



User Manual

miniCMTS200a



Pico Digital Inc. www.picodigital.com	24 July 2014	Release 1.5
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Product Inspection

Inspect the equipment for shipping damage. Should any damage be discovered, immediately file a claim with the carrier.

Important Safety Instructions

To ensure proper installation and operation, take a moment to read this guide before proceeding with the installation. If you have any questions or comments about the product, please contact your dealer or have him contact the Pico Digital service center at this phone number: 800-421-6511.



The lightning flash with arrowhead symbol, within an equilateral triangle, is intended to alert the user to the presence of uninsulated "dangerous voltage" within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.



The exclamation point within an equilateral triangle is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in the literature accompanying the appliance.

WARNING:

TO REDUCE THE RISK OF FIRE OR ELECTRIC SHOCK, DO NOT EXPOSE THIS APPLIANCE TO RAIN OR MOISTURE. DO NOT OPEN THE CABINET REFER SERVICING TO QUALIFIED PERSONNEL ONLY

CAUTION:

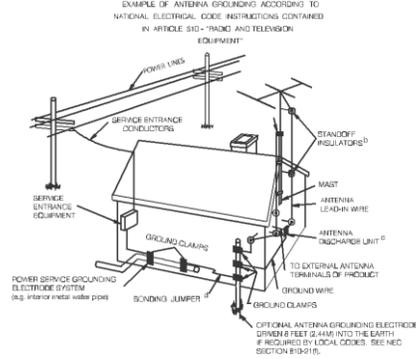
TO PREVENT ELECTRIC SHOCK, DO NOT USE THIS (POLARIZED) PLUG WITH AN EXTENSION CORD RECEPTACLE OR OTHER OUTLET UNLESS THE BLADES CAN BE FULLY INSERTED TO PREVENT BLADE EXPOSURE.

ATTENCION:

POUR PREVENIR LES CHOCS ELECTRIQUES, NE PAS UTILISER CETTE FICHE POLARISEE AVEC UN PROLONGATEUR, UNE PRISE DE COURANT OU UNE AUTRE SORTIE DE COURANT, SAUF SI LES LAMES PEUVENT ETRE INSEREES A FOND SANS EN LAISSER AUCUNE PARTIE A DECOUVERT

1. **Read Instructions:** All safety and operating instructions should be read before the appliance is operated.
2. **Retain Instructions:** The safety and operating instructions should be retained for future reference.
3. **Heed Warnings:** All warnings on the appliance should be adhered to.
4. **Follow Instructions:** All operating and user instructions should be followed.
5. **Cleaning:** Unplug this appliance from the wall outlet before cleaning. Use a damp cloth for cleaning. Do not use liquid cleaners or aerosol cleansers.
6. **Do Not Use Attachments:** Use of attachments not recommended by the manufacturer may cause hazards.
7. **Water and Moisture:** Do not use this product near water for example, near a bathtub, washbowl, kitchen sink, laundry tub, in a wet basement, or near a swimming pool and the like.
8. **Accessories:** Do not place this product on an unstable cart, stand, tripod, bracket, or table. The product may fall, causing serious injury to a child or adult, and serious damage to the appliance.
9. **Elevated Operating Ambient:** If installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack environment may be greater than room ambient. Therefore, consideration should be given to installing the equipment in an environment compatible with the maximum ambient temperature 50°C.
10. **Reduced Air Flow:** Installation of the equipment in a rack should be such that the amount of air flow required for safe operation of the equipment is not compromised.
11. **Mechanical Loading:** The product is designed to be rack mounted in a standard EIA 19 inch width telecommunications rack. Mounting of the equipment in the rack should be such that a hazardous condition is not achieved due to uneven mechanical loading.
12. **Circuit Overloading:** Consideration should be given to the connection of the equipment to the supply circuit and the effect that overloading of the circuits might have on over current protection and supply wiring. Appropriate consideration of equipment nameplate ratings should be used when addressing this concern.
13. **Reliable Earthing:** Reliable earthing of rack-mounted equipment should be maintained. Particular attention should be given to supply connections other than direct connections to the branch circuit (e.g. use of power strips)

14. **Power Sources:** This product should be operated only from the type of power source indicated on the marking label. If you are not sure of the type of power supplied to your home, consult your appliance dealer or local power company.
15. **Power-cord Protection:** Power-supply cords should be routed so they are not likely to be walked on or pinched by items placed upon or against them. Pay particular attention to cords and plugs, convenience receptacles, and the point where they exit from the appliance.
16. **Lightning:** For added protection for this product during a lightning storm, or when it is left unattended or unused for long periods of time, the unit should be disconnected from power source.
17. **Power Lines:** An outside antenna system should not be located in the vicinity of overhead power lines, other electric light or power circuits, where it can fall into such power lines or circuits. When installing an outside antenna system, extreme care should be taken to keep from touching such power lines or circuits as contact with them may be fatal.
18. **Object and Liquid Entry:** Never push objects of any kind into this product through openings as they may touch dangerous voltage points or short-out parts that could result in a fire or electric shock. Never spill liquid of any kind on the product.
19. **Servicing:** Do not attempt to service this product yourself as opening or removing covers may expose you to dangerous voltage or other hazards. Refer all servicing to qualified service personnel.
20. **Damage Requiring Service:** Unplug this product from the wall outlet and refer servicing to qualified service personnel under the following conditions:
 - a. When the power-supply cord or plug is damaged.
 - b. If liquid has been spilled, or objects have fallen into the product.
 - c. If the product has been exposed to rain or water.
 - d. If the product does not operate normally by following the operating instruction. Adjust only those controls that are covered by the operating instructions. An improper adjustment may result in damage and will often require extensive work by a qualified technician to restore the product to its normal operation.
 - e. If the product has been dropped or the cabinet has been damaged.
 - f. When the product exhibits a distinct change in performance—this indicates a need for service.
21. **Replacement Parts:** When replacement parts are required, be sure the service technician has used replacement parts specified by the manufacturer or have the same characteristics as the original parts. Unauthorized substitutes may result in fire, electric shock or other hazards.
22. **Safety Check:** Upon completion of any service or repairs to this product, ask the service technician to perform safety checks to determine that the product is in proper operating conditions.
23. **Outdoor Antenna Grounding:** Before attempting to install this product, be sure the antenna or cable system is grounded so as to provide some protection against voltage surges and built-up static charges.
 - a. Use No.10 AWG (5.3mm) copper, No.8 AWG (8.4mm) aluminum, No.7 AWG (10mm) copper-clad steel or bronze wire or larger, as ground wire.



- b. Secure antenna lead-in and ground wires to house with stand-off insulators spaced from 4 feet (1.22m) to 6 feet (1.83m) apart.
- c. Mount TV antenna discharge unit as close as possible to where lead-in enters house.
- d. A driven rod may be used as the grounding electrode where other types of electrode systems do not exist. Refer to the National Electrical Code, ANSI/NFPA 70-1984 for information.
- e. Use jumper wire not smaller than No.6 AWG (13.3mm) copper or equivalent, when a separate antenna grounding electrode is used

NOTE TO THE CATV SYSTEM INSTALLER

THIS REMINDER IS PROVIDED TO CALL THE CATV SYSTEM INSTALLER'S ATTENTION TO ARTICLE 820-22 OF THE NEC THAT PROVIDES GUIDELINES FOR PROPER GROUNDING AND, IN PARTICULAR, SPECIFIES THAT THE CABLE GROUND SHALL BE CONNECTED TO THE GROUNDING SYSTEM OF THE BUILDING, AS CLOSE TO THE POINT OF CABLE ENTRY AS PRACTICAL.

Equipment connected to the protective earthing of the building installation through the main connection or through other equipment with a connection to protective earthing – and to a cable distribution system using coaxial cable, may in some circumstances create a fire hazard. Connection to a cable distribution system must therefore be provided through a galvanic isolator providing electrical isolation below 5 MHz

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Pico Digital, Inc.
8880 Rehco Road
San Diego, CA 92121

Patent Pending



Warning! Approved external telecom power cross protection must be incorporated into the final installation in accordance with Annex NAC of UL/CSA standard 60950-1. Failure to comply may result in a fire or electric shock hazard and will void regulatory compliance certification.

THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION OF THIS DEVICE IS SUBJECT TO THE FOLLOWING TWO CONDITIONS: (1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND (2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRED OPERATION.

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Revision History

Rev #	Date	SW Version	Description
1.3	7/18/2014	NA	New format and consolidated documents
1.4	7/18/2014	NA	Minor changes
1.5	7/24/2014	NA	Minor corrections

Table 1 Revision History

1 Introduction

1.1 Introducing the miniCMTS200a

As an alternative to larger, more expensive cable modem termination systems (CMTS) and second-hand units with low bandwidth, Pico Digital's miniCMTS is designed to provide smaller cable operators with the capabilities they need at an exceptional value. The low-cost unit supports up to 400 DOCSIS cable modems (max. 250 DOCSIS 3.0 + 150 DOCSIS 2.0 or 400 DOCSIS 2.0) and offers 16 downstream bonded channels for up to 800-Mbps downstream /120-Mbps upstream data delivery. Ideal for providing high-speed data services to commercial residential properties and academic and medical facilities, as well as the hospitality industry, the miniCMTS features an extensive Web interface for simple configuration, management, and debugging.



Figure 1 miniCMTS200a

1.2 Features

1.2.1 DOCSIS

- QoS supported
- Load Balancing supported
- BPI+ supported
- Upstream Scheduler supported: Best Effort, UGS, UGS/AD

1.2.2 Network features

- CMTS IP - static or DHCP based
- Up to 3 LAN ports available
 - all LAN ports fully, independently configurable
 - designed to split customer traffic, cable modem traffic and management traffic
 - VLAN tagging possible (QinQ is not supported)
- DHCP relay, Option 60 tuning, Option 82insertion
- VLAN assignment for Management traffic
- VLANs assignment for Cable Modems, CPEs and MTAs.
- L2VPN based on DOCSIS standard "BSoD"
- Complex VLAN setup separating CM and CPE traffic into VLANs per individual CM and CPE

1.2.3 IPTV and Multicast features

- IPv4 Multicast supported, enabling IPTV over DOCSIS through miniCMTS.

1.2.4 Security features

- IP Address Check based on DHCP snooping- blocking of IPs not assigned by DHCP.

- Cable Security: blocks access from CPEs to internal miniCMTS IPs.

1.2.5 Monitoring and Management features

- GUI tool monitoring US SNR and FEC per US and per CM.
- Cable modem monitoring: via CMTS web interface, includes main RF values read from Cable Modems via SNMP.
- SNMP support for main DOCSIS OIDs.
- SNMP support for miniCMTS environment monitoring.
- DHCP snooping log: provides DHCP diagnostics.
- MiniCMTS Time Synchronization.
- Hardware monitoring: temperature, voltage etc.
- Software upgrades
- Alarming
- TCPDUMP - Packet tracing

2 Installation

2.1 Unpacking the Unit

Please inspect the carton upon receiving and note any damage while inspecting for possible unit damage. Please open the carton and unpack carefully. Locate:

- The miniCMTS200a unit
- The power cord

2.2 Before Rack Mounting

There are no user adjustable switches, jumpers or controls inside the unit itself, so do not open the unit. Opening the unit will result in voiding of the warranty.

2.3 Rack Mounting

The unit is designed for installation in an EIA standard 19-inch (480 mm) equipment rack. When mounting in the rack, use pan or round head screws and soft washers in all four front panel mounting locations. This ensures a secure mount. You must supply screws matching your rack.

To prolong service life, pay special attention that the environment in which the unit is being used is as free of dust and other airborne particles as possible.

Make sure the unit is operated in a moderate temperature environment. The miniCMTS200a is fan cooled. Never place a unit near a heat source. Do not install a unit in areas of extremely high humidity or where there is any danger of water or condensate dripping into or on the unit.

Where space is not an issue, allow a 1.75-inch (1RU) air gap above and below receivers for cooling purposes. However, you may install the units with no air gap between them and have reliable operation. Never install multiple units or any other equipment units in such a way that the air intake from one unit directly aligns with the outlet of another. Long-term reliability is best obtained with consistently cool environments.

2.4 Front Panel



Figure 2 miniCMTS200a Front Panel

The front panel has a number of LED's on it. Note the button on the left has no function assigned to it.

2.5 Rear Panel



Figure 3 miniCMTS200a Rear Panel

2.5.1 Ground

Securely connect the “Grounding Port” to a protective earth grounding accordance with the local legal and safety regulations.

2.5.2 Upstream RF connection

The F-type connector labeled U/S is for the upstream signals or the return path, this is where the cable with the signals from the cable modem is connected.

2.5.3 Downstream RF connection

The F-Type connector labeled D/S is the downstream connector, this contains the QAM channels generated by the miniCMTS.

2.5.4 Management Ethernet

This can be configured to be a separate management Ethernet port, however by default this is connected to the Data Ethernet port via a switch

2.5.5 Data Ethernet

This is the data port used to pass Ethernet data to cable modems.

2.5.6 SFP

This can be used to add fiber signals to the miniCMTS.

2.5.7 Console

The console port is a serial port used to communicate with the miniCMTS.

2.5.8 Power & Power Switch

Make sure the switch is in the off position before plugging the power into the unit, the unit supports 110/220V.

2.6 Overview of miniCMTS

The diagram below shows the blocks within the miniCMTS.

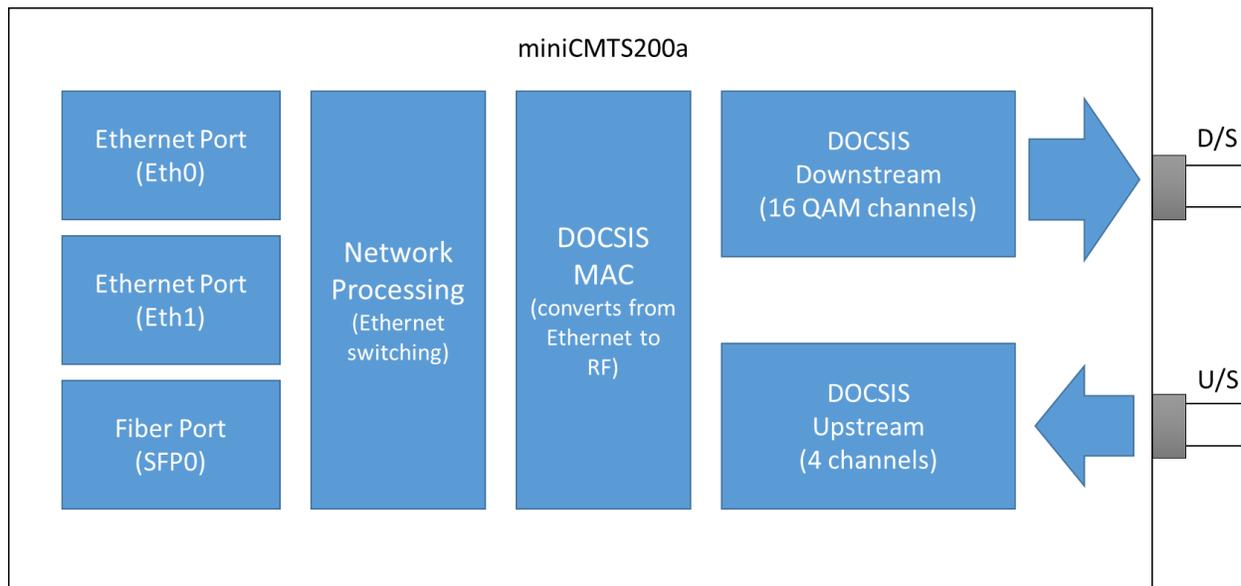


Figure 4 miniCMTS block diagram

The miniCMTS takes Ethernet packets from either one of the Ethernet ports (Eth0 or Eth1) or from the SFP port, it converts these Ethernet packets to DOCSIS packets and put them out of the D/S F-Type connector in QAM channels. The cable modem then looks at these signals and converts them back to Ethernet. The modem then transmits signals to the miniCMTS and the miniCMTS receives these on the U/S connector. It converts these signals back to Ethernet and put them out of one of the Ethernet ports or as fiber on the SFP port.

