CASA

Casa Systems **C2200 Cable Modem Termination System**

The Casa Systems C2200 is a new breed of Cable Modem Termination System (CMTS), providing high density, unmatched flexibility, and cost efficiency for supporting all your broadband IP services. With the highest density and most flexible solution in the industry, the C2200 enables cable operators to deliver broadband IP services, along with digital video services in a compact form factor. The revolutionary IP bandwidth capacity and cost per-bit of C2200 provides an unprecedented opportunity for cable operators to cost-effectively provision high-bandwidth IP services. Video-over-IP, interactive gaming, high speed internet access, Voice over IP (VoIP), and other emerging bandwidth intensive applications can all be provisioned with a lower than expected investment by the operator.

Compact and Modular Architecture

The C2200 comes in a compact 1RU form factor. Its modular architecture 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 four slots for interface modules. There are three versions of downstream modules offering 4-channels, 8-channels and 16-channels of QAM output. Each type of downstream module has four RF ports (connectors) and each port contains up to four QAM channels. Upstream modules support either four or eight burst mode receiver channels. The flexibility of the C2200 allows from 4 to 48 downstream QAM channels and 4 to 24 upstream receiver channels in a 1RU chassis. Each downstream QAM channel can be configured to support DOCSIS or MPEG/DVB-C video. In the minimum configuration, C2200 can have one downstream module (4 channels of QAM) and one upstream module (4 channels of burst mode receivers).

Early DOCSIS 3.0 features such as Downstream Channel Bonding are available in the C2200 allowing bandwidth in excess of 120 Mbps to the end user as well as enabling the statistical advantages of having a single large data pipe rather than many smaller flows.

Third Generation DOCSIS Device

Traditional DOCSIS compliant CMTS products broadband access over cable on the market today are characterized by fixed downstream to upstream ratio, with very low downstream channel density per rack unit, and lower noise immunity. As a new generation DOCSIS device, the C2200 has several unique features:

• **Flexible downstream to upstream channel ratios** - Cable operators can add and bind downstream and upstream channels independently. Business users may require more symmetric downstream to upstream traffic ratio. Residential broadband access has more asymmetric traffic patterns. For video-over-IP applications, significantly more downstream traffic is required than the upstream traffic which is mostly for control plane applications.

• **Higher channel density** - The C2200 can have up to 48 downstream QAM channels in a 1RU while second generation CMTS typically has 1 or 2 downstream channels in a 1RU. The extremely high downstream channel density makes it an economical choice for providing video-over-IP service today as well as providing incremental downstream bandwidth without purchasing unused upstream receivers. With the trend for much higher downstream bandwidth commitments, it is much more efficient and much less costly to add only downstream channels when they are needed. The C2200 allows for the downstream channels to be added without the overhead of four or six unused upstream ports.

• **DOCSIS and MPEG/DVB traffic on a single platform** - This allows operators to manage

FEATURE HIGHLIGHTS

High Density
Offers the highest channel density per 1RU space in the industry and highest downstream bandwidth

Flexible Downstream/Upstream Ratio
Unlike traditional CMTS with fixed downstream to upstream ratio, C2200 can add downstream and upstream channels completely independently

Cost Effectiveness
Offers the lowest cost per bit in the industry. The only economical solution for high bandwidth IP applications

Modularity
Downstream and upstream channel capacity can be customixed to fit different size markets

Quality of Service
Guaranteed QoS through hierarchical per service flow queuing at wire-speed

Integrated Upconverter
Fully tunable RF upconverters can tune in the frequency range 52~860MHz

DOCSIS Compatible
Compatible with DOCSIS1.0, 1.1, 2.0 EuroDOCSIS 1.0, 1.1, 2.0 . Includes DOCSIS 3.0 features such as Downstream Channel-Bonding

DOCSIS DSG
Supports DOCSIS Set-top Gateway features

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

Rev 3 5/07

and allocate the HFC spectral resources to be shared dynamically between video and DOCSIS. For example, more bandwidth can be allocated to DOCSIS traffic during the day while more bandwidth can be allocated to MPEG/DVB video traffic at night to efficiently utilize the spectral resources.

• **Channel bonding and greater upstream bandwidth** – Standard based channel bonding implementation on the C2200 allows multiple channels to be bonded to deliver greater bandwidth. The C2200 also supports up to 30Mbps per upstream channel which is three times the data rate of an older generation CMTS upstream channel.

Standard-based Implementation

The C2200 CMTS is compliant with DOCSIS 1.0, 1.1, and 2.0. To support the international markets, the C2200 is compliant with EuroDOCSIS 1.0, 1.1, and 2.0.

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, as well as dynamic scheduling of MPEG and IP traffic.

Routing

The C2200 is a Layer3 forwarder for CMTS applications with a hardware-based packet-forwarding engine that can handle 24Gbps capacity at wire-speed.

Applications

The C2200 supports a wide array of applications in an HFC network. Tiered high speed data, gaming, video over IP, voice over IP, on-demand bandwidth, video monitoring, and more can be enabled by the C2200.

