

Cisco uBR-MC3GX60V-RPHY Broadband Processing Engine for the Cisco uBR10012 Universal Broadband Router

The migration to IP-based cable solutions just got a little easier with the Cisco® uBR-MC3GX60V-RPHY Broadband Processing Engine (BPE). This high capacity, DOCSIS® 3.0-capable and C-DOCSIS/Remote-PHY-compliant line card for the Cisco uBR10012 Universal Broadband Router is shown in Figure 1. The new BPE has been streamlined, with upstream and downstream physical (PHY) layer functions relocated to the Cisco Coaxial Media Converter located at a remote site while MAC and DOCSIS software features are still retained in the center. With this new architecture and the introduction of a set of mature protocols, Cisco offers our cable customers with 1Gbps+ service and a smooth migration path towards an IP-based cable solution. With digital-optical and central control, the Cisco uBR-MC3GX60V-RPHY BPE is also easier to operate.

Figure 1. Cisco uBR-MC3GX60V-RPHY Broadband Processing Engine

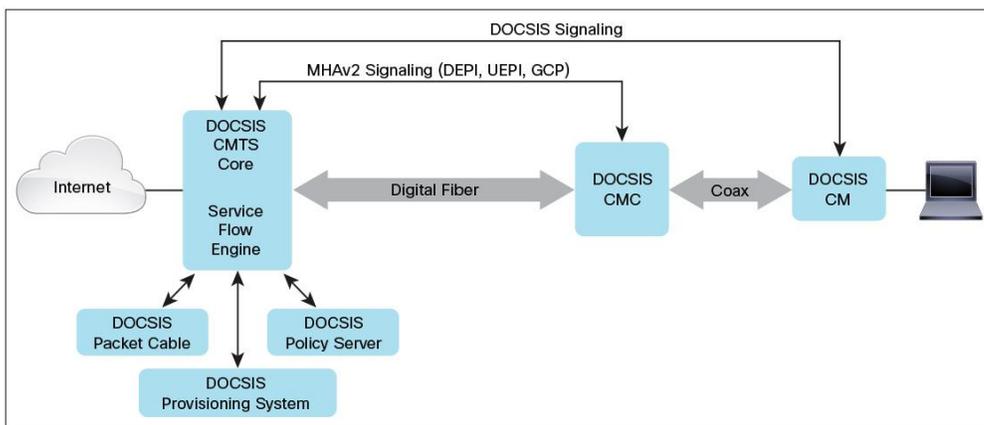


There are 72 DOCSIS downstream and 60 upstream channels per card, so the Cisco uBR-MC3GX60V-RPHY BPE supports the same benchmark for scalable, fast, and cost-effective DOCSIS 3.0 Cable Modem Termination System (CMTS) solutions maintained by the Cisco uBR-MC3GX60V Broadband Processing Engine (BPE). With the new Cisco uBR-MC3GX60V-RPHY BPE, the Cisco uBR10012 platform scales up to 576 modular DOCSIS downstream channels and 480 upstream channels, (approximately 24 Gbps of downstream throughput and 14.4 Gbps of upstream throughput) in a single, carrier-class chassis as part of our Remote-PHY solution. On top of this, with the introduction of virtual combining, the bandwidth can be further scaled in the Ethernet domain to support more CMC hosted upstream channels and as many CMC downstream channels as required. The limit for downstream channels is based on the available bandwidth to be delivered to and from each CMC. This evolution moves the traditional RF combining of multiple service areas into CMTS ports to the Ethernet domain, allowing virtual combining to greatly enhance network scalability.

Remote-PHY System Architecture

The Cisco Remote-PHY system consists of the DOCSIS CMTS core, Cisco Coaxial Media Converter (CMC), cable modem and supporting system. It implements broadband data and digital video access and forwarding, service configuration, and management and maintenance of CATV coaxial cable networks. The Modular Headend Architecture version 2 (MHA v2) is a set of open protocol standard recommendations specifically designed for Remote-PHY.

