



## DOCSIS 1.0 Micro CMTS

Our Micro CMTS Provides a number of interface types, some of which are necessary to implement the basic functionality of a DOCSIS HFC network and others which are necessary for management and fault diagnosis of the system.

Interfaces supported include:

**Downstream RF** - Provides a single RF carrier modulated with DOCSIS downstream traffic destined for a set of Cable Modems. F-type.

**Upstream RF** – Accepts a single upstream RF coaxial cable connection which two upstream carrier channels. F-type.

**Network Interface** – A full-duplex 10/100BaseT Ethernet (DCE) port that carries traffic and CMTS management data packets between the CMTS and the backbone network. RJ45.

**Console Diagnostic Port** – A standard RS232 serial port used with a terminal or PC and terminalemulator to monitor and control the CMTS. TELNET is also available on this interface to gain access to the internal DHCP server, TFTP server, and MicroCMTS data base to support MicroCMTS and Cable Modem provisioning. DB-9 RS232.

**Downstream RF Monitor Port** – Technical support personnel can connect test equipment, such as a spectrum analyzer, to this port to monitor downstream cable signal quality. F-type.

**Upstream RF Monitor Port** - Technical support personnel can connect test equipment, such as a spectrum analyzer, to this port to monitor received upstream cable signal quality. F-type.

### DOWNSTREAM FEATURES AND FUNCTIONS

- Quality of Service (QoS) capability
- Guaranteed maximum (throttling) per CM
- DOCSIS BPI Security
- Encryption
- DOCSIS MAC layer generation
- MAC management message insertion
- MAP insertion
- Time SYNC insertion

- DOCSIS convergence layer (MPEG) formatting
- DOCSIS PHY Layer generation
- Interleaving
- Forward error correction
- Modulation (64 QAM and 256 QAM)
- RF Channel Up-conversion

## **UPSTREAM FEATURES AND FUNCTIONS**

- DOCSIS PHY layer processing
- RF tuning and filtering
- Channel Equalization
- Burst demod: Full DOCSIS-1.0/1.1 flexibility
- Forward-error-correction: Full DOCSIS-1.0/1.1 flexibility
- DOCSIS MAC layer processing
- CM ranging support
- MAC de-framing
- Frame error checking
- MAC message extraction
- PDU Frame Decatenation
- MAC Upstream Bandwidth Allocation
- QoS scheduling
- DOCSIS MAP generation
- DOCSIS UCD generation
- DOCSIS BPI Security
- Decryption

## **NETWORKING FEATURES AND FUNCTIONS**

- Layer-2 Bridging
- DOCSIS spanning-tree protocol
- DHCP
- Built-in DHCP server to support CM provisioning, or
- DHCP relay to support external DHCP for CMs and CPE devices
- DHCP client for CMTS provisioning from optional external DHCP server
- TFTP
- Built-in server for CM provisioning

- Client to support CMTS provisioning from optional external TFTP server
- Built-in DOCSIS Time-of-Day server for CM support
- DOCSIS IGMP Proxy
- Cable Modem Registration
- CM Registration filtering: Reject up to 5 sets of CM ethernet address ranges

