



## Casa Systems C2200 CMTS (DOCSIS 3.0 Release)

### Overview

The Casa Systems C2200 Cable Modem Termination System (C2200) is a new class of cable edge device that combines a third generation DOCSIS CMTS and an MPEG video Edge-QAM in a single compact 1RU platform.



The broadband access over cable market has experienced two generations of DOCSIS CMTS. Most of the products on the market today are either first generation CMTS or second generation CMTS that can be characterized by fixed downstream to upstream ratios, instantaneous bandwidth per subscriber limited to a single RF channel, very low downstream channel density per rack unit, and high cost per unit bandwidth.

The legacy CMTS does not have any MPEG video processing capability and thus makes it necessary to implement two parallel access networks for MPEG video and IP data. With those limitations, the legacy CMTS is not economically viable in the new market of high bandwidth applications such as IPTV or IP video delivery and is not competitive with other broadband access methods such as FTTX.

### Feature Highlights

**Full DOCSIS 3.0 qualified** – Multi-channel DRFI RF for Annex A, B, & C, downstream channel bonding up to 16 channels, upstream channel bonding up to 16 channels, IPv6, AES encryption/decryption, multicast QoS, bonded channel multicast, bonded S-CDMA with multiple logic channels, full DOCSIS 3.0 MIBs, and IPDR

**Separate Downstream and Upstream Modules** – Unlike traditional CMTS with fixed downstream to upstream ratio, Casa CMTS has separate downstream modules and upstream modules that provide flexible downstream to upstream ratio

**Integrated CMTS & Video QAM** – DOCSIS traffic & MPEG/DVB video traffic can share the same RF channel

**Cost Effectiveness** – The lowest cost per DOCSIS channel in the industry. The only economical solution for high bandwidth multimedia IP applications

**Software Licensing** – Ability to activate additional channels as needed up to the available physical capacity of the module

**Superior Density** – Offers the highest channel density in the industry, ranging from 48DSx16US for IP video to 32DSx32US for typical broadband service deployment in a single chassis

**Best Multi-channel RF performance** – Exceeds DOCSIS DRFI specification

**Extended Frequency Range** – Downstream frequency range up to 1GHz (48~1002MHz)

**DOCSIS 1.1 and 2.0 Features** – Complete DOCSIS/EuroDOCSIS 1.1 and 2.0 feature sets

**Rich Operational Features** – Rich operational features such as show cable modem, flap list, spectral management and IP bundling ready for deployment

As a third generation CMTS, the C2200 has several unique capabilities beyond DOCSIS 3.0 features. First, the C2200 supports complete separation of downstream channel capacity and upstream channel capacity in a single physical chassis, and thus provides a flexible downstream to upstream channel ratio. Cable operators can add downstream channels and upstream channels completely independently within the same chassis. Business users may require more symmetric downstream to upstream traffic ratios, while residential broadband is typically more asymmetric. For IPTV or video-over-IP applications, significantly more downstream traffic is required than the upstream traffic which is mostly for control plane applications.

Second, the C2200 has significantly higher channel density than a second generation CMTS. The extremely high downstream channel density makes it economical to provide video-over-IP service today.

Third, it can support both DOCSIS and MPEG/DVB traffic in a single platform. This unique feature is very important for cable operators to manage their HFC spectral resources in a single platform. It also allows the spectral resources to be shared dynamically between MPEG video, DOCSIS business users and DOCSIS residential users. For example, more bandwidth can be allocated to DOCSIS business traffic during the day while more bandwidth can be allocated to MPEG/DVB video traffic at night to efficiently utilize the spectral resource.

Fourth, The C2200 has the most extensive DOCSIS 3.0 features on the market today. It offers the highest channel bonding capability in both downstream and upstream. This bandwidth scalability from 150Mbps to 800Mbps makes it essentially equivalent to PON in bandwidth capacity.

The revolutionary DOCSIS bandwidth capacity and cost per-bit of DOCSIS bandwidth of the C2200 provides an unprecedented opportunity for cable operators to cost-effectively provision high-bandwidth IP services such as IPTV or video-over-IP and interactive gaming in addition to traditional broadband access and VoIP services.

The integrated MPEG video capacity of the C2200 provides cable operators the flexibility to offer MPEG or DVB-based broadcast digital cable TV, video-on-demand (VOD), and interactive services in the same platform. The flexibility, multi-functionality and economics of the platform eliminate the need to deploy multiple parallel systems for MPEG TV, IPTV bypass and DOCSIS broadband access. The following sections detail the unique capabilities of the C2200.