Figure 2. Remote-PHY Standard Architecture



The Modular Headend Architecture (MHA) is a CableLabs[®] specification for a M-CMTS architecture that differs from the integrated CMTS (I-CMTS) architecture, which has PHYs internal to CMTS. The MHA includes DOCSIS External Downstream Interface (DEPI), DOCSIS Timing Interface (DTI), Operations Support System Interface (OSSI), and video-related specifications. MHA v2 is the extension of MHA, a new Layer 2 Tunneling Protocol Version 3 (L2TPv3)-based protocol. Upstream External PHY Interface (UEPI) is defined for upstream DOCSIS MAC management and data packets encapsulation. It supports the combination of DEPI and UEPI in the remote side, hence it is also called as DOCSIS Remote PHY. General Control Plan (GCP) protocol is also introduced as the general control plane protocol used to start, run, and configure the CMC.

In the MHA v2 architecture, both downstream PHY and upstream PHY are deployed on the remote side, which is called CMC. Please note that the CMC has to work with the Cisco uBR-MC3GX60V-RPHY BPE line card that has the same functionality as the existing Cisco uBR-MC3GX60V BPE except for the RF and PHY-related features. The CMC has both radio frequency interference (RFI) and Gigabit Ethernet (GigE) interfaces while the line card only has GigE interfaces for both upstream and downstream.

DEPI is based on L2TPv3 and is the downstream link between the downstream MAC and remote downstream PHY, which is inherited from MHA and contains the forwarding plane protocol. UEPI is also based on the L2TPv3 and is the upstream link between upstream MAC and upstream PHY.

In the MHA v2 architecture, the CMC and the digital fiber network are transparent to cable modems. The CMC is managed in the CMTS core with GCP. The cable modem and provisioning system do not change. With this approach, Cisco CMC for Remote-PHY has some of the least complicated electronics in the cable field, providing better reliability and lower cost.

The MHA v2 with DEPI and UEPI has been adopted by CableLabs and the China State Administration of Radio, Film, and Television (SARFT) for inclusion in the China DOCSIS (C-DOCSIS) specification.

Remote-PHY System Key Benefits

- Preserves the centralized software structure of the CMTS and rich feature sets. Allows for future software upgrades without requiring upgrades of the numerous remote nodes in the field.
- Requires a small amount of hardware and software in the remote node to keep the device relatively simple and stable. This provides many operational advantages, including less need for troubleshooting, normal operation and evolution. The simpler the hardware, the less chance of failure. Since most of the intelligent software resides in the headend, upgrades are easier since upgrading thousands of nodes in the field is not necessary.
- Supports Ethernet-based networks such as Ethernet Passive Optical Network (EPON), Gigabit Passive Optical Network (GPON), and Layer 2 Metro Ethernet. This gives customers the flexibility to cost-effectively select which transmission network is most appropriate to their needs.
- Preserves the sophisticated DOCSIS quality of service (QoS) assurance mechanism to help ensure end-to-end QoS. The granularity of scheduling is per service flow-based. In addition, there is no mapping needed from DOCSIS service flow to Ethernet packet, virtual LAN (VLAN).
- The CMC and transmission network are transparent to the CMTS and cable modem so the Remote-PHY has no effect on the existing CMTS and cable modem. Instead, the architecture allows the use of digital Fiber.

Key Features and Benefits

Shared Upstream and Downstream Channels (Virtual Combining)

Upstream and downstream channels on the same GE port on the Cisco uBR-MC3GX60V-RPHY BPE can be grouped into multiple channel groups. One downstream channel can be shared by multiple channel groups. The set of downstream and upstream channels in each channel group can be shared by a maximum of four CMCs, which enhances the channel utilization and the number of CMCs connecting to them. By implementing upstream sharing, one Cisco uBR-MC3GX60V-RPHY BPE can support up to 60 CMCs with each CMC having four active upstream channels and can support 240 CMCs with each CMC having one active upstream channel.

GE Connectivity for Downstream and Upstream

Unlike traditional CMTS line cards, there are no RF ports on the Cisco uBR-MC3GX60V-RPHY BPE and no RF connectivity is needed. The CMTS reduces to an "IP only" chassis and no longer needs direct access to the plant RF cabling. This in turn eliminates the need to run analog optical and coaxial cabling to central locations to make best use of a dense CMTS chassis.