## **SECURITY FEATURES AND FUNCTIONS**

- DOCSIS-1.0 Baseline Privacy for Cable Modem to CMTS link security

## **OPERATIONAL SUPPORT SYSTEM FEATURES AND FUNCTIONS**

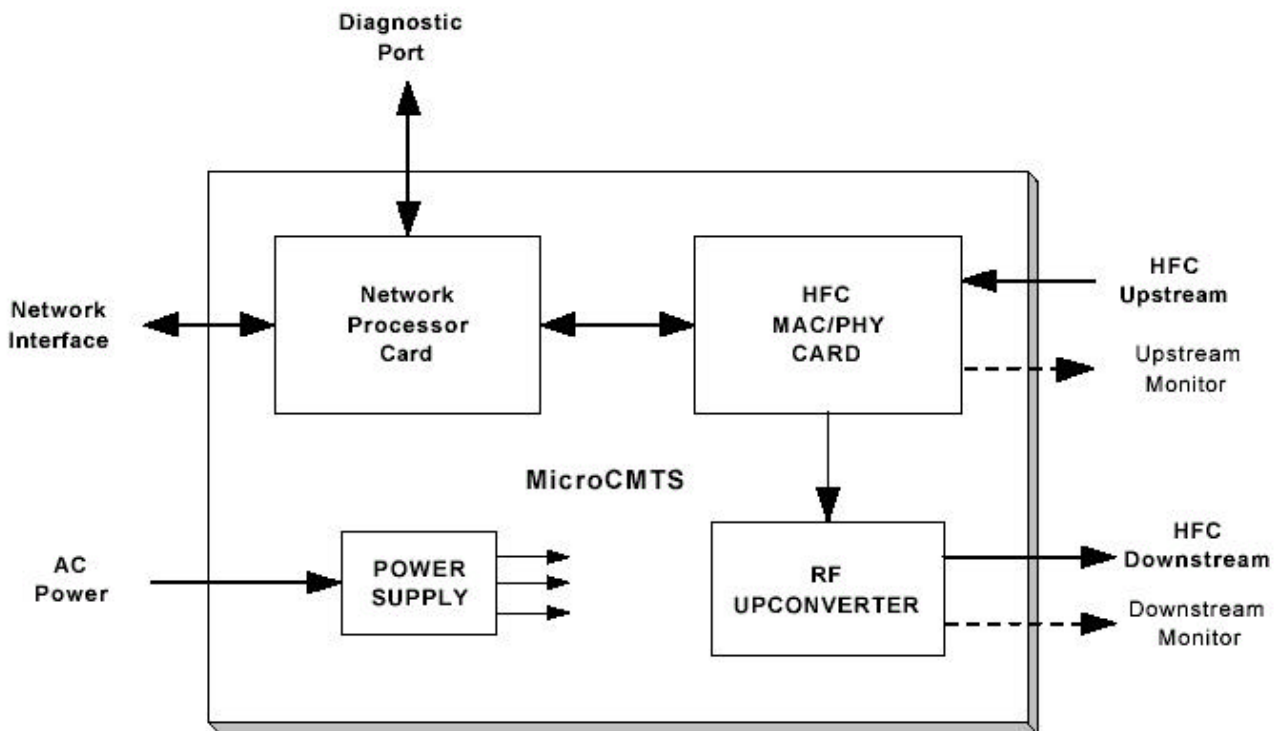
- SNMP access
- MIB I/II
- Standard DOCSIS MIB
- Private OEM MIB support
- TELNET access
- Through the network interface or the maintenance console
- Access to MicroCMTS data base
- Access to internal DHCP server
- Access to internal TFTP server
- Maintenance console port
- RS232 DB-9 interface
- Telco modem dial-up support when the IP network is down
- TELNET functions the same as over the NSI port
- Debug CLI
- MicroCMTS provisioning is similar to DOCSIS CM provisioning:
- MicroCMTS DHCP client retrieval of:
  - CMTS IP address
  - Handle to CMTS configuration file
  - Handle to software/firmware update files
- TFTP client retrieval of:
  - CMTS configuration file
  - Software/firmware update files
- Stand-alone static CMTS and CM provisioning
- Avoids the need for external DHCP/TFTP provisioning servers
- Self provisioning recovery from power outages

- Quality-of-Service (QoS) support
- Support of DOCSIS-1.0 standard configuration file provisioning method
- Statistics monitoring
- Counts of ranged CMs, registered CMs, offline CMs

## MICROCMTS SYSTEM ARCHITECTURE

Four sub-assemblies and a chassis comprise the MicroCMTS:

- Network Processor Card- a single-board network processor based upon the Intel® IXP-1200 processor,
- HFC MAC/PHY Card- a circuit card that performs the PHY (DS modulation and US burst demodulation) functions as well as some high-speed MAC processing functions,
- RF Upconverter- which accepts IF signal from the DS modulator and shifts the modulated carrier up to the frequency range required by the HFC system, and
- Power Supply- a standard universal PC-type supply which accepts AC power and delivers DC voltages to the other MicroCMTS sub-assemblies.



**MicroCMTS Block Diagram**

## MICROCMTS SPECIFICATIONS

### DOWNSTREAM PHY SPECIFICATIONS

Parameter	Value
Center Frequency ( $f_c$ )	91 – 858 MHz $\pm$ 30 kHz, 12.5 KHz steps
Level	Adjustable over the range 50 to 61 dBmV
Modulation Type	64QAM and 256QAM
Symbol Rate (nominal)	
64QAM	5.056941 Msym/sec (NA)
256QAM	5.360537 Msym/sec (N/A)
Nominal Channel Spacing	6 MHz (NA)
Frequency Response	
64QAM	~18% Square Root Raised Cosine shaping - NA
256QAM	~12% Square Root Raised Cosine shaping - NA
Spurious and Noise	
Inband discrete ( $f_c \pm 3$ MHz)	< -57 dBc in 6 MHz
Inband spurious & Noise ( $f_c \pm 3$ MHz)	< -48 dBc in 6 MHz; where channel spurious and noise includes all discrete spurious, noise, carrier leakage, clock lines, synthesizer products, and other undesired transmitter products. Noise with +/- 50 KHz of the carrier is excluded.
Adjacent channel ( $f_c \pm 3.0$ MHz) to ( $f_c \pm 3.75$ MHz) NA	< -58 dBc in 750 kHz
Adjacent channel ( $f_c \pm 3.75$ MHz) to ( $f_c \pm 9$ MHz) NA	< -62 dBc, in 5.25 MHz, excluding up to 3 spurs, each of which must be <-60 dBc when measured in a 10 kHz band
Next adjacent channel ( $f_c \pm 9$ MHz) to ( $f_c \pm 15$ MHz) NA	< -65 dBc in 6 MHz
Other channels 47 MHz to 1,000 MHz NA	< -12 dBmV in each 6 MHz channel
Phase Noise	1 KHz – 10 KHz: -33dBc double sided noise power 10 KHz – 50 KHz: -51 dBc double sided noise power 50 KHz – 3 MHz: -51 dBc double sided noise power
Output Impedance	75 ohms
Output Return Loss	> 14 dB within an output channel up to 750 MHz; > 13 dB in an output channel above 750 MHz
Connector	F connector per [ISO-169-24]

