

Equipment List

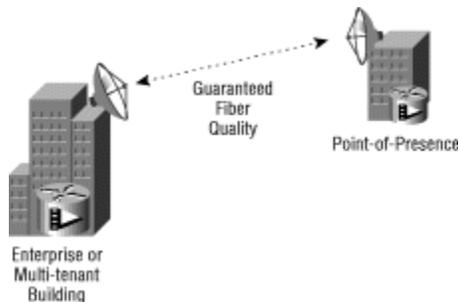
Servers

Network

Cisco uBR7246 or uBR7223
unlicensed U-NII band (5.725 to 5.825 GHz).

And when used as a local loop bypass wireless solutions can significantly reduce or eliminate the recurring cost of leased lines.

providers must react now by installing flexible, scalable networks that meet today's requirements and are designed to support the emerging new world broadband fixed packet-based services that scale with the customers need to grow



The Cisco broadband fixed wireless system is an integrated solution, consisting of a Cisco router (Cisco uBR7246 or uBR7223 universal broadband router), one or more wireless modem cards that are installed in the router, a power feed panel, and a wireless transverter containing the RF amplifier. (See [Figure 1-1.](#)) These components coupled with the necessary cables and an antenna subsystem provide an effective, easily-deployed means of providing broadband access without a fiber/wired infrastructure.

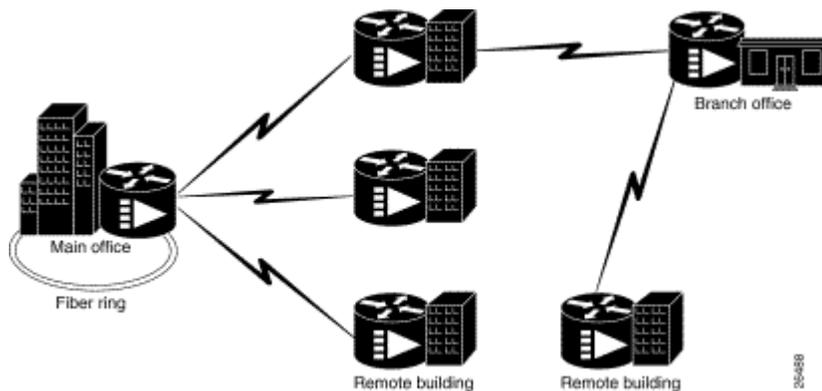
As part of an end-to-end solution, the broadband fixed wireless system can be integrated with Cisco's digital subscriber line (DSL) and cable offerings to provide broadband access services. Cisco incorporates Vector Orthogonal Frequency Division Multiplexing (VOFDM), which allows wireless operation in obstructed,

non-line-of-site (NLOS) environments by taking advantage of multipath signals and diversity reception.

The Cisco broadband fixed wireless system is a point-to-point product that provides up to 44 Mbps full-duplex data in a 12 MHz RF channel in the licensed MMDS band (2.500 to 2.690 GHz) and the unlicensed U-NII band (5.725 to 5.825 GHz).

Enterprise "Virtual Campus"

Shown is a large business campus with many buildings spread throughout a metropolitan area. Because campus environments require high-speed connections between sites to satisfy their LAN-based applications environment, fiber or possibly Gigabit Ethernet is used for the connection. If these sites are spread over many miles, broadband fixed wireless offers a quick and efficient way to interconnect the multiple buildings.