There is much more going on in a DOCSIS network that the above simplified explanation, as there are many MAC management messages being sent between the miniCMTS and the modems to help control and configure the network.

2.7 RF Configuration

The miniCMTS200a can be configured in many different ways, below is a simple configuration to allow the miniCMTS200a to be in a network with other broadcast TV channels.

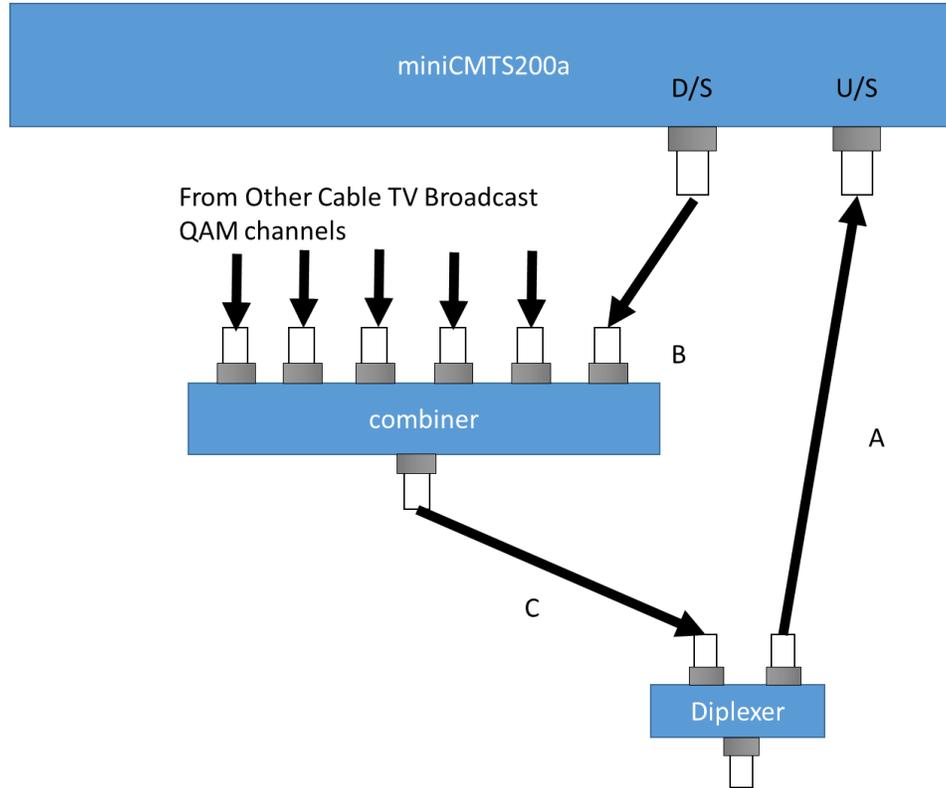


Figure 5 Simple RF network

The RF goes to the cable TV network at the bottom of the picture, and comprises of both upstream (A) and downstream (B) DOCSIS signals.

Notice the DOCSIS D/S signals are being combined with other cable TV signals to be placed on the network. This allows the power settings of all the QAM channels to be configured by adding attenuation to each product's feed. By measuring the power at 'C' they can be easily leveled.

The upstream should be split using a diplexer with the appropriate RF frequency range (depending on the network). Attenuation can then be applied to leg 'A' to adjust the signal strength so it will reach the miniCMTS200a at the correct power.

This is a simple example of how to connect the miniCMTS200a, more complex setups are possible.

Output Power: 45dB

Receive power: 6dB, depending on the modulation profile and the channel bandwidth the cable modems have a power range they can transmit in.

3 Basic Setup Guide

3.1.1 Login & Language

The default miniCMTS IP address is 10.7.1.77, netmask 255.255.0.0 and a gateway IP address of 10.7.1.1

An emergency (Backdoor) IP is available: 192.168.2.200/24 if you change the IP address and forget it.

- This IP address is a fixed static address and always untagged.
- In the event you lose IP connectivity to the miniCMTS, access to the miniCMTS Web GUI can be made via this address from a local subnet 192.168.2.0/24.

Using a browser, type in the IP address of the miniCMTS you should see the login page:

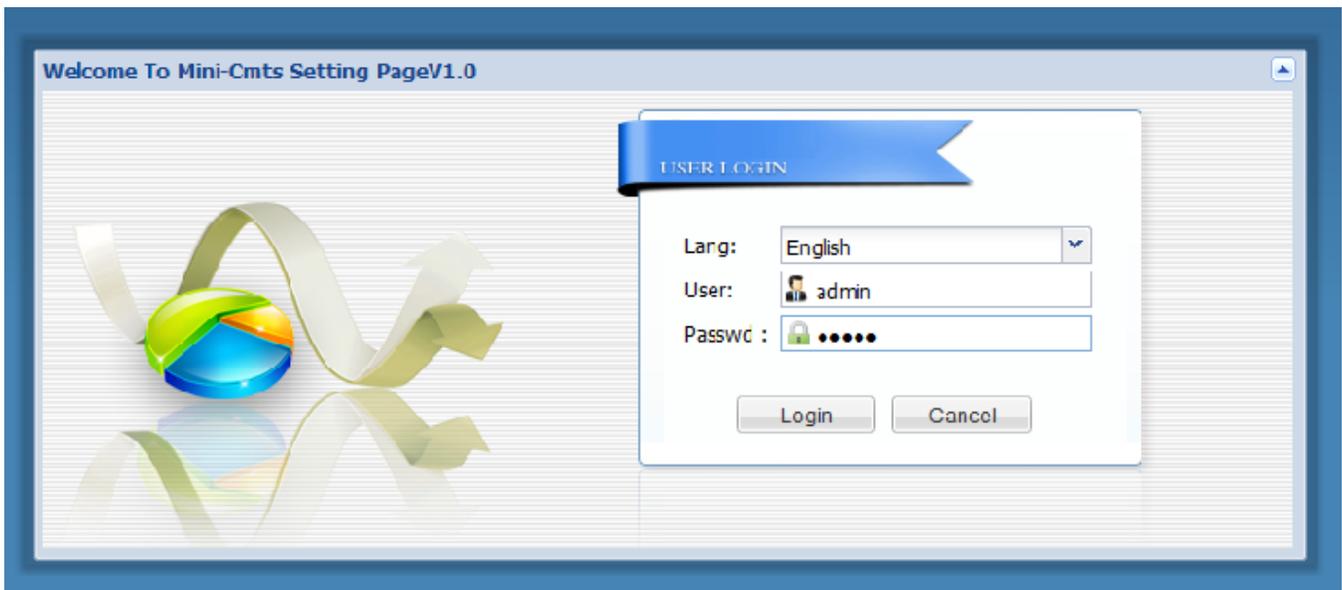


Figure 6 Login Page

During the initial login into the miniCMTS web interface, select the required language from the drop-down menu. English or Chinese are supported. The default username and password is case sensitive:

