



MQAM Modulator Models D9477-1, D9477-2, and D9477-3 Installation and Operation Guide

Please Read

Important

Please read this entire guide. If this guide provides installation or operation instructions, give particular attention to all safety statements included in this guide.

Notices

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Contents

Safety Precautions	vii
Read, Retain, and Follow These Instructions.....	vii
Warning and Caution Icons	vii
Heed All Warnings	vii
Avoid Electric Shock	vii
Servicing.....	viii
Cleaning, Water, Moisture, Open Flame	viii
Ventilation.....	viii
Placement.....	viii
Fuse	ix
Grounding This Product (U.S.A. and Canada Only).....	ix
FCC Compliance	xi
United States FCC Compliance.....	xi
Canada EMI Regulation.....	xi
About This Guide	xiii
Introduction	xiii
Scope	xiii
Audience	xiii
Related Publications	xiv
Document Version	xiv
Chapter 1 Introducing the MQAM	1
System Overview	2
Features	2
Input/Output Process	4
Back Panel Components	4
Input/Output Diagram.....	6
Input/Output Stage/Description Table	6
Front Panel Overview	7
Front Panel Diagram	7
Back Panel Overview.....	9
Back Panel Diagram	9
Back Panel Indicator Lights.....	10

Chapter 2 Installing the MQAM	11
Installation Process Summary	12
Before You Begin.....	12
MQAM Installation Processes.....	12
Unpack and Inspect the MQAM.....	14
Carrier's Responsibility.....	14
Unpacking and Inspecting Procedure	14
Install the Modulator Into a Rack	15
Installing the Modulator into a Rack	15
Connect Power Sources.....	16
Connecting an Earth Ground	16
Connecting a DC Power Source.....	16
Connecting an AC Power Source	17
Record the MAC Address.....	18
Recording the MAC Address	18
Connect the RF OUT Ports	20
Location of RF OUT Ports.....	20
Connecting the RF OUT Ports.....	21
Connect the DVB ASI Input Ports	22
Location of DVB ASI Input Ports.....	22
Connecting the DVB ASI Ports	23
Connect the CA SYNC Port.....	24
Location of CA SYNC Port	24
Guidelines for Connecting the CA SYNC Port.....	24
Connecting the CA SYNC Port	25
Connect the 10/100BaseT Ethernet Port.....	26
Description.....	26
Location of 10/100BaseT Ethernet Port	26
Connecting the 10/100BaseT Ethernet Port.....	27
Chapter 3 Provision the MQAM	29
Overview	30
Basic Parameters Tab.....	31
Advanced Parameters Tab.....	33
File Selection Dialog Window.....	34
Connectivity Tab.....	36
Provisioning the MQAM on the DNCS	38

Chapter 4 Operating the Modulator	41
Understand the Boot Process	42
Initial Boot Screens	43
Code Download Messages	44
Change the Boot Mode.....	45
Boot Modes	45
Changing the Boot Mode	46
Read the Default Status Screen	47
Reading the Default Status Screen.....	47
Use the Front Panel Keys to Change Configuration Settings.....	48
Diagram of MQAM Menu Structure.....	48
Accessing the MQAM Menus	49
Navigating Within a Menu or Changing a Screen Value.....	49
Saving Changes to Configuration Settings.....	49
Adjust the Frequencies of a Selected Carrier	50
Adjusting the Output Frequency.....	50
Adjust the RF Output Level of a Selected RF Module.....	51
LEVEL Button Menu Flow	51
Adjusting the RF Output Level.....	51
Mute the RF Output of a Selected RF Module	52
Enabling or Disabling a Muting Option	52
Change the Carrier Mode of a Selected RF Module.....	53
Selecting Modulated or Continuous Wave Carrier Mode	53
Monitor Setup Options.....	54
OPTIONS Menu.....	54
Displaying Alarm Status.....	55
Viewing the Session Count.....	55
Viewing the Program Count	55
Viewing the Encryption Mode.....	56
Viewing the MAC Address	56
Viewing the Netmask Screen	56
Viewing the IP Address	56
Viewing the I/O Board Software Revision Level.....	57
Viewing the RF Module Revision Numbers	57
Checking the Temp of an RF Module	57
Viewing the Hardware Revision String.....	58
Setting the Modulation Type.....	58
ITUB Interleave Screen.....	59
Adjusting the LCD Contrast.....	59
Resetting the MQAM	59
Inspect the Modulator	60
Select an RF Module	61
Selecting an RF Module	61