Cisco Software Licensing Flexibility

The Cisco uBR-MC3GX60V-RPHY BPE still provides true cost flexibility for operators with licensing options that offer a pay-as-you-grow model. Licensing features include:

- Base hardware and 16 upstream and 16 downstream channel licenses constitute the minimum configuration supported.
- Additional optional licenses are available for purchase up to the full capacity of 72 DOCSIS downstream (or 54 EuroDOCSIS downstream) and 60 upstream channels.
- The Cisco Software Licensing (CSL) infrastructure provides an operationally simple licensing experience.

The ability to purchase and activate downstream and upstream channels as needed through software licensing allows cable operators to closely match their capital expenditures to their growth requirements. The sharing of licenses to multiple CMC decouples CMTS licenses from the CMC channels. The central CMTS licensing effectively becomes a bandwidth capability purchase - the bandwidth purchased being shared as required by CMTS configuration to all connected CMC. Operators can thus reduce their operational expenses by designing their DOCSIS networks to accommodate future growth by simply installing upgrade licenses to add bandwidth when needed to existing connected CMC.

Effective CMC Management

CMC management is supported with the GCP protocol. The detailed management function includes CMC statistics collection (e.g., downstream and upstream PHY counter and CMC status data, CMC status notification to notify CMTS about a specific event such as a critical issue on the CMC, and environmental events).

Features List

- DOCSIS3.0 and Euro-DOCSIS3.0 compliant
- C-DOCSIS and Remote-PHY Standard compliant
- Six Small Form-Factor Pluggable (SFP) ports (three active and three standby) for downstream and upstream traffic
- 15 MAC domains
- Support scheduling, MAC processing, and most of current IOS DOCSIS features
- Takes advantage of most of current uBR10K software and features
- Downstream and upstream channels sharing by multiple CMC
- Max 60 CMC per Cisco uBR-MC3Gx60V-RPHY BPE with each CMC having 4 active upstream channels
- Max 240 CMC per Cisco uBR-MC3GX60V-RPHY BPE with each CMC having 1 active upstream channel
- Removes the requirement to run RF cable TO/FROM the chassis
- Coexist with traditional Cisco uBR-MC3GX60V BPE and Cisco uBR-MC20X20V line card
- Standard DOCSIS provisioning, Standard MIBs, Standard DOCSIS OSS, and Standard Billings
- Standard DOCSIS service flow-based end to end QoS
- No adaption of service flow to PON VLANS that reduces the end to end system to DOCSIS 1.0 Class of Service operation
- Standard Dynamic QoS, standard packet cable 1.5 and packet cable multimedia
- CMC management functions like CMC monitor, error handling, and control
- Multicast DEPI support to maintain high efficiency in DEPI forwarding
- DOCSIS line-rate operation for all downstream channels (72 at 256QAM Annex B or 54 at 256QAM Annex A) and all 60 upstream channels (up to 64QAM at 6.4 MHz) in bonded and non-bonded modes
- From 4-channel to more than 32-channel downstream bonding capable*; 4-channel upstream bonding capable
- Full DOCSIS 3.0 CMTS and downstream external PHY interface (DEPI) capability
- Full DOCSIS 3.0 CMTS and upstream external PHY interface (UEPI) capability
- Full DOCSIS 3.0 CMTS and General control plane protocol (GCP) capability

- Simultaneous operation of Cisco uBR-MC3GX60V-RPHY with Cisco MC20X20V and Cisco uBR-MC3GX60V in the same uBR10012 chassis
- One CMC controller (Cisco uBR-MC3GX60V-RPHY BPE) provides single point of management for many CMCs

* 32-channel downstream bonding will be supported in future releases.

