstream channels of your cable plant terminate at the headend over fiber-optic lines, ensure that you have a receiver allocated for each upstream in your network.

DHCP, DNS, TFTP, and TD Servers

A DHCP server must be installed at the headend. The DHCP server must also offer a time-of-day (TD) server option that is compliant with RFC 868.

In conjunction with the DHCP server, a Domain Name System (DNS) server must be installed to translate names of network nodes into IP addresses. A TFTP server must be installed to facilitate the transfer of DOCSIS configuration files over the broadband network.

Cisco provides a configuration tool with every Cisco uBR7200 series universal broadband router—Cisco Network Registrar (CNR)—to automate dynamic IP address allocation to cable interfaces, PCs, and other devices on the broadband network. CNR provides integrated DHCP and DNS services for your network configuration.

Telco Return

To support telco return, ensure that:

- Your downstream plant meets DOCSIS or EuroDOCSIS specifications.
- Your headend is wired for narrowcast downstream data transmission.
- You have assigned downstream frequencies.
- All equipment needed to support upstream traffic over the PSTN, as well as to monitor telco return service features is installed. Key components include:
 - Dial-up access server (for example, the Cisco AS5300 or Cisco AS5800)
 - RADIUS dial security server
- All third-party, telco return cable interfaces are DOCSIS-compliant.
- Your Cisco IOS software image supports telco return functionality.

The following sections describe CMTS equipment necessary to support telco return service.

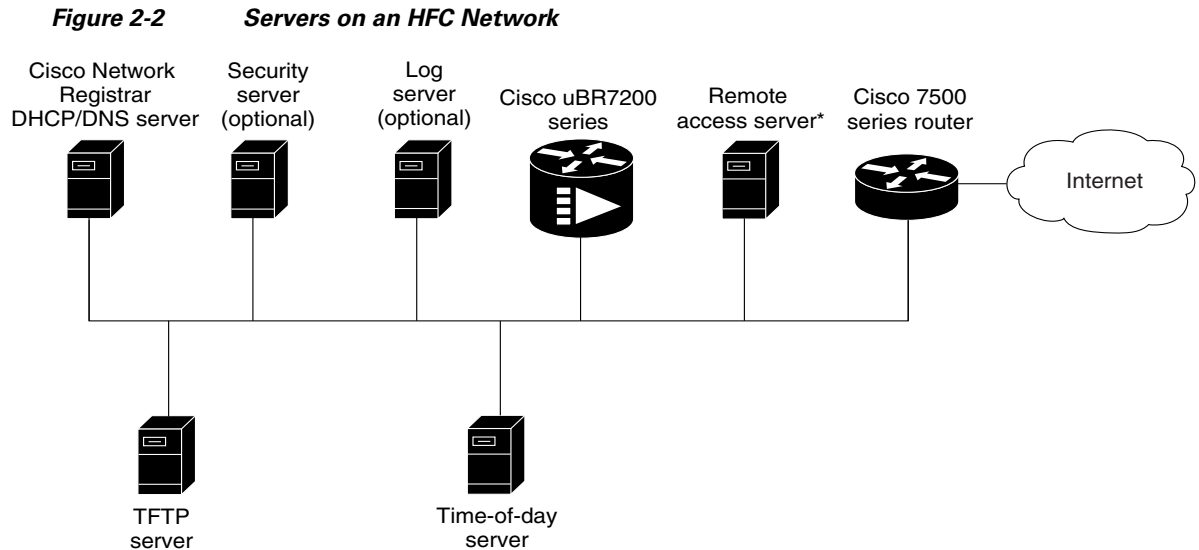
Dial-Up/Remote Access Servers

Because a telco return cable network relies on the local telephone system to complete the upstream data path to the Cisco uBR7200 series, you need to be sure that you provision your network with a dial-up access server and other required equipment through which remote cable interfaces will gain access to your headend.

RADIUS Dial Security Servers

After remote telco return cable interfaces have initiated dial-up to the CMTS via the network access server, a RADIUS dial security server typically authenticates their respective usernames and passwords or MAC address and passwords and then determines whether or not to allow the connection.