## Modular and Flexible Architecture

The C2200 CMTS comes in a compact 1RU chassis. It is based on a modular architecture that gives cable operators the maximum flexibility in tailoring their networks according to the requirements of their services. The C2200 consists of a base system with built-in L2/L3 switch and 4 GbE (SFP) ports and four slots for DOCSIS interface modules (downstream modules or upstream modules).

Any combination of downstream modules and upstream modules are supported by the platform. This enables flexible downstream to upstream channel ratio. The DOCSIS QAM Module (DQM) is a complete DOCSIS downstream unit that includes DOCSIS packet processing, QoS, DOCSIS downstream MAC, PHY, and RF up-conversion.

The DOCSIS Control and Upstream module (DCU) is a complete DOCSIS upstream unit that includes DOCSIS packet processing, DOCSIS upstream MAC and burst mode receivers. A typical configuration for channel-bonded deployment can be 32DSx32US for a 1:1 channel ratio or 16DSx32US for a 1:2 channel ratio. In the minimum configuration, C2200 can have one DQM08 downstream module (8 channels of QAM) and one DCU04 upstream module (8 channels of burst mode receivers). Each downstream QAM channel can be configured to support DOCSIS or MPEG/DVB-C video or a combination of the two.

## High Performance Video QAM

The C2200 downstream channels can also function as a MPEG or DVB-C compliant MPEG video Edge-QAM for digital video applications such as broadcast digital cable TV, video-on-demand, interactive TV, and network DVR. The C2200 receives MPEG-2 over IP/Ethernet packets in multiple program transport streams (MPTS) or single program transport streams (SPTS) through its multiple Gigabit Ethernet ingress interfaces, it then de-multiplexes MPTS and routes the native MPEG-2 packets to its egress QAM interfaces. At the egress interfaces, the re-multiplexing function generates multiple program transport streams (MPTS) for the designated cable channels. The C2200 performs PSI/SI table processing, PID filtering and substitution, and PCR de-jittering to satisfy the most demanding needs of various video networks.

The C2200 supports both CBR traffic and VBR traffic for narrowcast applications and broadcast applications. The C2200 is the only product that can make the most efficient use of the RF bandwidth and maintains video quality at the same time through concurrent use of tools such as statistical multiplexing of all MPEG video traffic and DOCSIS traffic, and dynamic scheduling of MPEG and IP traffic.

## Rich Operational Features

The C2200 supports industry standard Command Line Interface (CLI) and SNMP for configuration and management. Operational features such as show cable modem, show ARP, spectral management, CPU and memory resource reporting, user privilege management are available in the current release. Advanced features such as load balancing for bonded channels is also available in the current release.

Extensive IP features such as DHCP Relay and option 82, multiple DHCP servers, proxy ARP, IP subnet bundling, IGMP snooping, IGMP v2 and v3, access control list (ACL) are also available in the current release.

In the current release, the C2200 is functioning as a Layer 3 routing device. Static routes and default route are supported. For route redundancy, multiple default routes can be configured. In subsequent software releases, Layer 2 bridging, VLAN, RIP, OSPF, and PIM-SM are supported.

## Applications

The applications of the C2200 in a cable network can be divided into two categories. The first category the C2200 provides is DOCSIS-based IP applications, such as broadband access, VoIP, and IPTV and video-over-IP etc. The second category the C2200 provides is digital video applications that include SDTV Broadcast over Cable, HDTV broadcast over Cable, VOD, Network Digital Video Recorder (nDVR), interactive gaming, and switched digital video.

# C2200 Specifications

## System

- 4x2 Gbps switching capacity
- MPEG switching from any port to any port
- Four DOCSIS interface slots per system
- 1-3 Downstream modules per system
- 1-3 Upstream modules per system

## DOCSIS Features

- Full DOCSIS 3.0 Qualified (May, 2008)
- Full Euro-DOCSIS 3.0
- DOCSIS 3.0 downstream channel bonding up to 16 channels
- DOCSIS 3.0 upstream channel bonding up to 16 channels
- DOCSIS 3.0 AES encryption/decryption
- DOCSIS 3.0 IPv6
- DOCSIS 3.0 Multicast
- Complete DOCSIS/EuroDOCSIS 1.1 features
- DOCSIS/EuroDOCSIS 2.0 A-TDMA (standard)
- DOCSIS/EuroDOCSIS 2.0 S-CDMA (optional)
- PacketCable 1.5 qualified
- PacketCable MultiMedia (PCMM) 1.0
- DSG

