

## Cadant<sup>®</sup> C3 Cable Modem Termination System

***A CableLabs<sup>®</sup> DOCSIS<sup>®</sup> 1.1 Qualified & DOCSIS 2.0 upgradeable Cable Modem Termination System (CMTS) designed for providing advanced IP services over DOCSIS and PacketCable<sup>™</sup> networks. The C3 CMTS offers operators of any size, the opportunity to deploy next generation IP services in both new and existing cable networks worldwide.***

### Versatile design to deliver next generation IP services quickly

- Operator Selectable Layer 2 or Layer 3 IP Forwarding
  - Layer 2 bridging and IP forwarding
  - Static layer 3 routing
    - RIPv2 routing
    - OSPF routing (Future 2004)
- Virtual LAN (VLAN) support
  - 802.1Q VLAN – End to End VLANs
  - Supports multiple ISPs (“Open Access”)
  - Business class services delivery
- Flexible Upstream Channel Configurations
  - Two, four or six upstream modules available, scalable to application



### Superior RF performance for challenging HFC plant applications

- Advanced RF Performance
  - Full digital upstream receiver
  - Integrated downstream upconverter
  - Active ingress noise cancellation enabling 16 QAM upstream operation below 20 MHz
  - Advanced TDMA (A-TDMA) operation (QPSK & 8, 16, 32, 64, 128 and 256 QAM)
  - 6.4 MHz upstream channel width (DOCSIS 2.0 specification)
  - Downstream modulation beyond DOCSIS 256 QAM (1024 QAM)
- Multiple RF operational modes
  - DOCSIS (6 MHz downstream – Annex B)
  - Euro-DOCSIS (8 MHz downstream – Annex A)
  - Japanese DOCSIS (6 MHz downstream / 5-55 MHz upstream frequency range – Annex C)

### Advanced technology maximizes subscriber service penetration

- Upstream Compression Technology
  - Conservation of upstream bandwidth
  - Transparent to network and IP endpoint connections
- Efficient and Automatic Bandwidth Management
  - User-configurable upstream channel bandwidth
  - Upstream load balancing capability

## Introducing the Cadant C3 CMTS

The ARRIS Cadant C3 Cable Modem Termination System is a flexible, powerful and easy-to-use system for next generation advanced IP services. The C3 CMTS now permits cable operators and multiple system operators (MSOs) of any size to provide advanced tiered data, peer-to-peer, and voice telephony services over converged IP networks to both residential and business subscribers alike.

With advanced DOCSIS functionality, the C3 CMTS is DOCSIS 1.1 Qualified and is DOCSIS 2.0 upgradeable. The C3 CMTS provides all the DOCSIS 1.1 Quality of Service (QoS) capabilities defined by CableLabs for supporting advanced IP services. The C3 system supports advanced security features of DOCSIS 1.1 along with dynamic QoS functionality required for tiered data and telephony (VoIP) services. The system is designed to support further advanced bandwidth applications with DOCSIS 2.0 in future releases.

As cable operators worldwide support a wide variety of networking configurations, the capabilities of the C3 are being expanded to provide an operator selectable set of Layer 2 and Layer 3 forwarding operations. This capability combined with advanced DOCSIS RF functionality offers operators unique flexibility to deploy the C3 CMTS into existing networks with advanced routing capabilities for “future” network upgrades. With the C3 system, operators can support over 2,000 cable modems or users per CMTS system. Flexible powering options, with either AC or DC power modes and only 80 watts maximum power dissipation, allow the C3 CMTS to easily fit into any cable operator’s head-end system with minimal operational changes.

The C3 CMTS utilizes dual RISC processors to support low latency and high traffic volume applications. The C3 has scalable transmit and receive capacity, and can be configured to support up to six upstream channels in a single system. When operating in Layer 2, the C3 supports both PPPoE and NetBEUI and therefore allows for easy integration into existing cable networks. The interfaces support dual Fast/Gigabit BaseT Ethernet network connections, and a 64 or 256 QAM (Quadrature Amplitude Modulation) downstream channel. Up to six upstream channels with a selectable choice of modulations ranging from QPSK (Quadrature Phase Shift Keying) to 256 QAM are available in the current software release.