Wiring

Wireless Modem Card

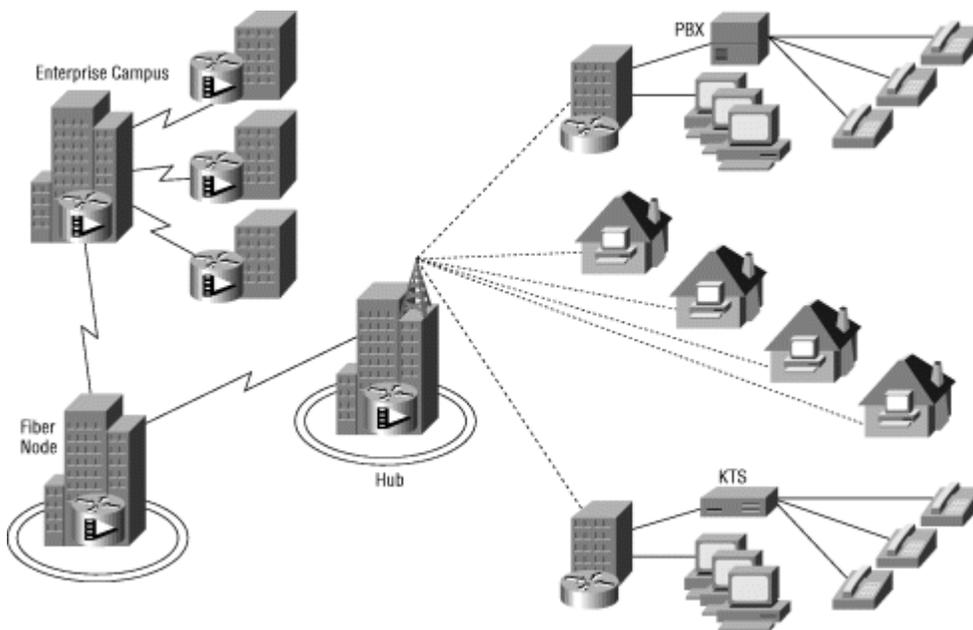
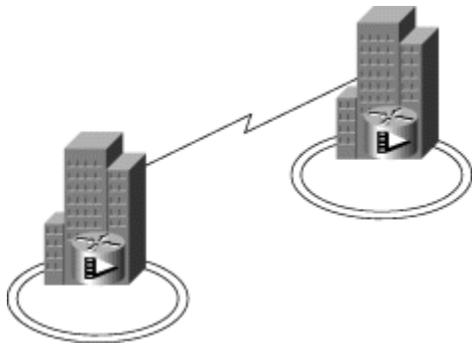
The wireless modem card installs in a modem card slot of a Cisco uBR7200 series router. It is configured through the router's system console or via the CiscoView network management system. The wireless modem card provides the control and data interface to the system's digital motherboard and the radio frequency (RF) subsystem in the wireless transverter. It also provides the up/down conversion from baseband to intermediate frequency (IF).

Wireless modem cards consist of the following components:

- Digital motherboard
- IF analog board
- Main and diversity serial interface control connectors
- 10-MHz external reference clock connection (optional)
- Monitor and Power Feed Panel connectors (Main and Diversity)
- Light-emitting diodes (LEDs) that provide a visual indication of the state of the modem card .

As the World Wide Web becomes a larger part of the education system, at all levels, fixed wireless broadband networks will play a key role in bringing the Internet to the student. Fixed wireless links provide the backbone for connecting new buildings and remote sites to the educational infrastructure to permit tools such as distance learning and two-way, interactive training to reach every student. Using fixed wireless solutions, concentrated users such as dormitories can be linked to existing networks without the need and the permanency of trenching cables or fiber.

Fixed wireless networks are perfect for links from district offices to local school facilities creating a private connection for sensitive information or for high-speed connectivity between schools as an intranet.



Digital microwave systems fall into two categories: wavelengths less than 10 GHz and wavelengths greater than 10 GHz (referred to as millimeterwave). Several bands exist below 10 GHz for high speed transmissions. These may be licensed bands such as MMDS (2.5 GHz) or unlicensed such as U-NII (5.7 GHz). Bands which are below 10 GHz have long propagation distances (up to 30 miles). They are only mildly affected by climatic changes such as rain. These

frequencies are generally not absorbed by objects in the environment. They tend to bound and thus result in a high amount of multipath.

