CHAPTER 2

Preparing for Installation

This chapter recommends general safety guidelines to follow and identifies requirements to meet before going to a subscriber site to install a Cisco uBR924 cable access router. It also lists the major Federal Communications Commission (FCC), Underwriter Laboratory (UL), and other agency approvals for the router. For additional safety and regulatory information, see Appendix C, "Regulatory Compliance and Safety Information."

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

The chapter includes the following sections:

- Safety
- Site Requirements
- Approvals and Regulations
- Required Tools and Equipment

Safety

This section describes the general, electrical, and electrostatic discharge guidelines that should be followed when installing the Cisco uBR924 cable access router.

Warnings and Cautions

Follow these guidelines to ensure general safety:

- Install the Cisco uBR924 cable access router in compliance with national and local electrical codes:
  - In the United States: National Fire Protection Association (NFPA) 70, United States National Electrical Code.
  - In Canada: Canadian Electrical Code, part I, CC22.1.
  - In other countries: International Electro-technical Commission (IEC) 364, part 1 through part 7.

- Ensure the shield of the coaxial cable is connected to the grounding system of the residence or building as close to the point of cable entry as practical. In the United States, the cable system must be in accordance with Article 820-40 of the National Electric Code.
- Keep the router area clear and dust free during and after installation.
- Keep tools and router components away from walk areas.
- Do not wear loose clothing, jewelry (including rings and chains), or other items that could get caught on the cable access router. Fasten your tie or scarf and roll up your sleeves.
- Use the Cisco-provided power supply and power cord to connect the Cisco uBR924 cable access router to its power supply and the power supply to the power outlet. The router ships with a three-wire electrical grounding-type plug which only fits into a grounding-type power outlet. This is a safety feature. Equipment grounding should be in accordance with local and national electrical codes.

Warning **Failure to properly ground the router—either by circumventing the three-wire grounding-type plug or by using a power outlet that is improperly grounded—can create a potentially hazardous electrical situation.**

- Operate the Cisco uBR924 cable access router in accordance with its marked electrical ratings and product usage instructions.
- Always unplug the power cable before installing or removing a cable access router.
- Do not work on the system or connect or disconnect cables during periods of lightning activity.

Electrical

Follow these guidelines when working with electrical equipment:

- Disconnect all power and external cables before installing or removing a cable access router.
- Do not work alone when potentially hazardous conditions exist.
- Never assume that power has been disconnected from a circuit; always check.
- Do not perform any action that creates a potential hazard to people or makes the equipment unsafe.
- Never install equipment that appears damaged.
- Carefully examine your work area for possible hazards such as moist floors, ungrounded power extension cables, and missing safety grounds.

In addition, follow these guidelines when working with equipment that is disconnected from a power source, but still connected to cable wiring.

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

Electrostatic Discharge

Electrostatic discharge (ESD) damage, which occurs when electronic cards or components are improperly handled, can result in complete or intermittent system failures. The Cisco uBR924 cable access router consists of a printed circuit board that is housed in a metal enclosure. Electromagnetic interference (EMI) shielding and connectors are integral components of the enclosure. Although the enclosure helps protect the boards, use an antistatic strap whenever handling the Cisco uBR924 cable access router. This will minimize the possibility that ESD damage can occur to the internal boards by touching the external connectors.

Following are guidelines for preventing ESD damage:

- If you use an ESD wrist strap or ankle strap, ensure that it makes good skin contact and that the equipment end of the ESD strap is attached to an unfinished surface of the Cisco uBR924 cable access router.
- Always place the router 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.

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

Site Requirements

Before going to a subscriber site to install the Cisco uBR924 cable access router, verify that the following have been done:

- Ensure that a coaxial cable connection is run from the cable TV trunk to the subscriber building or residence. For sites that support multiple telephones or fax devices on a VoIP telephone line, ensure all wiring is in place to support the configuration.

