

10.5GHz Point-to-Multipoint [PMP] Broadband Fixed Wireless Access Network Technology Background

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Product Line Overview

The 10.5GHz Multipoint Broadband Wireless Solution delivers an alternative “last-mile access” solution for service providers, enabling them to either directly compete or complement more traditional broadband access technologies such as DSL and Cable.

The system delivers uncompromised performance, wireline-grade availability, end-to-end

QoS, security, provisioning, and NMS/OSS/BSS support. Designed for service provider-class scalability, flexibility and reliability, the Cisco solution readily addresses customer requirements..

Based around the industry standard DOCSIS protocol, the system allows the operator to use DOCSIS-compliant cable modems to connect to the wireless network.

DOCSIS Architecture

Figure 1 below shows the standard DOCSIS¹ architecture. An HFC² network is used to interconnect the CMTS³ to Cable Modems [CMs] located at customer sites.

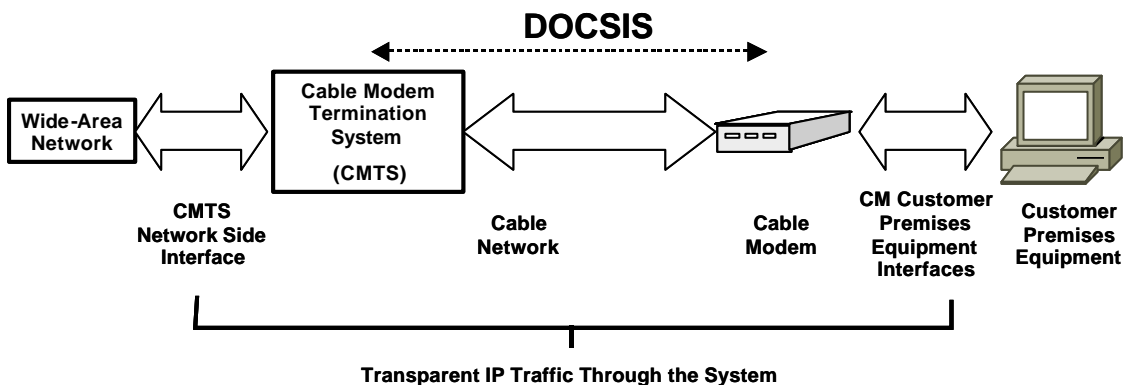


Figure 1: DOCSIS Reference Architecture

¹ The solution supports both DOCSIS & EuroDOCSIS; for simplicity this document refers only to DOCSIS

² Hybrid Fibre Coax

³ Cable Modem Termination System

DOCSIS⁴ provides the Layer 2 transport and associated higher level protocols to pass data between the CMTS & CM. The Layer 3 protocol is IP.

The 10.5GHz Multipoint Broadband Wireless Solution replaces the HFC network with a radio network. Please refer to Figure 2.

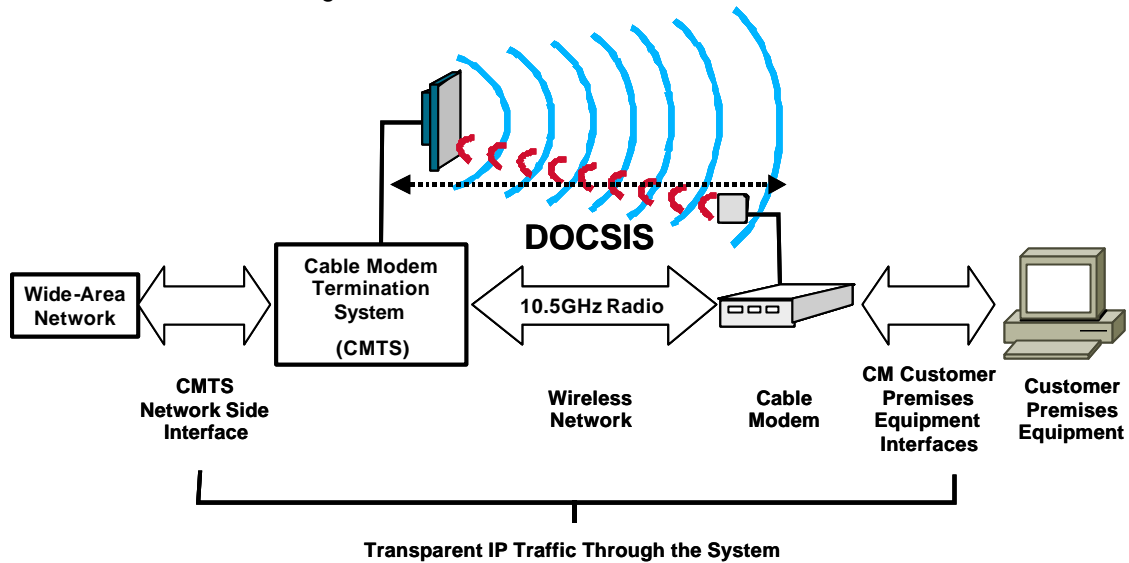


Figure 2: 10.5GHz Multipoint Broadband Wireless System Reference Architecture

Figure 2 illustrates the wireless physical media between the CMTS & CM.