Product Specifications

Table 1. Product Specifications

Descriptions	Specifications
Physical	<ul style="list-style-type: none"> • Occupies a single slot in the Cisco uBR10012 chassis • Interface: line card single mode with intermediate reach connector • Hot-swappable; no slot dependency • Weight: 12.97 lb (5.895 kg) • Dimensions (H x W x D): 21.6 x 1.4 x 17.2 in. (55 x 3.6 x 43.8 cm)
Power	<ul style="list-style-type: none"> • Max rated power: 211W
Reliability and availability	<ul style="list-style-type: none"> • Designed for five 9s of availability (99.999%)*
Environmental	<ul style="list-style-type: none"> • Operating altitude: -197 to 13,123 ft (-60 to 4000 m) • Storage temperature: -4 to 149°F (-20 to 65°C) • Operating temperature, nominal: 41 to 104°F (5 to 40°C) • Storage relative humidity: 5 to 95% • Operating relative humidity: 10 to 90% • Maximum heat dissipation: 211W
Software release	<ul style="list-style-type: none"> • Cisco IOS® Software Release 12.2(33) CX or later
Supported SFP	<ul style="list-style-type: none"> • SFP-GE-T (1000BASE-T) • GLC-SX-MM (1000BASE-SX) • GLC-LH-SM (1000BASE-LX/LH) • GLC-ZX-SM (1000BASE-ZX)
Regulatory Compliance	
Safety	<ul style="list-style-type: none"> • CAN/CSA-C22.2 No. 60950-1 1st ed./UL 60950-1 1st ed. (Safety of Information Technology Equipment) • EN/IEC 60950-1 (Safety of Information Technology Equipment) • AS/NZS 60950.1 (Safety of Information Technology Equipment)
Electromagnetic emissions	<ul style="list-style-type: none"> • EN55022, Class B • CISPR 22, Class B • FCC 47CFR15, Class B • ICES-003, Class B • VCCI, Class B • AS/NZS CISPR 22, Class B • KN 22, Class B • IEC/EN61000-3-2 Power Line Harmonics • IEC/EN61000-3-3 Voltage Fluctuations and Flicker
Electromagnetic immunity	<ul style="list-style-type: none"> • IEC/EN61000-4-2 Electrostatic Discharge Immunity • IEC/EN61000-4-3 Radiated Immunity • IEC/EN61000-4-4 Electrical Fast Transient Immunity • IEC/EN61000-4-5 Surge • IEC/EN61000-4-6 Immunity to Conducted Disturbances • IEC/EN61000-4-11 Voltage Dips, Short Interruptions, and Voltage Variations

Descriptions	Specifications
ETSI/EN	<ul style="list-style-type: none"> • EN 300 386 Telecommunications Network Equipment (EMC) • EN55022 Information Technology Equipment (Emissions) • EN55024 Information Technology Equipment (Immunity) • EN61000-6-1 Generic Immunity Standard
Network Equipment Building Systems (NEBS): Level 3	Designed to meet requirements of: <ul style="list-style-type: none"> • GR-63-CORE, Issue 3, March 2006 • GR-1089-CORE, Issue 4, June 2006
Mechanical	<ul style="list-style-type: none"> • IEC 68-2-1, IEC 68-2-2, IEC 68-2-56: Operational temperature and humidity • IEC 68-2-27: Operating shock • IEC 68-2-64, IEC 68-2-6, IEC 68-2-47: Operating and non-operating vibration • IEC 68-2-32: Nonoperating freefall drop • IEC 68-2-40: Nonoperating altitude • IEC 68-2-27, IEC 68-2-32: Nonoperating mechanical shock • IEC 68-2-3: Nonoperating humidity • IEC 68-2-14, IEC 68-2-33: Nonoperating temperature shock
LEDs	<ul style="list-style-type: none"> • One power LED (green) • One status LED (green/yellow): solid green indicates the processor has booted and passed its diagnostics; LED blinks green on a protect card, yellow when in one of the booting states • Maintenance (yellow): indicates the line card can be removed • One LED on each GE port (green): upstream and downstream path is configured and able to pass traffic • LK/ACT0-LK/ACT5 LED (blinking green) indicates port enabled with traffic and LED (solid green) indicates port enabled with no traffic • Front panel display for licenses: First two digits signify downstream licenses and next two digits signify upstream licenses installed
Network Management Information	
Standard MIBs	<ul style="list-style-type: none"> • IF-MIB (RFC-2233) • IP-FORWARD-MIB (RFC-4292) • ENTITY-MIB (RFC-2737) • MIBII (RFC1213) • EtherLike-MIB (RFC-2665) • IGMP-MIB (RFC-2993) • RMON-MIB (RFC-1757) • IP-MIB • ENTITY-SENSOR-MIB
Expression MIBs	<ul style="list-style-type: none"> • Simple Network Management Protocol Version 2 Structure of Managed Information (SNMPv2 SMI) • SNMPv2-TC • SNMPv2-MIB • IANAifType-MIB
Simple Network Management Protocol Version 3 (SNMPv3) MIBs	<ul style="list-style-type: none"> • SNMP-FRAMEWORK-MIB (RFC-2571) • SNMP-MPD-MIB (RFC-2572) • SNMP-NOTIFICATION-MIB (RFC-2573) • SNMP-TARGET-MIB (RFC-2573) • SNMP-USM-MIB (RFC-2574) • SNMP-VACM-MIB (RFC-2575)
DOCSIS and EuroDOCSIS MIB	<ul style="list-style-type: none"> • DOCS-IF-MIB (RFC 4546) • DOCS-CABLE-DEVICE-MIB (RFC-2669) • DOCS-BPI-PLUS-MIB (Rev 5) • DOCS-QOS-MIB (Rev 4) • DOCS-CABLE-DEVICE-TRAP-MIB • DOCS-SUBMGT-MIB (Rev 2) • DOCS-IF3-MIB • DOCS-QOS3-MIB • DOCS-DRF-MIB • DOCS-LOADBAL3-MIB