A unique strength of the C2200 is the ability to easily add downstream channels without the cost of unnecessary upstream hardware. Equipment in the market today usually is manufactured with fixed configurations such as 1x4, 1x6, 2x8 or 2x12, When adding downstream ports for bandwidth hungry applications like high speed data at over 20 Mbps, you need to manage well the cost of the equipment. Paying for upstream ports when they are not needed, only increases the time to recover the investment.

The C2200 provides the means to scale the service as customers are added. Single or multiple ports in the downstream can be added to existing service groups through software configuration. Not having to pay for unused or unnecessary upstream hardware will do wonders for the "bottom line".

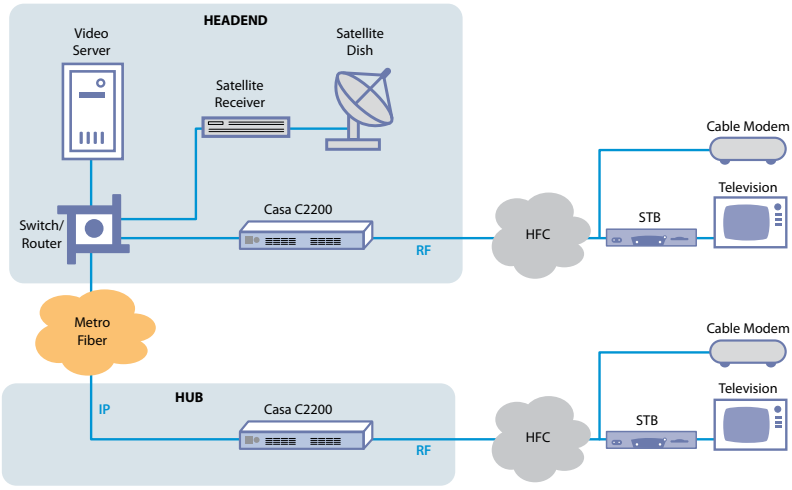
Configurations like 2x1 and 3x1 will be more common and can easily be adjusted through software to meet the service demand.

Video over IP

Video over IP has different characteristics when compared to very high speed data services, but can consume even greater amounts of bandwidth for longer periods of time. Once again, there is an imbalance of downstream to upstream bandwidth that needs to be managed cost effectively. With the capabilities of the C2200, you can add downstream bandwidth as you need it. The channel bonding capabilities will allow you to present larger streams to your customer and reduce the complexity of managing multicast video to subscribers that may be tuned to different downstream channels. With the channel bonding function enabled, the information pipe to the end user will grow as additional downstream channels are added for capacity reasons.

The Casa Systems C2200 is the answer to the downstream bandwidth dilemma that exists today. This new breed of CMTS solves the downstream issues that we are beginning to face due to the demands of very high speed data services along with the demand of bandwidth required for video over IP. The C2200 provides these new key features while providing excellent support for existing applications that are more symmetrical in nature.

The following diagram shows an example of how the C2200 can be applied in the cable network.



C2200 Application Diagram

System
12x2 Gbps switching capacity
Ethernet switching and IP routing
MPEG switching from any port to any port
CLI and SNMP management
Four RF interface slots per system
1~3 Downstream modules per system
1~3 Control/Upstream modules per system
Maximum of four modules per system

Standard Compliance
DOCSIS 1.0, 1.1, 2.0 (A-TDMA)
EuroDOCSIS 1.0, 1.1, 2.0 (A-TDMA)
PacketCable 1.0
PacketCable MultiMedia (PCMM) 1.0
DOCSIS DSG 1.0
VLAN Trunking
SNMPv1, SNMPv3
DHCP Relay
Proxy ARP

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 insertion
DVB SimulCrypt scrambling
Session-based Encryption

Management
RS232 Serial port (DB9)
10/100BaseT management port
Command Line Interface (CLI)
Telnet
SNMP
Standard DOCSIS and IETF MIBs
Casa Systems Enterprise MIBs
Event logging through Syslog
Electronic mail notification
Performance monitoring

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

Downstream Module

Number of ports	4
Number of channels	4, 8 or 16
QAM constellations	64, 256 QAM
Connector	F-type, 75 Ω
Frequency range (center)	91 to 867 MHz (standard) 52 ~ 999 MHz (optional)
Frequency step size	5 kHz
Channel width	6 to 8 MHz (tunable)
Max. 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	± 0.3 dB
Return loss	>15 dB
Data rates (DOCSIS)	64 QAM: 30 Mb/s 256 QAM: 42 Mb/s
Data rates (EuroDOCSIS)	64 QAM: 41 Mb/s 256 QAM: 55 Mb/s
Modulation error rate	>40dB

Upstream Module

Number of channels	4 or 8 channels
Modulation	QPSK, 16 & 64 QAM
Data rate per channel	0.32 – 30.72 Mbps
Input frequency range	5 – 42 MHz (DOCSIS) 5 – 55 MHz (J-DOCSIS) 5 – 65 MHz (EuroDOCSIS)
Connector	F-type, 75 Ω
Input range	-4 to 26 dBmV

Mechanical

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

Environmental

Operating temperature	0° to 50° C
Storage temperature	-20° to 70° C
Operating humidity	5% to 95%, non-condensing
Power supply	115 to 230 V AC
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