The RF output of the CMTS is connected to an Outdoor Unit [ODU]. The primary function of the ODU is to convert the standard DOCSIS frequencies [50 to 860MHz Downstream, 5 to 42MHz Upstream] into frequencies within the required frequency band, in this case 10.5GHz. An antenna is then used to radiate the RF signal.

At the CM, a CPE ODU is used, to detect the 10.5GHz radio signal, and convert it into standard DOCSIS signals to pass to the CM.

In the upstream direction, the CPE ODU / Antenna converts the CM DOCSIS signals to 10.5GHz, and transmit it back to the CMTS ODU. Either 6MHz DOCSIS or 8MHz EuroDOCSIS channels can be used.

Radio Frequency Aspects

The Outdoor radio components are provided by 3rd party organisations.

At the CMTS / HE⁵ the antennas are “sectorized”, i.e. they radiate within a sector, typically 60°, 90° or 120° although omni [360°] can also be used. Currently, the solution supports 90° sectors. The DOCSIS protocol administers the access of multiple CMs within that sector. (The sector is analogous to the HFC network, connecting multiple CMs to a single CMTS modem channel.)

⁴ Data Over Cable System Interface Specification

⁵ Headend. Also often referred to as the hub or basestation.

At the CPE site, the antenna presents a focussed beam to connect back to the associated HE site. Typical beamwidths are $< 20^\circ$ azimuth [width] & elevation [height].

The downstream frequency range is 10,196 to 10,224 MHz

The upstream frequency range is 10,546 to 10,574 MHz

Please refer to diagram Figure 3.

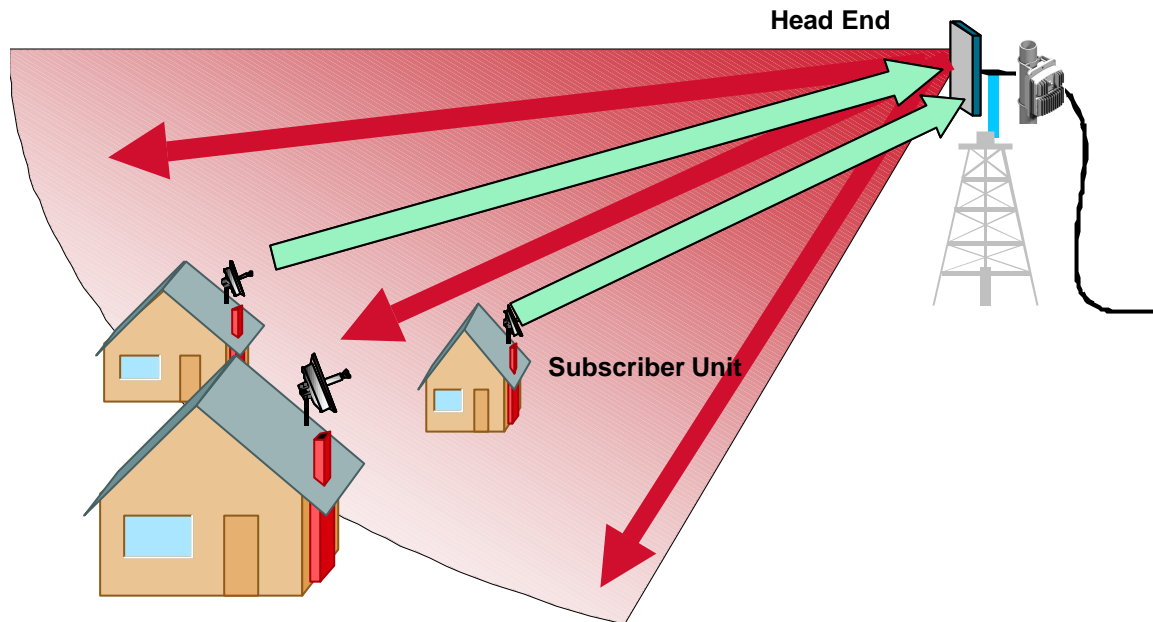


Figure 3: Sectored HE antenna & focussed CPE antennas

HEs are typically designed with 3, 4 or 6 sectors [120° , 90° or 60°], depending upon the specific deployment requirements. If 360° coverage is not required (for example at the edge of a city or by a lake) less sectors may be deployed. Currently, the solution supports 90° sectors. A “Frequency Reuse Plan” is prepared, defining the way in which the allocated spectrum is use. Parameters taken into account include:

- Selecting HE locations
- Calculating LOS⁶ between HEs and the CPE locations
- Ensuring that the same frequencies are not used in adjacent sectors,
- Calculating the ranges of sectors for particular modulation profiles, transmit power levels, antenna sizes & types, geographic terrain etc.