Username: admin

Password: admin

3.1.2 Start Page

The start page is the main page where you can control the miniCMTS

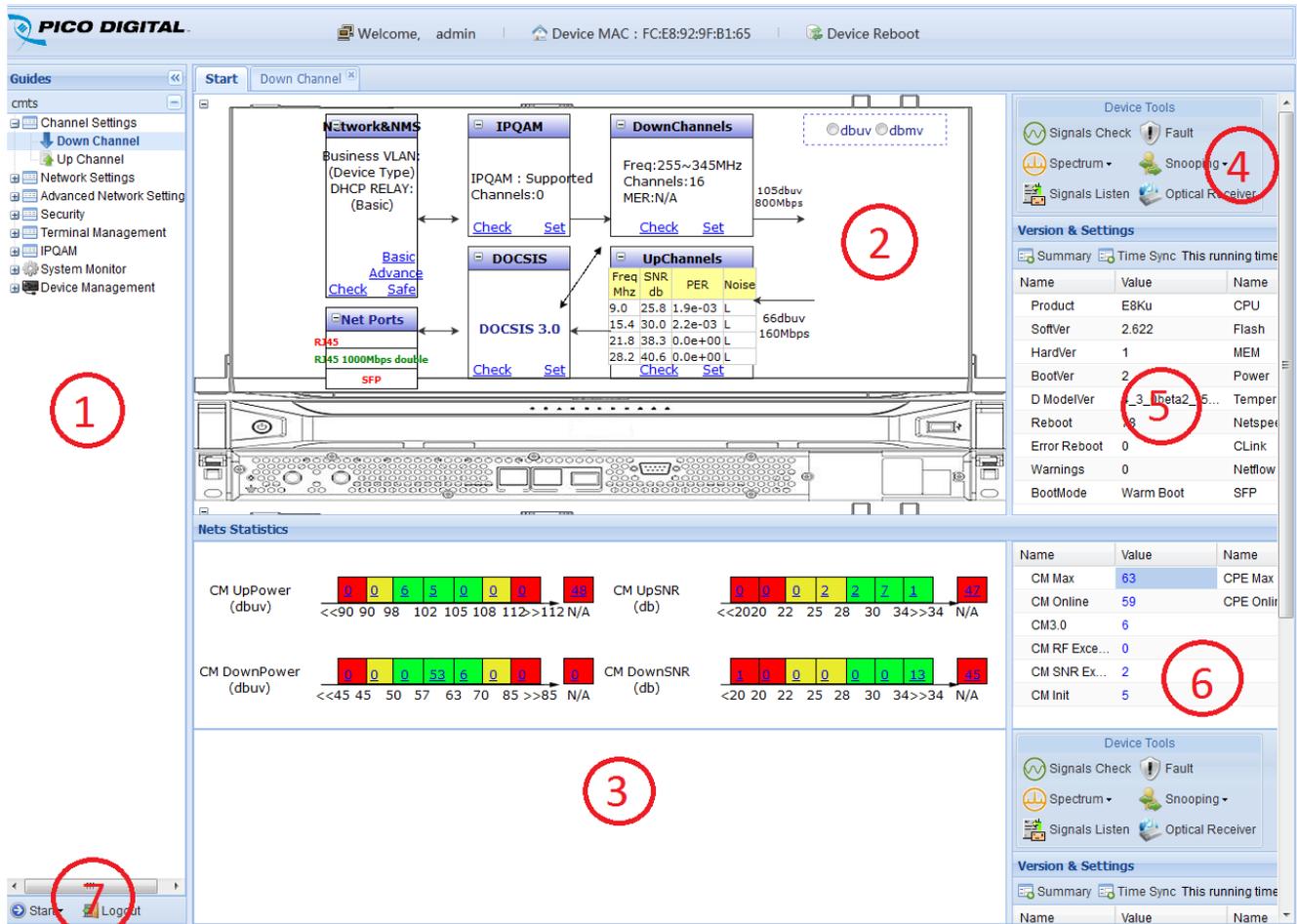


Figure 7 Start Page

1. **Navigation bar (Guides) on the left:** This may be hidden and un-hidden using the << button. This provides a tree structure of the available tabs to be displayed in the main area.
2. **Main Tab Area (System Overview):** The main tab area in the center of the page is where the tabs are loaded when the menu options from the Navigation bar are selected.
3. **Middle Bottom (Net Statistics):** RF value distribution bar graphs, by clicking on the displayed values a list of cable modems in each bucket can be opened
4. **Right Top (Device Tools) :** Advanced Feature icons
5. **Right Middle (Version and Settings):** Main operational information
6. **Right Bottom (Cable Modem Info):** Main Cable Modem statistics
7. **Left Bottom Logout and Change Language**

3.1.3 Network Setup– Management IP and VLAN

The first step to configuring the miniCMTS200a is to set the IP address, this is done by clicking on the Network Settings -> Manage IP. The “Manage IP” tab is displayed in the main Tab area.

3.1.3.1 Field names

Configuration Mode – choose Static IP or DHCP

IP Address, Subnet Mask, Default Gateway – required to be set in case of choosing “Static IP”

Management VLAN –set for dot1.q tagging of CMTS IP management traffic

Management VLAN Fixed – set VLAN tag.

The configuration shown is a simple test configuration with no VLAN support.

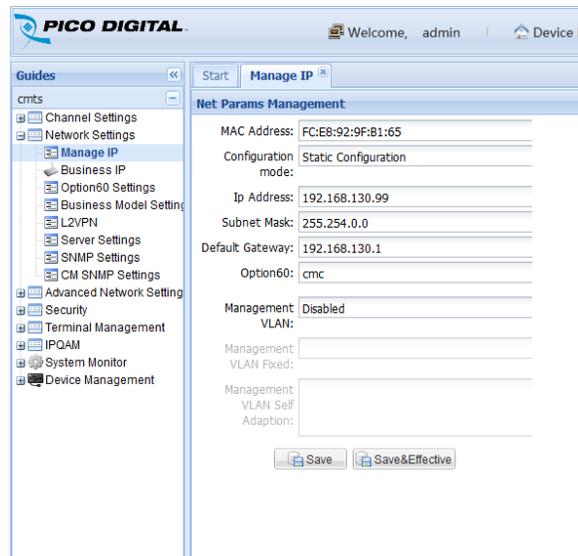


Figure 8 Network Setup Page

Channel Settings - Downstream Channels

The next step is to configure the downstream channels. By default the miniCMTS200a is configured for annex-A, this means the channel widths will be 8MHz and will only work with annex-a configured modems. The below figure shows the setup for an Annex B configuration.