The C3 CMTS system supports markets worldwide with DOCSIS, Euro-DOCSIS, and Japanese DOCSIS specifications that are selectable in software. These features supply full upstream support from the appropriate frequency range and channel width for each standard. ATDMA as defined in DOCSIS 2.0 is fully supported in the current release.

Upstream load balancing allows for efficient bandwidth management and the ability to distribute upstream traffic evenly across the available upstream channels. The active ingress noise suppression also reduces the need to change upstream profiles and frequencies for bandwidth management and to allow for QAM 16 upstream modulation operation below 20MHz. Operation below 20 MHz provides additional upstream bandwidth without any changes to existing customer cable modems deployed in the network.

## Cadant C3 CMTS Architectural Overview

The Cadant C3 CMTS system delivers superior performance while occupying only one rack unit (1 RU) of space (1.75 in) in a cable operator’s head-end facility. This small size allows for operators to successfully deploy advanced DOCSIS functionality in any size market. The C3 is DOCSIS 1.1 Qualified and is upgradeable to the DOCSIS 2.0 standard.

The system utilizes a dual RISC processor architecture for supporting high traffic volume along with excellent latency control and ample reserve processing resources. The transmit and receive capacity is scalable with a single system supporting one downstream RF channel and up to six upstream RF channels. The network interface supports 10/100/1000 BaseT Ethernet network connections. A second network interface supports out-of-band network management

The C3 system offers advanced TDMA (A-TDMA) modulation methods (upgradeable to DOCSIS 2.0 including S-CDMA) and is capable of delivering symmetric rate data services in real-world upstream frequency allocations. The C3 CMTS uses digital signal processing coupled with integral real-time spectrum analysis to mitigate upstream noise and optimize the upstream configuration for maximum possible bandwidth. Additionally, the C3 CMTS offers full support for Virtual Local Area Networks (VLANs) and other advanced packet classification features for supporting tiered data and business services. All these capabilities allow an operator the ability to maximize return on the existing cable modems in a network while offering advanced services and new revenue streams.

### **Advanced RF Performance**

The Cadant C3 CMTS includes a fully digital receiver with active ingress noise suppression and an integrated upconverter. The receiver has the ability to cancel both wideband and multiple ingress noises, cancel co-channel interference and suppress burst noise in the upstream. This allows operators to utilize parts of the upstream below 20 MHz that were previously unusable due to noise conditions. The added benefit of this function is that any DOCSIS or Euro-DOCSIS 1.x cable modem can take advantage of the lower noise conditions to operate in 16 QAM mode on existing HFC cable plant.

Along with ingress noise suppression, the C3 CMTS can provide complete spectrum analysis capabilities. The hardware-based spectrum analysis data can be retrieved using SNMP commands or via a PC-based spectrum analysis software package. With spectrum analysis, an operator can support fault isolation down to an individual cable modem to assist in determining the source of network performance problems.

The C3 CMTS supports additional higher density modulations available with the newest generation of DOCSIS technology. The advanced TDMA option supports additional upstream channel bandwidth through 256 QAM as a proprietary extension in addition to 8, 32, 64, 128 QAM and QPSK. The C3 also operates with the new upstream channel width of 6.4 MHz as defined by DOCSIS 2.0 specifications. With 64QAM in the upstream, operators can offer more than 30 Mbps of upstream capacity on a single upstream channel. The C3 hardware supports downstream modulations up to 1024 QAM, beyond the DOCSIS 1.1/2.0 specified 64QAM and 256QAM operational modes.

### **DOCSIS, Euro-DOCSIS, and Japanese DOCSIS Support**

The C3 CMTS incorporates an advanced modulator and upconverter for the downstream signal. The signal format is selectable for DOCSIS (6 MHz downstream – Annex B), Euro-DOCSIS (8 MHz downstream – Annex A), and Japanese DOCSIS (5-55 MHz upstream with 6 MHz downstream – Annex C). The integrated upconverter is field-replaceable, and can generate the full DOCSIS/Euro-DOCSIS power range across the entire frequency range. The frequency agile upconverter can be tuned either through the command line interface or SNMP command.