In addition to the dial-up numbers provided in telephony channel descriptor (TCD) messages originating from the Cisco uBR7200 series, username and password information is included in TCD messages to validate the cable interface's upstream connection. After dialing in to the network access server, the username and password portions of the TCD messages are passed through a RADIUS dial access server for authentication before the upstream data path can be completed. (See [Figure 2-2](#).)



*A remote access server is required on an HFC network only when you want to offer VoIP using H.323 or telco return service.

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Authentication, Authorization, and Accounting Servers

Authentication, authorization, and accounting (AAA) servers are essential to the network, because they typically monitor usage for subscriber billing and record keeping. AAA features call upon a RADIUS security server to help authenticate and monitor users' access.

VoIP Gateways and Gatekeepers

To support digitized voice transmission using Cisco IOS Release 12.0(5)T1 CMTS images, be sure to include VoIP gateways and gatekeepers in your configuration. Cisco IOS Release 12.0(5)T1 supports VoIP by using the H.323 protocol. VoIP gateways convert IP-based voice packets into standard PSTN voice traffic, making the process of placing calls over the IP network transparent to users.

VoIP gatekeepers manage H.323-compliant gateways throughout the network. Gatekeepers also manage traffic between their local cable system networks, as well as the networks of other VoIP gatekeepers.

VoIP SGCP Pass-Through

To support digitized voice transmission using Simple Gateway Control Protocol (SGCP), be sure to include VoIP gateways and external call control elements (often referred to as call-agents) in your configuration. Cisco IOS Release 12.0(6)T and later versions of Cisco IOS Release 12.0 T and Cisco IOS Release 12.0(6)XR and later versions of Cisco IOS Release 12.0 X support VoIP communication using the SGCP 1.1 protocol. Just as with H.323 systems, VoIP gateways in an SGCP environment convert IP-based voice packets into standard PSTN voice traffic, making the process of placing calls over the IP network transparent to users.

Call-agents manage SGCP-compliant gateways throughout the network, allowing them to engage in common channel signaling (CCS) over a 64-kbps circuit emulation service (CES) circuit.

Headend Wiring

This section provides guidelines for setting up the headend wiring and cabling at your site. When planning the location of the new system, consider the distance limitations for signaling, EMI, and connector compatibility, as described in the following sections.

Interference Considerations

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 headend wiring:

- Bad wiring practice can result in radio interference emanating from the wiring, ingress noise, co-channel interference, and degraded or erratic universal broadband router performance.
- Strong EMI, especially when caused by lightning or radio transmitters, can destroy the signal drivers and receivers in the Cisco uBR7200 series router, and can even create an electrical hazard by conducting power surges through lines and into equipment. (Review the safety warnings in the [“Safety with Electricity”](#) section on page 2-3.)

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

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 EMI problems in the past, you might want to consult experts in electrical surge suppression and shielding.

Distance Limitations and Interface Specifications

The size of your networks and the distances between connections depend on the type of signal, the signal speed, and the transmission media (the type of cabling used to transmit the signals). For example, standard coaxial cable has a greater channel capacity than twisted-pair cabling. The distance and rate limits are the IEEE-recommended maximum speeds and distances for signaling; however, you can usually get good results at speeds and distances far greater than these. For example, the recommended maximum rate for V.35 is 2 Mbps, and it is commonly used at 4 Mbps without any problems. If you understand the electrical problems that might arise and can compensate for them, you should get good results with rates and distances greater than those recommended by IEEE; however, do so at your own risk.



Note

We recommend that you do not exceed specified transmission rate and distance limits.

When preparing your site for network connections to the Cisco uBR7200 series router, you must consider a number of factors related to each type of interface:

- The type of cabling required for each type of interface (fiber, thick or thin coaxial, shielded twisted-pair, or unshielded twisted-pair cabling)
- Distance limitations for each signal type
- The specific cables you need to connect each interface

- Any additional interface equipment you need, such as transceivers, hubs, switches, modems, channel service units (CSUs), or data service units (DSUs)
- Cable pinouts if you plan to build your cables

Before installing the Cisco uBR7200 series, have all additional external equipment and cables available. The information listed above is available at Cisco.com.

For ordering information, contact a customer service representative.