Descriptions	Specifications
	<ul style="list-style-type: none"> • DOCS-DIAG-MIB • DOCS-SUBMGT3-MIB • CLAB-TOPO-MIB • DOCS-MCAST-AUTH-MIB • DOCS-MCAST-MIB • DOCS-SEC-MIB • DOCS-IETF-BPI2-MIB • DOCS-IETF-QOS-MIB
Cisco DOCSIS MIBs	<ul style="list-style-type: none"> • CISCO-DOCS-EXT-MIB • CISCO-DOCS-REMOTE-QUERY-MIB • CISCO-DOCS-QOS-EXT-MIB • CISCO-CABLE-SPECTRUM-MIB • CISCO-CABLE-AVAILABILITY-MIB • CISCO-DOCS-EXT-CAPABILITY-MIB • CISCO-CABLE-WIDEBAND-MIB
Cisco C-DOCSIS MIBs	<ul style="list-style-type: none"> • CISCO-CDOC-CHGRP-MIB • CISCO-CMC-MGR-MIB
Cisco generic MIBs	<ul style="list-style-type: none"> • CISCO-SYSLOG-MIB • CISCO-SMI-MIB • CISCO-TC-MIB • CISCO-PRODUCTS-MIB • CISCO-FLASH-MIB • CISCO-CONFIG-MAN-MIB • CISCO-CONFIG-COPY-MIB • CISCO-MEMORY-POOL-MIB • CISCO-BULK-FILE-MIB • CISCO-SONET-MIB • CISCO-TCP-MIB • CISCO-RTTMON-MIB • CISCO-FTP-CLENT-MIB • CISCO-IPMROUTE-MIB • CISCO-QUEUE-MIB • CISCO-IMAGE-MIB • CISCO-ENVMON-MIB • CISCO-ENTITY-VENDORTYPE-OID-MIB • CISCO-PRODUCTS-MIB

Note: Line card redundancy is not supported at FCS.

Table 2. System Requirements

Item	Description
Power supplies	Dual AC or DC PEMs must be installed at all times
Hardware	Cisco uBR10012 Performance Routing Engine 4 (PRE4) and Engine 5 (PRE5) Dual Cisco UBR10-DTCC
Flash memory	At least 1 GB of flash memory is required for Cisco IOS Software
Software	Cisco IOS Software Release 12.2(33)CX or later

Warranty Information

Warranty information is available on Cisco.com at the Product Warranties page.