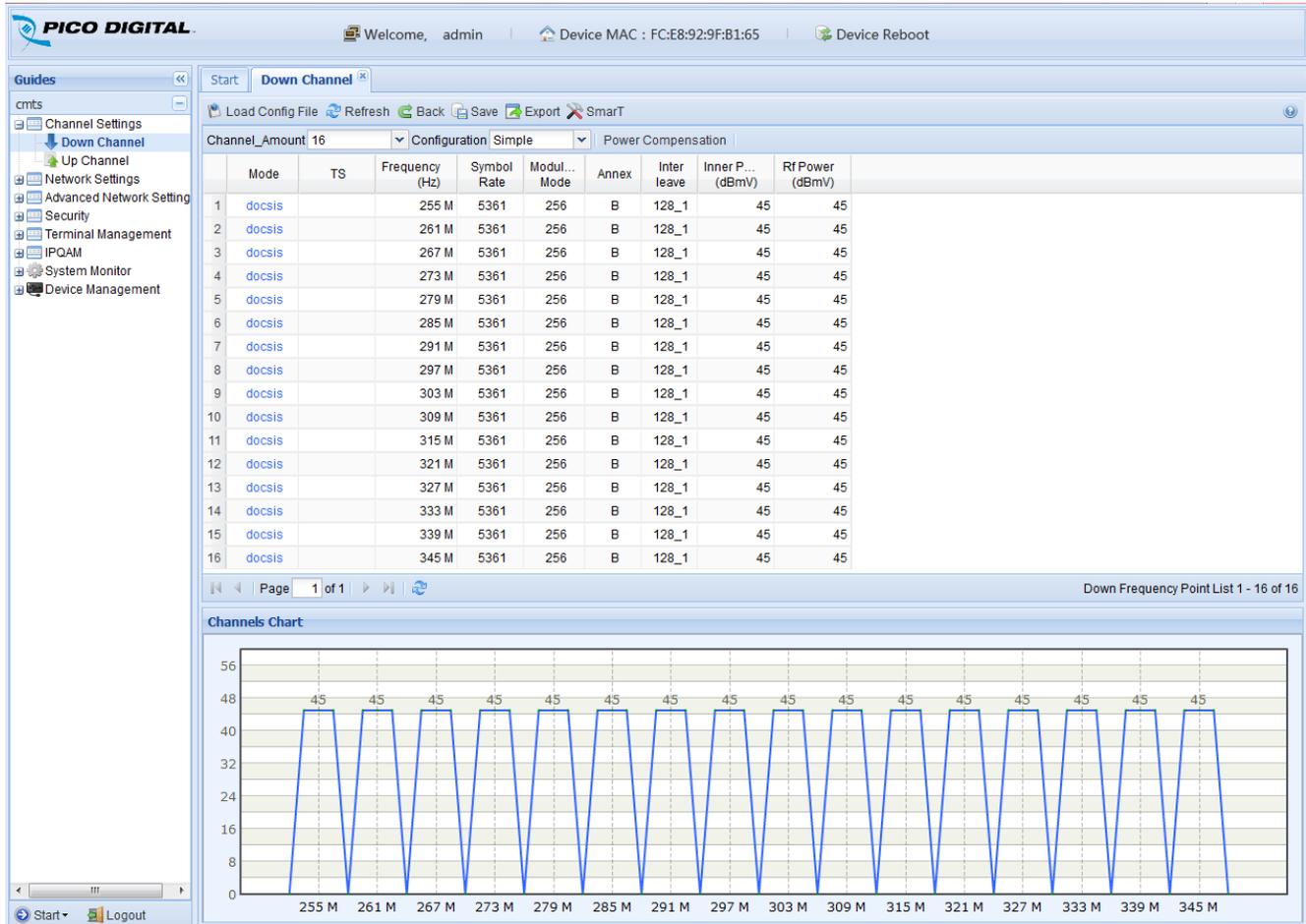


Figure 9 Downstream Channel Page

3.1.3.2 Toolbar

Channel_Amount: This sets the number of downstream channels which are enabled

Configuration: in “Simple” mode only first downstream channel is configurable, with the remainder being set automatically adjacent to the first downstream channel, in “Complex” mode each downstream can be configured separately. Note: IPQAM channels should be configured in “Complex” mode.

Power Compensation– This is to configure the power tilt compensation. Downstream channels at higher frequencies can be set to transmit at higher output levels relative to downstream channels at lower frequencies.

3.1.3.3 Table and Columns

- **Mode**–set “docsis” for DOCSIS Downstream or “ipqam” for IPQAM channel
- **TS**–displays Transport Stream name for Downstream channels set as “ipqam”
- **Frequency**– set center frequency for Downstream channel

- **Symbol Rate**– This is automatically set based on the annex and the modulation rate
- **Modulation Mode**– choose QAM64 or QAM256
- **Annex** - “A” means EuroDOCSIS, “B” means DOCSIS
- **Interleave**–in case of “Annex A”, Interleave is set automatically to “ignore”. Set desired value in case of “Annex B”.
- **Inner Power**– the power level configured for the internal DOCSIS chipset output
- **RF Power**–indicates RF power level available on CMTS RF connector. This is lower than “Inner Power” due to the internal RF combining and splitting.

3.1.4 RF Settings - Upstream Channels

The next step is to configure the upstream channels.

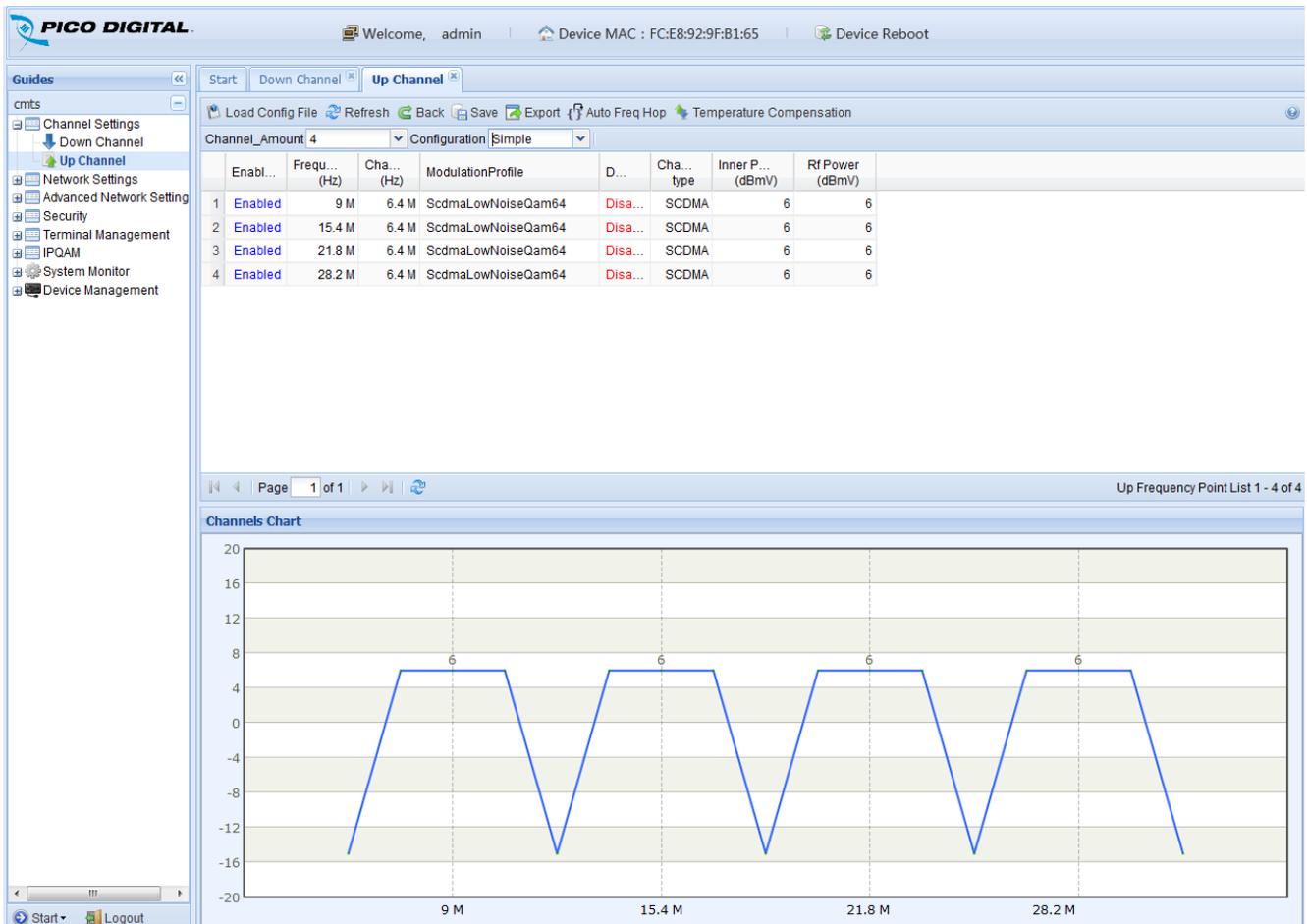


Figure 10 Upstream Channel Page

3.1.4.1 Toolbar

Channel_Amount – This sets the number of upstream channels which are enabled.

Configuration: in “Simple” mode only first upstream channel is configurable, with the remainder being set automatically adjacent to the first downstream channel, in “Complex” mode each upstream can be configured separately.

3.1.4.2 Tables and columns

- **Enable/Disable:** Each upstream channel can be enabled or disabled individually.
- **Frequency:** set center frequency for upstream channel from available range. For EuroDOCSIS the available frequency range is 5-65 MHz side-to-side. NOTE: Do not set the frequency above what the RF network is capable of, if Analog TV channels are being transmitted on channel 2, the top frequency edge should be 42MHz.
- **Channel Width:** choose from 1.6MHz, 3.2MHz or 6.4MHz.
- **ModulationProfile:** choose from predefined modulation profiles. Low noise profiles have a wider power range for the cable modems to use and there are recommended for good networks.
- **D30Mode:** this option is reserved for future releases, and must be set to DISABLED.
- **Channel type:** This field is automatically set to match the chosen modulation profile.
- **Inner Power:** the power level configured for the internal DOCSIS chipset input. The available power range is related to the configured channel width and modulation profile.
- **RF power:** with the miniCMTS200a model of miniCMTS, the RF power is set to the internal power setting and is the target receive power at the upstream f-type connector.