## Flexible Upstream Channel Configurations

With two, four or six upstream modules available for the C3 CMTS, an operator can choose and tailor the number of upstreams in the system to match the anticipated traffic conditions and node sizes in their network. With advanced traffic engineering analysis, the optimal number of upstreams can be chosen to balance both cost and service growth potential in a given deployment area.

## Advanced bandwidth management

User-configurable dynamic upstream channel bandwidth allocation allows the C3 CMTS to respond to network connections in real-time. Load-balancing on the upstream channels allows the CMTS to automatically or manually distribute the upstream traffic evenly across multiple channels and upstream receivers.

## Operator Selectable Layer 2 or Layer 3 IP Forwarding

Networks implementing Layer 2 bridging technology can currently take advantage of the C3's Layer 2 mode of operation. Software release 3.0 incorporates optional Layer 3 RIPv2 routing. Future loads will offer a choice of Layer 3 routing; RIPv2 or OSPFv2 routing protocols. The C3 CMTS supports high packet forwarding throughput. One advanced processing core is dedicated to packet data forwarding activities ensuring low-latency queuing of packets through the system. The network interface supports Fast or Gigabit Ethernet that supports data rates up to one Gbps.

## Virtual LAN (VLAN) support

The C3 CMTS supports end-to-end VLANs for advanced data applications such as business class services or multiple ISP support. The 802.1Q VLAN protocol stack ensures seamless integration into existing 802.1Q VLAN based networks and supports 384 VLANs with up to 4094 VLAN IDs. For business class services, each VLAN can represent an end customer and their dedicated, secure network connections. For multiple ISPs or "open access" the C3's VLAN support can maintain separate VLAN for management for each ISP's modem population.

## C3 CMTS Ordering Codes

<u>Ordering Code</u>	<u>Product Name &amp; Description</u>
#710634KA	Cadant C3 CMTS; 1 downstream & 2 upstreams; Australian power cord
#710634KE	Cadant C3 CMTS; 1 downstream & 2 upstreams; European power cord
#710634KJ	Cadant C3 CMTS; 1 downstream & 2 upstreams; Japanese power cord
#710634KN	Cadant C3 CMTS; 1 downstream & 2 upstreams; North Amer power cord
#710634KU	Cadant C3 CMTS; 1 downstream & 2 upstreams; United Kingdom pwr cord
#710635KA	Cadant C3 CMTS; 1 downstream & 4 upstreams; Australian power cord
#710635KE	Cadant C3 CMTS; 1 downstream & 4 upstreams; European power cord
#710635KJ	Cadant C3 CMTS; 1 downstream & 4 upstreams; Japanese power cord



## Cadant® C3™ CMTS Product Overview

#710635KN	Cadant C3 CMTS; 1 downstream & 4 upstreams; North Amer power cord
#710635KU	Cadant C3 CMTS; 1 downstream & 4 upstreams; United Kingdom pwr crd
#710636KA	Cadant C3 CMTS; 1 downstream & 6 upstreams; Australian power cord
#710636KE	Cadant C3 CMTS; 1 downstream & 6 upstreams; European power cord
#710636KJ	Cadant C3 CMTS; 1 downstream & 6 upstreams; Japanese power cord
#710636KN	Cadant C3 CMTS; 1 downstream & 6 upstreams; North Amer power cord
#710636KU	Cadant C3 CMTS; 1 downstream & 6 upstreams; United Kingdom pwr crd

### Software required for each CMTS:

#### **Release 2.0-**

#713249K	Cadant C3 CMTS Software Rel 2.0 Kit (license, software & Documentation CD)
#713248	Cadant C3 CMTS Software Release 2.0 License

#### **Release 3.0-**

#713867K	Cadant C3 CMTS Software Rel 3.0 Kit (license, software & Documentation CD)
#713873K	Cadant C3 CMTS Software Rel 3.0 Upgrade Kit for deployed unites (license, software & Documentation CD)
#713864	Cadant C3 CMTS Software Release 3.0 License