Equipment Racks

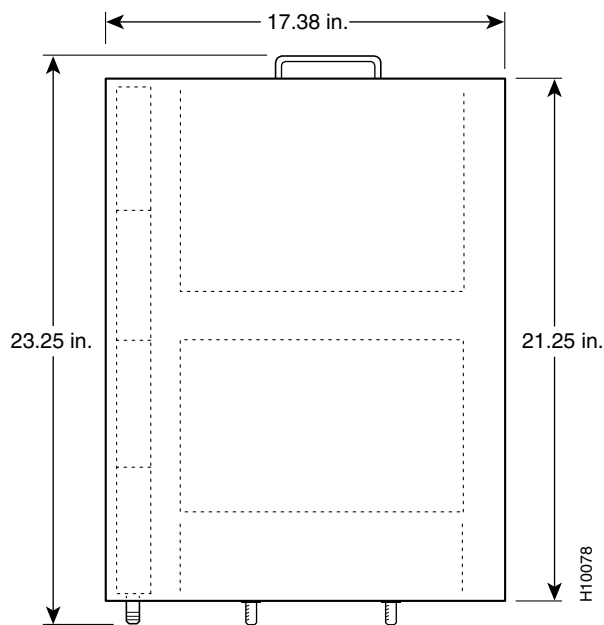
The rack-mounting hardware included with the Cisco uBR7200 series universal broadband router is suitable for most 19-inch equipment racks and telco-type racks. To easily access field-replaceable units (FRUs) while the router is installed in a rack, ensure that you have access to the front and rear of the router.

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 rear rack-mount installation, remove the power strip before installing the Cisco uBR7200 series router in the rack, then replace it after the chassis is installed. As an alternative, you can mount the Cisco uBR7200 series router on an equipment shelf if the rack dimensions allow you to secure the router to the shelf, and the overall configuration permits safe installation and access. However, we recommend rack-mounting the Cisco uBR7200 series router. [Figure 2-3 on page 2-18](#) shows the Cisco uBR7200 series router footprint and outer dimensions.

When rack-mounting the Cisco uBR7200 series router, consider the following information:

- To mount the router between two posts or rails using the brackets, the inner clearance (the width between the *inner* sides of the two posts or rails) must be at least 17.5 inches (44.45 cm).
- The height of the chassis:
 - Cisco uBR7246VXR chassis is 10.5 inches (26.67 cm).
 - Cisco uBR7246 chassis is 10.5 inches (26.67 cm).
- When mounting the router in four-post or telco-type racks, be sure to use all the screws and the brackets provided to secure the chassis to the rack posts.

Figure 2-3 Cisco uBR7200 Series Router Footprint and Outer Dimensions (View from Top Looking Down)



Note

We recommend the rear bracket mounting system for four-post racks because this method enables you to keep cables from protruding too far out in front of the Cisco uBR7200 series router, and simultaneously manage the cables at the front of the chassis with the cable-management bracket.

When planning your rack installation, consider the following information:

- Install the Cisco uBR7200 series router in an open rack whenever possible. If installation in an enclosed rack is unavoidable, ensure that the rack has adequate ventilation.
- If you plan to use an equipment shelf, ensure that the shelf is constructed to support the weight and dimensions of the chassis. [Figure 2-3](#) shows the chassis footprint, which you will need if you are designing a customized shelf. We recommend that you use the rack-mount kit designed for your particular Cisco uBR7200 series router:
 - Rack-mount kit for the Cisco uBR7246VXR or Cisco uBR7246 (product number ACS-uBR7200-RMK=)
- 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 port adapters, connecting cables, or replacing or upgrading components). Otherwise, allow at least 23.25 inches (59.06 cm) of clearance at the front, and 19 inches (48.3 cm) at the back to remove any of the field-replaceable units.
- Maintain a minimum clearance of 3 inches (7.72 cm) on the right and left of the chassis for the cooling air inlet and exhaust ports, respectively. Avoid placing the Cisco uBR7200 series router in an overly congested rack or directly next to another equipment rack; otherwise, the heated exhaust air from other equipment can enter the inlet air vents and cause an overtemperature condition inside the router.
- Always install heavier equipment in the lower half of a rack to maintain a low center of gravity and prevent the rack from falling.