3.1.5 Time Synchronization

The time is configured via the “Time Sync” icon under “Version & Settings” on the right side of miniCMTS Start page. The TIME protocol (TCP port 37) is used for miniCMTS Time Synchronization and two servers are available to be used for this.

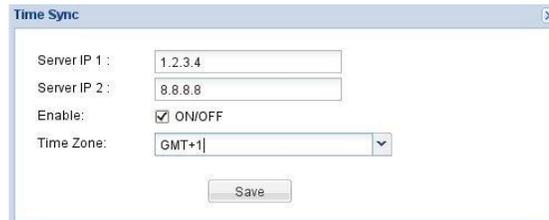


Figure 11 Time Synchronization

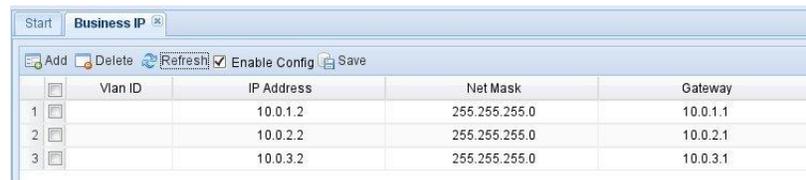
3.1.5.1 Fields

- **Server IP 1:** IP address of the external server
- **Server IP 2:** IP address of the backup external server
- **Enable:** Either on/off to enable or disable this feature
- **Time Zone:** set to the appropriate time zone for you location.

3.1.6 Network Setup: DHCP Relay, VLAN tagging

3.1.6.1 Business IP

- Businesses IPs are used as GIADDR and as source IPv4 addresses for the DHCP Relay function.
- Business IPs **MUST BE** from the same IP subnet as IPs assigned by DHCP server. One Business IP is required for each IP subnet for which miniCMTS relays DHCP packets.
- Business IPs are configured as new IP addresses from the miniCMTS configuration, and require a valid Net Mask.
- NOTE: Business IPs are created inside miniCMTS as new IP addresses. Enabling “Cable Security” is recommended to protect access to Business IPs from CPEs
- The example below shows three addresses to be used as GIADDR: 10.0.1.2, 10.0.2.2 and 10.0.3.2.



	Vlan ID	IP Address	Net Mask	Gateway
1		10.0.1.2	255.255.255.0	10.0.1.1
2		10.0.2.2	255.255.255.0	10.0.2.1
3		10.0.3.2	255.255.255.0	10.0.3.1

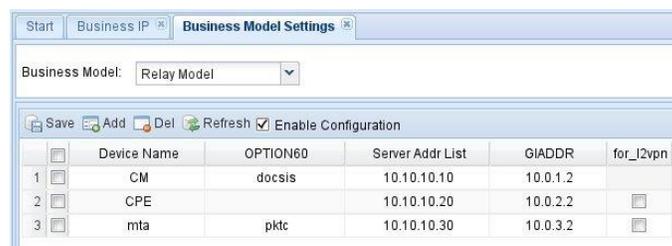
Figure 12 Business IP

- The “Gateway” field in the Business IP configuration page is optional, but needs to be set when, a VLAN is assigned to Business IP, or a Default Gateway is not provided under “Manage IP”.
- The setting or changing of the Business IPs does not require MiniCMTS restart.

3.1.6.1.1 Option60 Settings

Option 60 identification strings can be configured.

3.1.7 Business Model Settings – “Relay Model”



	Device Name	OPTION60	Server Addr List	GIADDR	for_I2vpn
1	CM	docsis	10.10.10.10	10.0.1.2	<input type="checkbox"/>
2	CPE		10.10.10.20	10.0.2.2	<input type="checkbox"/>
3	mta	pktc	10.10.10.30	10.0.3.2	<input type="checkbox"/>

Figure 13 Business Model Settings

Relay Model provides the DHCP Relay function, and can also be used to tag CM, CPE and other traffic based on the VLANs assigned to the Business IPs.

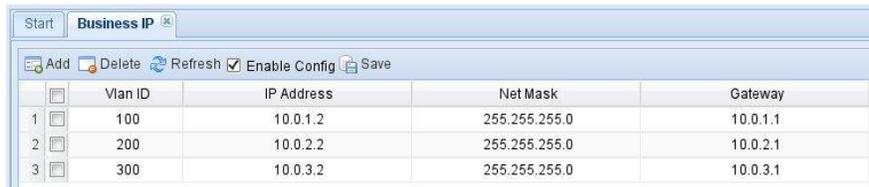
DHCP relay can be configured for specific device types, as identified by the “Option 60” parameter. Standard device types are predefined, including CM, STB, MTA and CPE. Option 60 for “CPE” is set to “NULL” so as to capture all device types not explicitly matched by other rules.

In the example above, DHCP relay is enabled for the following three element types:

- **Cable Modems** (IPs assigned for CMs are from subnet 10.0.1.0/24), relayed to DHCP server IP 10.10.10.10, with GIADDR set to 10.0.1.2.

- **CPEs** (IPs assigned for CPEs are from subnet 10.0.2.0/24), relayed to DHCP server IP 10.10.10.20, with GIADDR set to 10.0.2.2
- **MTAs** (IPs assigned for MTAs are from subnet 10.0.3.0/24), relayed to DHCP server IP 10.10.10.30, with GIADDR set to 10.0.3.2 The example shows three different DHCP server IPs, but it is also possible to use a single DHCP server IP for all relayed elements.

VLAN tagging for CM, CPE, MTA or other traffic is done based on “Business IP” VLAN ID.



	Vlan ID	IP Address	Net Mask	Gateway
1	100	10.0.1.2	255.255.255.0	10.0.1.1
2	200	10.0.2.2	255.255.255.0	10.0.2.1
3	300	10.0.3.2	255.255.255.0	10.0.3.1

Figure 14 Business IP - VLAN Tagging

The following screen shows mapping of Business IP addresses to VLAN IDs



Business Model: Relay Model

Default VLAN ID: 200 Default VLAN Priority: 0

Figure 15 Business Model Settings - VLAN ID

- For CPE tagging to operate correctly, a DHCP packet must be generated by CPE and seen by miniCMTS.
- If DHCP is not used for CPEs, a “Default VLAN ID” must be configured for all CPEs with the same VLAN ID.

Option 82 is populated automatically into relayed DHCP packets when operating in “Relay Mode”.

A miniCMTS restart is recommended after making changes to “Business Model Settings”.

3.1.8 Business Model Settings: “Option60 Model”

- **Option60 Model** is designed to provide VLAN tagging for CM, CPE and other traffic types based on Option60 in scenarios where **DHCP Relay functionality is not required**.
- This mode can also add Option 82 into broadcasted DHCP packets. If “ADD OPTION82” is enabled, then a copy of broadcast DHCP packet is generated with Option82 filled (The “original” DHCP broadcast packet without the Option82 cannot be changed, it will still ALWAYS be generated).
- The screen below shows the VLAN tagging configuration based on “Option60 Model”.

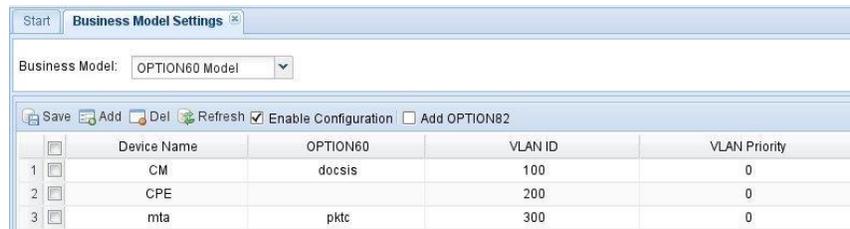


Figure 16 Business Model Option 60

3.1.9 IPQAM Setup

We do not recommend using the IPQAM features of the miniCMTS200a, we have alternative products if you require EdgeQAM functionality.