Note Cisco recommends that a dedicated (new) CATV cable drop be run from the grounding block directly to the Cisco uBR924 cable access router. If such a drop is not available, careful qualification of existing cable is often necessary. Cable ground should be connected to the grounding system of the building or residence as close to the point of cable entry as practical. For the United States, refer to the National Electrical Code Section 820-40 guidelines for proper grounding.

- Verify that each subscriber site is characterized at the headend to support upstream transmission and meets DOCSIS upstream and downstream RF requirements. Observe procedures in the *NCTA Recommended Practises for Measurements on Cable Television Systems*. Also see the “Cabling” section on page 6.
- Some sites specify that high pass filters must be installed on every tap drop that does not carry upstream data, voice, or IPPV services.

Note Installing a high pass filter between the Cisco uBR924 router and the headend will prevent the router from connecting to the headend—in this situation, the router’s US LED will never light.

- Ensure that all required headend routing and network interface equipment is installed, configured, and operational. Ensure that DHCP, Cisco IOS images, and configuration files have been created and pushed to appropriate servers such that each Cisco uBR924 router, when initialized, can transmit a DHCP request, receive an IP address, obtain TFTP and TOD server addresses, and download a configuration file (and/or updated software image) in compliance with DOCSIS and the procedures in place for your network.
- Ensure that each subscriber site meets the operating requirements specified in the "Site Requirements" section.
- Ensure that all supported equipment at a subscriber site—PC(s), telephone(s), fax device(s) and/or Ethernet hub—is installed and operational. Ensure telephones at subscriber sites support touch-tone dialing.
- Verify that all PCs at all subscriber locations meet the minimum computing requirements, that TCP/IP and DHCP operating modes are enabled, and that Internet connectivity is set for the Ethernet interface. See the "PC Subsystem" section on page 4-9 for procedures to verify TCP/IP and DHCP PC settings when onsite.

  Each service provider will have its own recommendations and requirements for the CPE devices connected to its network. However, at the very minimum a PC should have a 33 MHz 486 processor (a 75 MHz Pentium or greater processor is recommended); 16 MB of RAM; Windows for Workgroups for 486-based PCs and Windows 95 (or higher) for Pentiums; an Internet browser; an installed Ethernet Network Interface Card (NIC), with TCP/IP networking software installed and DHCP enabled.

Note This recommendation is for Internet access in general and is not specific to the Cisco uBR924. Other operating systems and hardware platforms of comparable capability are also supported.

- Ensure that you bring sufficient cables to connect all devices at all subscriber locations. For simultaneous TV and computer usage at a subscriber site, obtain cable splitters and directional couplers as appropriate to install when you install the router.
- Ensure the subscriber has ordered the backup POTS line(s) as appropriate from the telephone company and that an RJ-11 modular jack (USOC code) is installed near the location to connect to the router. The phone line should be a regular voice grade line or equivalent. Obtain each customer's telephone number onsite and verify the voice jack.
- As applicable for testing or reconfiguration based on your network practices, obtain IP addresses and/or telephone numbers pertinent to your network from your system administrator if you are statically configuring the subscriber site and voice dial peer groups. For most networks, IP addresses are supplied automatically. To test VoIP functionality at each site, obtain a special dialing number from your system administrator.

Environmental

Table 2-1 lists the operating and nonoperating environmental site requirements for operation of the Cisco uBR924 router. The ranges indicate the minimum and maximum values allowed for the router's operation, but if a measurement approaches the minimum or maximum of a range, it could indicate a potential problem. You can maintain normal operation by anticipating and correcting environmental anomalies before they approach a maximum operating range.