- If you use telco-type racks, be sure that the rack is bolted to the floor and secured, because in these types of installations, only one end of the chassis mounts to the two rack posts with the brackets. Ensure that the weight of the chassis does not make the rack unstable.
- Install and use the cable-management bracket included with the Cisco uBR7200 series rack-mount kit to keep cables organized and out of the way of the port adapters and I/O controller. Consider the equipment and cabling that is already installed in the rack. Ensure that cables from other equipment will not impair access to the port adapters, or require you to disconnect cables unnecessarily to perform equipment maintenance or upgrades.
- You cannot install the cable-management bracket on a Cisco uBR7200 series router that you have mounted from the front.

In addition to the preceding guidelines, review the precautions for avoiding overtemperature conditions in the [“Site Environment” section on page 2-6](#). To properly install the Cisco uBR7200 series router chassis in a rack, refer to the instructions in the [“Cisco uBR7200 Series Chassis Rack-Mounting Options” section on page 3-2](#).

**Caution**

Do not install the Cisco uBR7200 series chassis in an enclosed rack or room that is not properly ventilated or air-conditioned. The Cisco uBR7200 series chassis overheats if the input air temperature reaches 105°F (41°C).

Site Preparation Checklist

Before installing the Cisco uBR7200 series router, assemble the equipment needed to support your network configuration and subscriber service offering. Ensure all power and cabling requirements are met based on the equipment to be installed. Also ensure that environmental conditions are met to maintain proper equipment operation.

Table 2-2 is a checklist that identifies the key tasks to complete.

Table 2-2 Site Preparation Checklist

Task	Verified By	Date
General:		
Safety recommendations and guidelines reviewed.		
Required general CMTS preparations completed.		
Site power voltages verified.		
Site environmental specifications verified.		
Downstream and upstream channel plans created.		
Cable plant balanced, swept and verified to comply with DOCSIS or EuroDOCSIS recommendations.		
Optical receivers adjusted for proper upstream RF output levels.		
Required passwords, IP addresses, device names available.		
All additional CMTS equipment to support Internet access services, including upconverter and all other RF-related equipment, servers and other host computers, a Cisco uBR900 series cable access router, and console accessory kit to test operation of your network.		
Required tools and cables available.		
Telco Return Configurations:		
Telco return dial-up plan created.		
Network access server installed and configured.		
Telephone circuits, connections, and all equipment to support telco return.		
IP Telephony Configurations:		
Gatekeeper and gateway equipment installed and configured.		
Dial plan based on the supported VoIP protocol used—H.323 or SGCP.		

Component Checklists

- Check off the equipment as it is unpacked.
- Titles and quantities of documents will vary.

Cisco uBR7246 and Cisco uBR7246VXR Component List

Table 2-3 provides the list to verify the contents of the shipping container for the Cisco uBR7246 and Cisco uBR7246VXR routers.

Table 2-3 Cisco uBR7246VXR and Cisco uBR7246 Component List

Description	Received
<ul style="list-style-type: none"> • Cisco uBR7246VXR or Cisco uBR7246 chassis • Network processing engine • I/O controller • Up to two AC-input or DC-input power supplies • Up to two port adapters (blank port adapters should be installed in empty port adapter slots) • Up to four cable interface cards (blank cable interface cards should be installed in empty cable interface line card slots) • Up to two flash memory cards <p>Note An optional cable clock card can be installed in a Cisco uBR7246VXR.</p>	
<p>The following accessories might arrive in separate shipping containers:</p> <ul style="list-style-type: none"> • Rack-mount and cable-management kit—Two rack-mount brackets, one cable-management bracket, eight M4 x 6-mm Phillips flathead screws, four M3 x 6-mm Phillips panhead screws, and four 10/32 x 3/8-inch slotted binderhead screws • AC-input power cables—Up to two AC-input power cables (if separate AC-input power supply ordered) • Documentation, including the following: <ul style="list-style-type: none"> – Cisco Information Packet – Cisco Network Registrar documentation—if ordered – Cisco IOS software documentation set—if ordered <p>Note All hardware and software documentation is also found at the following URL:</p> <p>http://www.cisco.com/en/US/products/hw/cable/ps2217/tsd_products_support_series_home.html</p>	