Ordering Information

Table 3 provides ordering information. To place an order, visit the Cisco Ordering Home Page. To download software, visit the Cisco Software Center.

See the table below for ordering information.

Table 3. Ordering Information for Cisco uBR-MC3GX60V-RPHY BPE

Product ID	Descriptions
Line Cards	
UBR-MC3GX60V-RPHY	Line Card for Cisco uBR10012 Series Universal Broadband Routers supporting remote PHY; Base HW
UBR-MC3GX60V-RPHY=	Line Card for Cisco uBR10012 Series Universal Broadband Routers supporting remote PHY; Spare
UBR-MC3GX60V-R-SP=	Spare Cisco 3GX60V-RPHY BPE w/ 0x0 License
SWLIC-MC3GX60V-DS	1 Count of DS license (minimum 16)
SWLIC-MC3GX60V-US	1 Count of US license (minimum 16)
eDelivery Upgrade Licenses	
L-MC3GX60V-SWLIC=	Container PID for Upgrade License Applicable to 3G60
L-MC3GX60V-DS	1 count DS license
L-MC3GX60V-US	1 count US license
Cisco IOS Software 12.2(33)CX Cisco IOS required	
SU14MK8U-12233CX (=)	Cisco uBr10k-PRE4 Ser IOS DOCSIS BPI LAWFUL INTERCEPT
SU14MK9U-12233CX (=)	Cisco uBr10k-PRE4 Ser IOS DOCSIS 3DES LAWFUL INTERCEPT
SU15MK8U-12233CX (=)	Cisco uBr10k-PRE5 Ser IOS DOCSIS BPI LAWFUL INTERCEPT
SU15MK9U-12233CX (=)	Cisco uBr10k-PRE5 Ser IOS DOCSIS 3DES LAWFUL INTERCEPT

Note: A minimum configuration of 16 counts of both SWLIC-MC3GX60V-DS and SWLIC-MC3GX60V-US is required when purchasing Cisco uBR-MC3GX60V-RPHY hardware.

Notes on Licenses

- If purchasing multiple line cards, each line card in the order must have the same number of upstream and downstream licenses. Upgrade licenses may be purchased in case customers need line cards with different licenses.
- eDelivery allows for electronic delivery of purchased license product activation key (PAK).
- Partial fulfillment is supported. If customers wish to purchase upgrade licenses for multiple hardware devices (for example, if they wish to upgrade all their Cisco uBR-MC3GX60V-RPHY BPE), partial fulfillment allows all upgrade licenses to be generated using a single PAK if the customer desires. This can greatly increase operational ease of license upgrades.
- Partial fulfillment is supported with Cisco License Manager (CLM).
- Downstream and upstream upgrade licenses can be mixed and matched under a single L-MC3GX60V-SWLIC= PAK.

- Return materials authorization (RMA): Cisco Services will replace faulty hardware with hardware that has no downstream or upstream licenses. Customers will need to transfer licenses from the failed board to the new board to make it operational.
- uBR-MC3GX60V-RPHY shares the same software licenses with existing uBR-MC3GX60V. However, at the moment, the software licenses on uBR-MC3GX60V and uBR-MC3GX60V-RPHY are not interchangeable.

Cisco Services

Cisco Services make networks, applications, and the people who use them work better together. Today, the network is a strategic platform in a world that demands better integration between people, information, and ideas. The network works better when services, together with products, create solutions aligned with business needs and opportunities. The unique Cisco lifecycle approach to services defines the requisite activities at each phase of the network lifecycle to help ensure service excellence. With a collaborative delivery methodology that joins the strengths of Cisco, our skilled network of partners, and our customers, we achieve the best results.

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For More Information

For more information about the Cisco uBR10012 Universal Broadband Router, visit <http://www.cisco.com/c/en/us/products/video/ubr10000-series-universal-broadband-routers/index.html>.



Americas Headquarters
Cisco Systems, Inc.
San Jose, CA

Asia Pacific Headquarters
Cisco Systems (USA) Pte. Ltd.
Singapore

Europe Headquarters
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