Table 2-1 Specifications for Operating and Nonoperating Environment

Specification	Minimum	Maximum
Temperature, ambient operating	32°F (0°C)	104°F (40°C)
Temperature, ambient nonoperating and storage	–13°F (–25°C)	95°F (70°C)
Humidity, ambient (noncondensing) operating	5%	95%
Humidity, ambient (noncondensing) nonoperating and storage	5%	95%
Altitude, operating and nonoperating	Sea level	10,000 ft (3,050 m)
Vibration, operating	10 to 200 Hz, 0.0005 g (1 oct./min.)	N/A
Vibration, nonoperating	10 to 100 Hz, 0.0065 g (1 oct./min.)	N/A

Caution For proper airflow, keep the back, sides, and bottom of the cable access router clear of obstructions and away from the exhaust of other equipment. To prevent unit overheating, never install the Cisco uBR924 router in an enclosed rack or room that is not properly ventilated or air conditioned.

Power

The Cisco uBR924 router does not contain a power switch. After the cable system technician installs, connects, powers on, and initializes the unit, it is intended to remain connected to the broadband network when operating normally. Before plugging the unit in, verify that the power source is within the values given in Table 2-2.

Table 2-2 Cisco uBR924 Cable Access Router Power Specifications

Description	Specification
AC-input voltage	120 to 240 VAC[1] wide input with power factor correction
AC-input current rating	1.2A[2] maximum at 120 VAC and 0.6A maximum at 240 VAC
AC-input cable	18 AWG[3] three-wire cable, with a three-lead receptacle on the power supply end, and a North American (NEMA 5-15P) plug on the power source end; other country-specific cords are available and supplied as ordered.
Power dissipation	12 to 15W
Frequency	50/60 Hz[4]

1. VAC = volts alternating current.
2. A = ampere.
3. AWG = American Wire Gauge.
4. Hz = hertz.

Note The same power supply supports both domestic (U.S.) and international operation. Different power cords are required, however, depending on the country of operation.

Caution Use only a Cisco-provided power supply and cord. Using any other vendor's power supply and cord can cause loss of data or permanent damage. Cisco uBR924 and Cisco uBR904 power supplies and cords are identical and interchangeable, provided the power cords are applicable to the country of operation.

Cabling

When running the coaxial line from the cable TV trunk connection to the subscriber site, consider the issues of electromagnetic interference (EMI), coaxial cable quality, and distance limitations for signaling, 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 plant wiring:

- Bad wiring practice can result in radio interference emanating from the plant wiring.
- Strong EMI, especially when it is caused by lightning or radio transmitters, can destroy the signal drivers and receivers in the Cisco uBR924 router, and can even create an electrical hazard by conducting power surges through lines and into equipment. (Review the safety warnings in the *"Electrical"* section on page 2-2.

Note Category 5 data wiring and telco wiring is much more susceptible to EMI than high-grade well-shielded coaxial CATV cable.

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 unsaddled conductors to destroy electronic devices. If you have had problems of this sort in the past, you might want to consult experts in electrical surge suppression and shielding.

Coaxial Cable Quality

CATV coaxial cable quality can vary dramatically at each installation site. Poor insulation, improperly installed additional outlets, the condition and length of the cable's center conductor, and the quality of the cable can negatively affect the connectivity and performance of the cable access router for digital data transmission. Coaxial cable tolerances for the transmission of two-way digital data are much lower than the tolerances for the transmission of downstream-only video. Coaxial cable used to carry two-way digital data must be of very high quality.

Note A 5 dB reduction in signal quality for analog downstream video might cause a slight degradation of picture clarity, which might or might not be noticeable to a subscriber.

A 1 dB reduction in signal quality for digital data might completely disrupt service to a Cisco uBR924 router user.

Check the cables for general quality level, tears or cuts in the insulation, insulation that is at least 80% braid with foil, a broken or bent center conductor at the conductor ends, the length of the center conductor, and splitters or amplifiers that have been added to extend video connectivity at the installation site.

Note The center conductor should extend 1/8 inch (3.2 mm) beyond the end of the conductor.

Tips Cisco recommends that you replace any cable that is in question and begin the installation with clean, two-way digital data transmission media. If the cable is of high-quality and was recently installed, replacing the connectors with high-quality connectors can also improve performance and eliminate future service calls.