3.1.10 Cable Modem Analysis – basic tools

The primary screen for showing the Cable Modem overview and analysis is found in the “Guides” menu:

SID	MAC Addr	IP Addr	conn...	docsis version	Soft Version	Up Power(dbm)	Up SNR(db)	Down Power(dbm)	Down SNR(db)	Down Total octets	Up Total octets	Drops num	Last Drop time	Primary Us Channel	Primary Ds Channel	Us Channel	Ds Channel
9	10	00111a037dda	10.56.142.213	Online	Docsis20	SB5100E-2...	51.4	42.1	-0.2	39.9	57,900,105	0	0	3	3	3	3
10	15	00111a48b7fa	10.56.142.67	Online	Docsis20	SB5100E-2...	49.7	41.8	-2.5	37.9	181,976,122	6,019,902	0	3	2	3	2
23	22	e448c7b96eee	10.56.142.74	Online	Docsis30	e3000-v302...	47.5/47.5/48.0/4...	42.1/43.6/4...	-2.1/-2.7/-3.2/-3.6/2...	41.9/42.5/42.5...	974,664,863	1,135,639,621	0	3	1	1,2,3,4	1,2,3,4,5,6,7,8
24	12	e448c7b974ac	10.56.142.53	Online	Docsis30	e3000-v302...	41.7/42.0/42.5/4...	41.3/42.1/4...	10.5/10.2/9.5/9.1/3...	43.8/45.4/45.2...	-639488704	910,999,682	0	3	1	1,2,3,4	1,2,3,4,5,6,7,8

Figure 17 CM List

3.1.10.1 Toolbar

- **CM Details:** opens a window showing CM details when clicked.
- **Reboot:** performs Cable Modem reboot. CM reboot is initiated via DOCSIS command.
- **Clear Modem History:** clears Cable Modem History.
- **PING CM:** performs an ICMP ping to the Cable Modem. The ICMP ping is executed from the miniCMTS and results are displayed in a Web-Browser window.
- **SNMP Test:** opens a window that allows an SNMP command to be sent to the selected Cable Modem.
- **Move Freq:** moves selected Cable Modem to particular Downstream or Upstream channel. Move Downstream and Upstream separately, do not move both at the same time.
- **MAC Filter:** filters the list of cable modems to a particular MAC substring, e.g. “01ef”.
- **Refresh Power:** polls selected Cable Modem for actual information via SNMP.
- **Refresh:** refreshes information on the web-page.

3.1.10.2 *Table and columns*

- **SID:** internal DOCSIS Cable Modem ID.
- **MAC Addr:** MAC address of the CM.
- **IP Addr:** IP address assigned to the CM.
- **Connect state:** actual state of the CM.
- **DOCSIS version:** DOCSIS version of the CM as identified by CMTS.
- **Up Power, Up SNR, Down Power, Down SNR: RF values:** Up SNR is measured at the CMTS input. Up Power (transmit), Down Power (receive), Down SNR (receive) are read from the Cable Modem via SNMP. The CM SNMP read community can be set in “Terminal Management” → “CM SNMP Settings”.
- **Down Total octets and Up Total octets:** the number of octets transmitted and received by the CM
- **Drops num, Last Drop time:** the number of times and when the modem dropped offline.
- **Primary Us Chanel, Primary Ds Channel:** The RF channels used as primary channels for the CM.
- **Us Channel, Ds Channel:** list of CMTS channels that the CM is ranged to.

4 MiniCMTS Web Interface

4.1 Start page

See “Basic Setup Guide”.

4.2 Channel Settings

See “Basic Setup Guide”.

4.3 Network Settings

4.3.1 Manage IP

- See “Basic Setup Guide”.

4.3.2 Business IP

- Business IPs are configured to enable DHCP Relay feature.
- See “Basic setup Guide” for more details.

4.3.3 Option60 Settings

- Allows configuration of user-defined DHCP Option 60 distinctive strings.

4.3.4 Business Model Settings

- This tab allows to configure Network model setup in relation to **DHCP Relay function and VLAN tagging for CMs, CPEs, MTAs (and others)**.
- See “Basic Setup Guide” for more details.
- *Available options:*
 - None**–No DHCP Relay, No CM & CPE VLAN tagging
 - Relay Model**–DHCP Relay active, CM & CPE VLAN tagging available, Option 82 filled
 - OPTION60 Model**–No DHCP Relay, CM & CPE VLAN tagging, Option 82 optionally filled
 - Bundle**–No DHCP Relay, Cable Bundles (more complex VLAN setup) available
 - Advance Relay Model**–DHCP Relay active, Cable Bundles (more complex VLAN setup) available

4.3.5 L2VPN

- L2VPNforBusiness Services over DOCSIS (BSoD).
- Please contact Pico Digital to discuss implementation requirements related to L2VPN.

4.3.6 Server Settings

- **Time Sync** – Allows configuration of the miniCMTS200a to time synchronization. TCP port 37 is used. See “Basic Setup Guide” for more details.
- **Device Log Server** – When enabled, exports internal SYSLOG messages also to external SYSLOG server via UDP port 514 standard messages. A MiniCMTS restart is not needed after changing “Device Log Server” configuration.

4.3.7 SNMP Settings

- Allows configuration of the miniCMTS200a SNMP community strings.
- Default community is “public”.
- **Trap Server** – when enabled, generates SNMP traps.
- The miniCMTS200a must be restarted after changing miniCMTS200a SNMP community.

4.3.8 CM SNMP Settings

- The MiniCMTS will automatically try to read RF values via SNMP from Cable Modems, and display them on the CM List page.
- Set “Read Only Community” in “Network Settings” → “CM SNMP Settings” to see Cable Modem RF values on CM List page.
- Pre-defined CM community is “public”.

4.4 Advanced Network Settings

4.4.1 Uplink Settings

- Uplink Settings enable to manipulate VLAN tagging and trunking on Ethernet ports.
- Be careful not to block management VLAN, as the CMTS management IP may become inaccessible.

4.4.2 Port Isolation

- Port Isolation defines mutual visibility of Ethernet ports ETH0, ETH1 and SFP0.

4.5 Security

4.5.1 IP Address Check



Figure 18 IP Address Check

- When enabled, the miniCMTS blocks any MAC-IP pair that was not assigned by the DHCP server.
- CMTS uses DHCP Snooping to create the internal database of allowed MAC-IP pairs.

4.5.2 Cable Security

- When enabled, CPE traffic to the miniCMTS internal IP addresses (Manage IP, Business IPs, Back Door IP) is blocked.
- Only ICMP ping packets are allowed, allowing the miniCMTS to respond to ICMP Echo Requests.

4.6 Terminal Management

4.6.1 CM List

- See “Basic Setup Guide”.

4.6.2 CPE List& CPE List Advance

- These lists show CPE details.

4.6.3 Load Balancing

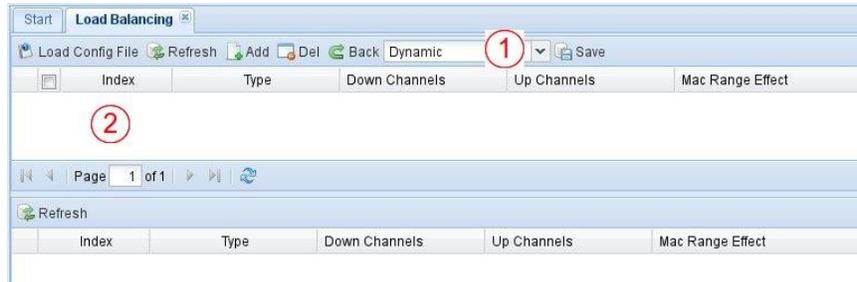


Figure 19 Load Balancing

1. General LoadBalancingconfiguration - the most typical configuration is “Dynamic”
 - *Disabled* – LoadBalancing is disabled
 - *Dynamic* – Dynamic LoadBalancing is activated
 - *Static* – Static LoadBalancing is activated
2. Restricted LoadBalancingGroups configuration

4.6.4 QOS



Figure 20 QOS

- DS Packet Classification is configurable via the Cable Modem configuration files using DOCSIS TLVs. DS&US Packet Classification via the MiniCMTS is not supported.
- NOTE: It is recommended that the Cable Modem configuration files are used to configure QoS Packet Classification in preference to configuring QOS via this tab.
- A maximum of 7 unique Downstream Packet Classes are supported by the MiniCMTS, identified by unique ClassifierRef's.