The RF Planning exercise will produce a map of locations of HEs, and coverage areas. Planning should also allow the deployment team to design the backhaul infrastructure to connect the HEs to the Service Provider’s network. A typical initial plan is shown below.

⁶ Line of Sight

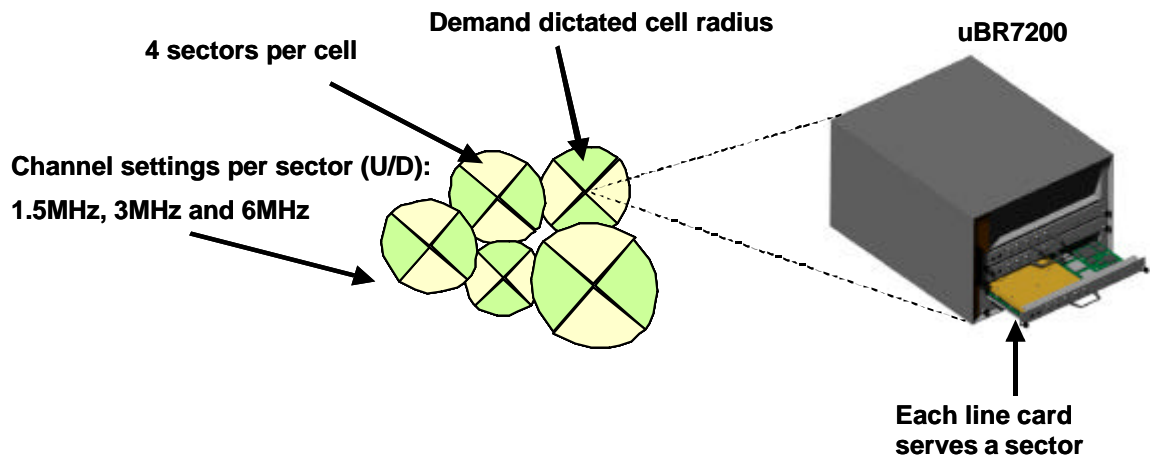


Figure 4: Example of HE location diagram.

The diagram shows a simple 5 cell plan, each with 4 sectors. If this example, each colour denotes a frequency, thus 2 frequencies are used. Techniques such as sector rotation, polarisation and frequency reuse are used to minimise interference and maximise coverage.

Solution Elements

Headend solution

The headend solution consists of:

CMTS: a uBR7200 or uBR7100. The uBR7200 series universal broadband router houses the DOCSIS Line Card delivering up to 38Mbps downstream and 10Mbps upstream bandwidth per 6 MHz channel pair. Up to 1 downstream and 6 upstream channels can be supported on a single card, and up to 4 cards can be housed within a uBR7246VXR.

For further information, refer to the Cable BU website located at:

10.5GHz ODU: An outdoor unit that converts an intermediate frequency [IF] signal to the proper 10.5GHz RF frequency for transmitting or receiving voice or data over the air. The first 10.5GHz to be used is provided by Electronics. For further information, refer to the website at:

Ancillary items: Antenna, cables, lightning protector, and other components for a complete headend solution offering. These devices are typically provided by the Systems Integrator.

CPE Solution

DOCSIS compliant cable modem. Either DOCSIS modems can be used.

10.5GHz ODU/Antenna: An integrated, outdoor RF unit that converts the IF signal to the 10.5GHz RF frequency for transmitting and receiving voice and data over the air.

Ancillary items: Cables, 12V DC power supply, power injector, lightning protector, and other components for a complete CPE installation. These devices are typically provided by the Systems Integrator.

OSS & BSS

The management platforms are exactly the same as for the Cisco DOCSIS solution. The ODU elements at both HE & CPE are both transparent to DOCSIS, and do not require any programming, configuration etc. Parameters such as RF transmit frequency are factory set.

Target Markets

The target market for this system is essentially the same as for Cable Modem networks, i.e.

SME	IP VPNs, Internet Access, voice access
MxU	Buildings containing multiple residential & business users
SOHO/Telecommuter	IP VPNs, Internet Access, voice access
Residential	Internet Access, Secondary Line Voice

Table 1: Target Markets & Example Services

Due to the QoS features of DOCSIS and IOS, a mix of QoS-aware features can be offered. Please refer to the standard Cable BU documentation for further detail.

DOCSIS Platform Features

- Fully standards compliant; DOCSIS 1.0 and 1.1
- Proven Technology; the Cisco uBR range of routers is extensively field proven.
- Scalable; over 1000 subscribers per sector
- Simple CPE installation; single cable between outdoor & indoor units
- High Capacity; 38Mb/s downstream & 10Mb's upstream, per sector.

Contact Details

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