Caution If you replace a connector, be careful not to score the center conductor. A scored conductor can reduce or impair performance for channels broadcast between 550 and 860 MHz. If the center conductor is too short, signals between 5 and 42 MHz might be affected.

Distance Limitations

The size of your networks and the distances between connections on the CATV network can affect the successful installation of a Cisco uBR924 router, which must be within 100 miles of the CMTS. This distance can also be defined in relation to the speed of light through the transmission network as being less than 2 msec from the CMTS to the Cisco uBR924 router and back again.

Note Exceeding this distance is a violation of the DOCSIS RFI specification.

When preparing a site for network connections to the Cisco uBR924 router, consider the following:

- The number of amplifiers from the installation site to the nearest node
- The number of outlets and amplifiers at the installation site
- Cable pinouts if you plan to build your cables

Potential distance limitation problems in the CATV network can be reduced by ensuring the following factors:

- A correct, linear unity gain two-way sweep procedure is in place
- Industry-standard configuration practices are used at the headend
- The downstream frequency is known at the time of installation
- The absolute downstream signal level can be measured where it enters the cable access router

Approvals and Regulations

The Cisco uBR924 router interfaces with national cable, telco, and network installations, which are subject to government regulation and oversight. Please read the following sections to verify that the installation of the router is within the parameters imposed by the regulatory bodies that are responsible for the subscriber's site. Additional information is available in Appendix C, "Regulatory Compliance and Safety Information."

FCC Requirements

Class B Equipment

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna (as appropriate).
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help (as appropriate).

Rights of the Telephone Company

The FCC has established rules that permit the device to be directly connected to the telephone network. Standardized jacks are used for these connections. This equipment should not be used on party lines or coin phones.

If this device is malfunctioning, it may also be causing harm to the telephone network; this device should be disconnected until the source of the problem can be determined and until repair has been made. If this is not done, the telephone company may temporarily disconnect service.

The telephone company may make changes in its technical operations and procedures; if such changes affect the compatibility or use of this device, the telephone company is required to give adequate notice of the changes. You will be advised of your rights to file a complaint with the FCC.

If the telephone company requests information on what equipment is connected to their lines, inform them of:

- The telephone number to which this unit is connected
- The ringer equivalence number (5 REN per port)
- The USOC jack required (RJ11C)
- The FCC registration number (5B1USA-33873-KX-N)

The ringer equivalence number (REN) and the FCC registration number are indicated on the label. The ringer equivalence number determines the maximum devices that can be connected to your telephone line. In most areas, the sum of the RENs of all devices on any one line should not exceed five. If too many devices are attached, they may not ring properly.

Country Approvals

As of the date of the publication of this manual, the Cisco uBR924 router is approved to operate in the following countries:

- North America: refer to the text that follows for Canadian requirements
- European Countries—EN55022 requirements
- Australia and New Zealand; AS/NZS 3548 requirements, PTC 210/99/007 requirements
- South America
- Asia: Japan—JATA requirements (approval number is A99-0334JP); Singapore (complies with TAS Standards TS PSTN-1), Hong Kong (approval number is HK99-00/VCS, Class B), Malaysia, Taiwan
- Saudi Arabia; SASO R-200752 requirements

Other companies might have been added to this list since the date of publication. See the release notes for this product for any additions.

UL/CSA/TUV Approvals

This product is UL-listed, CSA-approved, and TUV-certified for the uses described in this guide.

Industry Canada Requirements

NOTICE: This product is Canadian Industry certified. The Industry Canada Certification Number is 2461 9904 A. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to the certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

Caution Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

The Ringer Equivalence Number (REN) assigned to each terminal device denotes the percentage of the total load to be connected to a telephone loop which is used by the device, to prevent overloading. The termination on a loop may consist of any combination of devices subject only to the requirement that the total REN of all the devices does not exceed five.