### UPSTREAM PHY SPECIFICATIONS

Parameter	Value
Frequency Band	5 to 42 MHz edge to edge (DOCSIS North America)
Tuning Resolution	1 Hz
Level Range (one channel)	160Ksps = -16 to +14 dBmV 320Ksps = -13 to +17 dBmV 640Ksps = -10 to +20 dBmV 1.28Msps = -7 to +23 dBmV 2.56Msps = -4 to +26 dBmV
Total Input Power	Not to exceed +35dBmV (95dBuV)
Modulation Type	Burst (TDMA) QPSK and 16QAM
Burst Length	1 to 255 minislots, Minislot size from 6.25 to 800 usec
FEC Coding	Variable burst-to-burst: Reed-Solomon T=1 to 10 or off Codeword size 16 to 255 bytes
Randomizing	Burst Synchronous, programmable seed
Symbol Rate (nominal)	160, 320, 640, 1,280 and 2,560 ksym/sec
Bandwidth	200, 400, 800, 1,600 and 3,200 kHz (-30dB, 25% SRRC)
Equalization	Decision Feedback, 5 tapsFF, 4 taps FB
Input Impedance	75 ohms (F connector)

### MAC SPECIFICATIONS

Parameter	Value
Quantity of Upstream Carriers	1 or 2
Quantity of Downstream Carriers	1
Upstream Forwarding Rate	17K pkt/sec max 10 Mbps (limited by upstream modulation chosen)
Downstream Forwarding Rate	64QAM: 50K pkt/sec or 28 Mbps 256QAM: 66K pkt/sec or 38 Mbps
Broadcast Packet Forwarding Rate	Limited at 1000 packets/second to guard against denial of service attacks.
Media Service Access Point (MSAP)	1 MSAP - 8190 unicast Service IDs -100 Multicast Service IDs
CM Support	Up to 512
CPE Support	Up to 8192 CPEs. Up to 16 CPE devices per CM
CM Registration Filtering	Reject up to 5 sets of CM ethernet address ranges
Minimum Map Time Interval	2ms
Downstream QOS	DOCSIS rate limiting method. Elastic buffering of up to 800 ms. total downstream data
Ethernet Address Forwarding	Support for 32768 IDs
Upstream Packet Concatenation	Supported
Upstream Piggyback Requests	Supported

**AC POWER**

Parameter	Parameter (label)	Typ. Value	Max. Value	Unit
Nominal Input Voltage	$U_{\text{prim}}$	115-240		V~
Input Voltage Tolerance	$\Delta U_{\text{prim}}$		$\pm 10$	%
Input Frequency	$f_{\text{Netw.}}$	50/60		Hz
Input Frequency Tolerance	$\Delta f_{\text{Netw.}}$		$\pm 2$	%
Input Power	$P_{\text{prim}}$	150		W

**SAFETY APPROVALS**

European:	EN60950 (IEC950)
North America:	UL60950 and UL1950 (UL + CSA)

**EMISSIONS APPROVALS**

International Emissions Standard:	CISPR 22-1997 Class B
European Emissions Standard:	EN55022-1998 Class B
Susceptibility Standards:	ESD: IEC61000-4-2
Radiated Susceptibility:	IEC61000-4-3
EFT:	IEC61000-4-4
Surge:	IEC61000-4-5
Conducted RF:	IEC61000-4-6
Power Frequency Magnetic Fields:	IEC61000-4-8
Voltage Dips, Interrupts, & Voltage Variations:	IEC61000-4-11
Harmonics:	IEC61000-3-2
Flicker:	IEC61000-3-3
North America Emissions Standard:	FCC Part 15B Class B

**ENVIRONMENTAL LIMITS**

Ambient Operating Temperature Range:	0 – 50 degrees Celsius. Built-in fans Flat (tray) or vertical (wall) mounting
Storage Temperature Range:	-40 to – 125 degrees Celsius
Operating Humidity:	10% to 90% relative, non-condensing