#### **Release 3.0 (optional keyed features)**

#713868	Cadant C3 CMTS RIPv2 Routing License
#713869	Cadant C3 CMTS VLAN/Bridge Group License
#713870	Cadant C3 CMTS RIPv2 & VLAN/Bridge Group License

### Maintenance Plan (required):

#710645	Cadant C3 Software Maintenance - Phone Plus Silver
#710646	Cadant C3 Software Maintenance - Phone Plus Gold (note: Gold Service does NOT include free upgrades of optional keyed features).

### Optional Items & Spares:

#710633	Cadant C3 CMTS Spares Kit (dual upstream module, fan tray, front panel)
#710626	Compact DC Power Module (-48 VDC)
#710625	Compact AC Power Module (110-264 V AC; 50/60 Hz)
#710627	Cadant C3 Dual Upstream Receiver Module

## Technical Specifications

### SPECIFICATIONS

<b>RF</b>	
Downstream	
Frequency Range (MHz)	88-860
Modulation	64 or 256 (1024 QAM in future) (QPSK, 16 QAM for Wireless Applications)
Data Rate (Mbps) (Max.)	30 – 53.6
RF Output Level (dBmV)	+45 - +61
Upstream	
Frequency Range (MHz)	5-42 (DOCSIS 1.1); 5-55 (Japanese DOCSIS) 5-65 (Euro-DOCSIS 1.1)
Modulation	QPSK, 8, 16, 32, 64, 128 and 256 QAM
Data Rate (Mbps) (Max.)	5.12 – 40.96
Receive Input Level (dBmV)	-20 to 26

### Installation Environment

RF Interfaces	External 'F' type connector
Network Interfaces	Dual RJ-45 Ethernet connections
Network-Side Interfaces	10/100/1000 BaseT Ethernet
Power	Dual power supply unit: -48 volt DC or universal AC
AC Powering	115 – 240 VAC, 2A, 47-63 Hz
DC Powering	40-60V, 4A
Power Consumption	80 Watts Max power consumption

### Physical

Operating Temperature °F (°C)	32-104 (0-40)
Storage Temperature °F (°C)	-40 to 167 (-40 to 75)
Operating Humidity (Min.-Max.)	10-80% (Non condensing)
Dimensions (H x W x D) in. (cm)	1.75 x 19 x 18.3 (4.4 x 48.3 x 46.5) 1 rack unit (RU) high
Weight (kg)	10

### Software Support

DOCSIS 1.1, Euro-DOCSIS 1.1	Release 2.0
DHCP Relay Agent (Option 82)	Release 2.0
Layer 2 Bridging	Release 2.0
PPPoE	Release 2.0
DOCSIS MIBs and ARRIS enterprise MIBs	Release 2.0
Ingress Noise Suppression	Release 2.0
Command Line Interface (CLI)	Release 2.0
SNMP v1, v2 and v3	Release 2.0
Telnet	Release 2.0
In-band or out-of-band management	Release 2.0
Security: up to 30 ACLs with 20 entries per ACL	Release 2.0
Upstream Cable Modem Load Balancing	Release 2.0
802.1Q VLANs / Layer 2 VPN	Release 3.0
CLI Configurable SNMP	Release 3.0
RIPv2 (RFC 2453)	Release 3.0
IGMP Proxy	Release 3.0
Wireless Applications Support	Release 3.0
DOCSIS 2.0, Euro-DOCSIS 2.0	Future (2004)
OSPFv2 (RFC 2328)	Future (2004)
Policy Based Routing	Future (2004)



## Cadant® C3™ CMTS Product Overview

MPLS	Future (2004)
BGP	Future (2004)
RSVP-TE	Future (2004)
LDP	Future (2004)
IPDR	Future (2004)
Secure Shell 2	Future (2004)
Secure FTP	Future (2004)
TACACS+	Future (2004)
Intelligent Channel Seek™	Future (2004)

### Regulatory

EMC: FCC Part 15 Class A, CE

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