Required Tools and Equipment

Assemble the tools and equipment needed to install the Cisco uBR924 router at subscriber sites. Table 2-3 lists the recommended items that Cisco does not provide.

Table 2-3 Recommended Tools, Cabling, and Equipment List

Checked Off	Item
	Installation toolkit including a flathead screwdriver (small to medium size); Phillips screwdriver (small to medium size); 7/16-inch open-end wrench; ESD-preventive wrist strap
	Signal level meter capable of reading a 64 QAM signal or a spectrum analyzer (HP8594Q or equivalent) as appropriate. An alternative is a clear understanding of the digital-to-analog channel amplitude offset and a calibrated analog signal level meter to measure a nearby adjacent analog carrier.
	Mixed set of attenuators (pads), cable adapters, splitters, High Pass Filters (HPF), directional couplers as appropriate
	Telephone tester (handset) to check the backup POTS telephone line (optional)
	10BaseT Ethernet cable tester
	Portable, hand-held console terminal such as a laptop computer with RS-232 serial port communications software, and a setting of 9600 baud, 8 data bits, no parity, and 1 stop bit (9600 8N1); reserved for technicians in networks supporting remote configuration and troubleshooting.
	Connector assemblies/adapters and wiring items for subscriber sites that support multiple telephones or fax devices on a VoIP telephone line; items and wiring must be in accordance with regulations in the country of operation.
	Applicable cables based on the subscriber site configuration: • High-quality, shielded RF coaxial cable (with at least 80% braid) to connect the Cisco uBR924 to the cable system • Category 5 UTP (10BaseT Ethernet) straight-through cables to connect computers directly to the Cisco uBR924 • Category 5 UTP (10BaseT Ethernet) crossover cables to connect the Cisco uBR924 to an Ethernet hub (RJ-45 connectors) • All other cables to connect the Ethernet hub to the supported devices • FXS voice cables and appropriate items to connect the Cisco uBR924 to telephone or fax equipment (RJ-11 connectors) per the site's configuration • Backup POTS (optional) line connection (RJ-11 connectors) • Cable to connect the console port to the portable, hand-held console device (RJ-45 connectors)

The Cisco uBR924 cable access router is available in differing bulk box and single packages:

- Bulk box packages include: five Cisco uBR924 cable access routers, five power supplies, five power cords based on the country of operation, five 10BaseT Ethernet straight-through cables, five subscriber documentation sets, and one service provider documentation set.

- Single packages include: one Cisco uBR924 cable access router, one power supply, one 10BaseT Ethernet straight-through cable, and one service provider and subscriber documentation set. A power cord appropriate to the country of operation can be purchased together or separately from the router.

Caution Use only the Cisco-provided power supply and cord. Using any other vendor's power supply and cord can cause loss of data or permanent damage. Ensure the power cord is suitable for your country of operation. Cisco uBR904 and Cisco uBR924 power supplies and cords are identical and interchangeable, provided the power cords are applicable to the country of operation.

Note A cable console kit and console cable, used to locally reconfigure the router, can be purchased separately.

The subscriber in-box documentation set includes:

- *Quick Start, Cisco uBR924 Cable Access Router Subscriber Setup* publication

The service provider in-box documentation set includes:

- Warranty card
- Licensing information

The following additional documents are available via CCO:

- *Cisco uBR924 Cable Access Router Hardware Installation Guide*—this document
- *Cisco uBR924 Cable Access Router Software Configuration Guide*
- *Quick Start Guide, Cisco uBR924 Cable Access Router Installation and Startup* publication
- Release notes are available for all Cisco IOS Release images

Based on the number of subscriber sites you are scheduled to install, ensure that you have sufficient Cisco-provided bulk box packages. After you have completed installation, give each subscriber a copy of the *Quick Start, Cisco uBR924 Cable Access Router Subscriber Setup* publication, along with any documentation your company provides.