## IP Features

- DHCP Relay and option 82
- Multiple DHCP servers
- Proxy ARP
- IP subnet bundling
- Static IP routing
- Multiple default routes
- IGMP snooping
- IGMP v2 and v3
- Access Control List
- RIPv2
- BGP
- OSPFv2
- PIM-SM
- L2VPN VLAN tagging
- IS-IS

## Management

- RS232 Serial port (DB9)
- 10/100BaseT management port
- Command Line Interface (CLI)
- Telnet and SSH
- SNMPv1, v2, and v3
- Standard DOCSIS and IETF MIBs
- IPDR
- Casa Systems Enterprise MIBs
- Event logging through Syslog
- Electronic mail notification
- Resource usage reporting
- TACACS+ and RADIUS

## Additional Features

- Dynamic upstream and downstream load balancing
- Spectrum Management
- Software-defined MAC domains
- Software channel licensing
- Ingress cancellation filtering

## MPEG Stream Processing

- MPEG de-multiplexing and re-multiplexing
- Unicast to Multicast conversion
- PAT and PMT extraction and regeneration
- PID filtering and remapping
- PCR jitter removal and re-stamping
- SI table generation and re-insertion
- DVB Simulcrypt scrambling
- Session-based Encryption

## GbE Interfaces

- 10/100/1000 Mbps
- 4-port copper or fiber SFP
- CWDM
- Full line-rate support

## DOCSIS QAM Module (DQM)

Number of ports	4 ports per module
DQM04	4 channels, 1 channel per port
DQM08	8 channels, 2 channels per port
DQM16	16 channels, 4 channels per port
Channel bonding	All channels on a DQM
QAM modulation	Annex A, B or C
QAM constellations	64 & 256 QAM
Data Rates (DOCSIS)	27 Mbps @ 64 QAM 38 Mbps @ 256 QAM
Data Rates (EuroDOCSIS)	36 Mbps @ 64 QAM 56 Mbps @ 256 QAM
Connector	F-type, 75 $\Omega$
Frequency range (edge)	48 to 1002 MHz
Frequency step size	5 kHz
Channel width	6 to 8 MHz (tunable)
Maximum output power Per Channel	61 dBmV @ 1-ch/port 57 dBmV @ 2-ch/port 53 dBmV @ 4-ch/port
Output step size	0.1 dB
Output stability	$\pm$ 0.3 dB
Return Loss	50 ~ 870 MHz, 14 dB 870 ~ 1002 MHz 10 dB
Modulation Error Rate	44 dB (equalized)
Wideband Noise	-73 dBc

## DOCSIS Control and Upstream (DCU)

DCU04	4 channels in 4 ports
DCU08	8 channels in 8 ports
DCU16 (R2.0)	16 channels in 8 ports
Channel bonding	All channels on a DCU
Modulation	QPSK, 16, 32 & 64 QAM
A-TDMA or S-CDMA	
Data rate per channel	0.32 – 30.72 Mbps
Input frequency range	5 – 42 MHz (DOCSIS) 5 – 65 MHz (EuroDOCSIS)
Connector	F-type, 75 Ω
Input range	-4 to 26 dBmV

## Mechanical

Form Factor	1RU	1RU
Height	1.75 in. /44.45 mm	1.75 x 19 x23.5 inch 44 x 482 x 597 mm
Width	19 in. /482.6 mm	30 lbs / 13.62 kg
Depth	23.5 in. / 597 mm	19 inch, 1 rack unit high
Weight	30 lbs / 13.62 kg	Power, alarm, & I/O status
Mounting	19 inch, 1 rack unit high	
Front Panel LED	power, alarm, I/O status	

## Environmental

Operating temperature	0° to 50° C
Storage temperature	-40° to 70° C
Operating humidity	5% to 95%, non-cond.
Power supply	
AC operating range	90 to 264 V
(Option) DC	-36 to -60 V (redundant )
Power consumption	< 400 W (nominal)

## Regulatory Compliance

Safety: UL/IEC/CSA 60950-1  
EMC: FCC Part 15 Class A and CISPR Class A  
Immunity: EN61000-4

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