Bands over 10 GHz such as 24 GHz, LMDS (28 GHz), and 38 GHz are very distance limited (less than five miles). They are very susceptible to signal fades due to rain. Multipath tends not to be an issue since the transmission distances are less, and most of the multipath energy is absorbed by the physical environment. However, when these frequencies are used in highly dense urban areas, the signals tend to bounce off objects like metal buildings or metalized windows. The use of "repeaters" can add to the multipath propagation by delaying the received signal.

What is Multipath?

Multipath is the composition of a primary signal plus duplicate or echoed images caused by reflections of signals off objects between the transmitter and receiver. In Figure 1, the receiver "hears" the primary signal sent directly from the transmission facility, but it also sees secondary signals that are bounced off nearby objects. These bounced signals will arrive at the receiver later than the incident signal. Because of this misalignment, the "out-of-phase" signals will cause intersymbol interference or distortion of the received signal. Although most of the multipath is caused by bounces of tall objects, multipath can also occur from bounces on low objects such as lakes and pavements

For further information regarding the wireless modem card, including detailed installation and configuration information, refer to the *Cisco uBR7200 Series Universal Broadband Router Wireless Modem Card and Subsystem Installation and Configuration* document.

Power Feed Panel

The power feed panel serves as an interconnection device between the wireless modem card, the wireless transverter, and a -48 VDC power supply. The main purpose of this unit is to provide DC power, transmit and receive IF signals, and control signals to the wireless transverter. In addition, the unit contains circuit breakers for the DC power and secondary lightning protection circuitry for the control cables.

The power feed panel consists of the following components:

- Coaxial cable and control cable connection ports to the wireless modem card and the wireless transverter (main and diversity)
- DC power supply terminal block
- Main and diversity power ON/OFF switches
- Power LEDs visible on both front and rear panel

One power feed panel is required for each modem card. Each power feed panel supports two wireless transverters and two antennas (main and diversity).

For further information regarding the power feed panel, including detailed installation information, refer to the *Cisco uBR7200 Series Universal Broadband Router Wireless Modem Card and Subsystem Installation and Configuration* document.

Wireless Transverter

The ruggedized wireless transverter is the outdoor control and data interface to the indoor subsystems. It provides up/down conversion from IF to RF frequencies and power amplification.

The wireless transverter consists of the following components:

- RF head
- Connector ports for IF input, control, and test
- Duplexer assembly with antenna connection
- Connector port for antenna alignment signal

The installation of a wireless network requires much the same basic planning as any wired network. The main difference is that the wireless signal requires some additional planning. This planning includes RF path planning, site preparation, and installation of outdoor components such as outdoor units, antennas, lightning protection devices, and cabling suitable for outdoor conditions. Usually, you also need to investigate the zoning laws as well as Federal Communications Commission (FCC) and Federal Aviation Administration (FAA) regulations.

Although the technology implemented in Cisco's broadband fixed wireless system can make use of multipath signals, reducing the effect of obstructions in the path, it is important that the characteristics of the path be carefully examined. With this knowledge, components and network requirements can be correctly planned for your specific application.

This chapter provides insight into the planning necessary to prepare your site for your Except in extreme conditions, attenuation (weakening of the signal) due to rain does not require serious consideration for frequencies up to the range of 6 or 8 GHz. When microwave frequencies are at 11 or 12 GHz or above, attenuation due to rain becomes much more of a concern, especially in areas where rainfall is of high density and long duration. If this is the case, shorter paths may be required.

broadband fixed wireless system.

- Each combination of one wireless modem card and one power feed panel will support one end of *only* one point-to-point link. Each end of a link may consist of one wireless transverter and one antenna, or two wireless transverters and two antennas. When there are two transverters and two antennas, the first transverter-antenna set supports the main signal, and the second transverter-antenna set supports the diversity signal.
- The Cisco uBR7246 universal broadband router supports up to four wireless modem cards.
- The Cisco uBR7223 universal broadband router supports up to two wireless modem cards.
- When configuring the Cisco uBR7200 series routers, you must order a minimum of 64 Mb of RAM to support the modem cards.