4.6.5 MAC Aging

- The ARP table size is 4000 records.
- Enabling “MAC Aging” and configuring “Aging Time” is possible for scenarios where MAC addresses churn could result in ARP table exhaustion.

4.6.6 Flap List

- Displays Cable Modem Flaps.

4.7 System Monitor

4.7.1 Hardware Status

Real time monitoring of the hardware of the miniCMTS200a. The following is a list of the parameters which are monitored:

- CPU, RAM and internal Flash-disk usage
- miniCMTS temperature
- Internal Power Supply Voltages
- UpTime

4.7.2 Log Record

This allows the miniCMTS200a to display the internal events log for debug and fault finding.

4.8 Device Management

4.8.1 Version Upgrade

Please refer to the Upgrade Guide distributed with the FW package.

4.8.2 Users Management

Allows the creation of new users and the changing of user passwords.

4.8.3 Config Management

The miniCMTS200a, like all CMTS's, is a complex product and can be configured in a fashion which means it will no longer function correctly. The factory reset allows the restoration of the factory defaults, this is used to put the miniCMTS200a back to a known state.

- "Restore Factory Settings" – restore all settings, set default IP address.
- "Restore Factory Settings, Keep Current IP" – restore all settings, but currently configured IP address is not changed.

4.9 Device Tools (Right Top of Start Page)

4.9.1 Signal Check

The signal check allows the user of the miniCMTS200a to displays real time graphs for:

- Upstream channel SNR
- Upstream channel Error Rate
- Per Cable Modem US SNR
- Per Cable Modem US Error Rate

4.9.2 Snooping

Snooping: This displays a log of DHCP events that the miniCMTS has recognized during DHCP Snooping

TCP Dump: This is for lab use only, the TCP dump window is a graphical utility to display the output of "tcpdump" sitting inside miniCMTS

5 Setup a Basic System

To get a cable modem operational you need to configure the RF correctly so the mode will see the signal from the miniCMTS200a and the miniCMTS200a will see the signal from the cable modem. However this in only half of the task. The next stage is to setup a DHCP / TFTP server in the network, this give the cable modem an IP address and a configuration file, these are used to configure the cable modem so it know what level of service it should give to the customer and how to get to the internet. This DHCP / TFTP server can be call the provisioning server. This can be as simple or as complex as your number of cable modems / subscribers need.

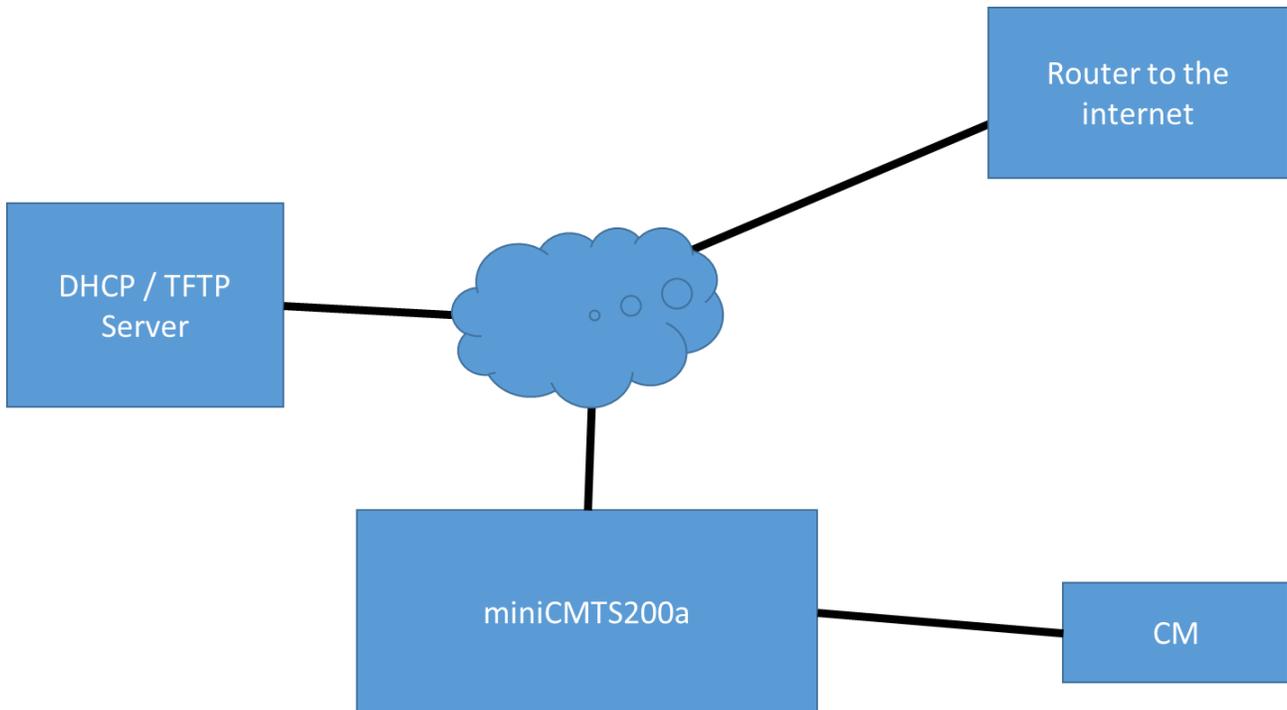


Figure 21 Basic Network setup

What the following describes is a simple DHCP server which has one IP address range and offers one configuration files to the cable modems. This is good enough to prove the miniCMTS200a is functional and interoperates with your desired cable modem.

The following section is intended for experience users with knowledge of the Linux environment and IP networking. This document assumes that the user has a PC configured with the Linux OS. The PC can access the internet to download and the files required to setup the DHCP Server. Also this documentation includes the configuration files required to complete the installation.

Note: Linux commands are in bold print below.

5.1 RF

Connect the f-type D/S and U/S connectors to a diplexer and make sure there is about 40dB of attenuation in the downstream path and 35 in the upstream path between the cable modem and the miniCMTS200a.

5.2 miniCMTS200a IP configuration

Configure the miniCMTS200a to the following IP address: 192.168.130.99 mask 255.255.0.0

Set a router up on the network with a ip address of 192.168.130.1

5.3 Installation Procedure

Start with a clean Ubuntu Linux PC.

- **sudo apt-get install isc-dhcp-server**
- **sudo apt-get install tftpd**
- **sudo apt-get install xinetd tftpd**

5.4 Configuration Procedure

Configure the IP Address of the server to 192.168.130.2 mask 255.255.0.0 default gateway 192.168.130.1

Pico Digital can supply some example files please place these following files on a USB 'stick' drive.

- dhcpd.conf – this is the configuration for the DHCP server.
- CM-BASIC-mib.cfg - this is the configuration file for the cable modem.

Plug the USB drive into the Linux DHCP server.

- Mount the USB drive to /mnt/tmp directory (may need to create this directory)
- **sudo mount /dev/sdb1 /mnt/tmp** (this assume the drive ID is sdb1, password required)

Copy the files on USB drive to their directory

- change directory to tmp directory
- **cd /mnt/tmp**
- **cp dhcpd.conf /etc/dhcp/dhcpd.conf** (may need to create directory dhcp in advance)
- **cp CM-BASIC-mib.cfg /tftpboot/CM-BASIC-mib.cfg**

Restart system

- **sudo /sbin/reboot**