Contents

Inspect the MQAM	62
Quarterly Inspection.....	62
Replace the Fuse.....	63
Replacing the Fuse.....	63
Diagnose the Fan.....	65
Diagnosing the Fan.....	65
Replace the Fan	66
When Can I Perform This Procedure?	66
Location of Fans	66
Replacing the Fan.....	67
Chapter 5 Troubleshooting the MQAM	69
Alarm Conditions	70
Purpose and Severity Levels of MQAM Alarms.....	70
LCD Alarm Display.....	71
Reading the Display	71
Troubleshooting Alarm Messages.....	72
Front Panel LCD Alarm Messages	72
Troubleshooting Boot Screen Error Messages	79
Booting Error Messages	79
Chapter 6 Customer Information	83
Appendix A Technical Specifications	85
Installation and Operation Requirements	86
Power Requirements Table.....	86
Rack Requirements Table	86
Environmental Requirements Table.....	87
RF Specifications	88
ASI Input Specifications.....	89
Modulation Specifications	90
Modulation Specifications Table	90
Digital I/O Performance Specifications.....	91
Digital I/O Performance Specifications Table.....	91
Connector Type.....	92
Connector Type Table	92
Factory Default Settings.....	93
Factory Default Settings Table	93
Standard Output Frequencies	94
Index	95

Safety Precautions

Read, Retain, and Follow These Instructions

Carefully read all safety and operating instructions before operating this product. Follow all operating instructions that accompany this product. Retain the instructions for future use. Give particular attention to all safety precautions.

Warning and Caution Icons



WARNING:

Avoid personal injury and product damage! Do not proceed beyond any icon until you fully understand the indicated conditions.

The following icons alert you to important information about the safe operation of this product:



You will find this icon in the literature that accompanies this product. This icon indicates important operating or maintenance instructions.



You may find this icon affixed to this product and in this document to alert you of electrical safety hazards. On this product, this icon indicates a live terminal; the arrowhead points to the terminal device.



You may find this icon affixed to this product. This icon indicates a protective earth terminal.



You may find this icon affixed to this product. This icon indicates excessive or dangerous heat.



You may find this symbol affixed to this product and in this document. This symbol indicates an infrared laser that transmits intensity-modulated light and emits invisible laser radiation and an LED that transmits intensity-modulated light.

Heed All Warnings

Adhere to all warnings on the product and in the operating instructions.

Avoid Electric Shock

Follow the instructions in this warning.



WARNING:

To reduce risk of electric shock, perform only the instructions that are included in the operating instructions. Refer all servicing to qualified service personnel.

Servicing



WARNING:

Avoid electric shock! Opening or removing the cover may expose you to dangerous voltages.

Do not open the cover of this product and attempt service unless instructed to do so in the operating instructions. Refer all servicing to qualified personnel only.

Cleaning, Water, Moisture, Open Flame

To protect this product against damage from moisture and open flames, do the following:

- Before cleaning, unplug this product from the AC outlet. Do *not* use liquid or aerosol cleaners. Use a dry cloth for cleaning.
- Do not expose this product to moisture.
- Do not place this product on a wet surface or spill liquids on or near this product.
- Do not place or use candles or other open flames near or on this product.

Ventilation

To protect this product against damage from overheating, do the following:

- This product has openings for ventilation to protect it from overheating. To ensure product reliability, do not block or cover these openings.
- Do not open this product unless otherwise instructed to do so.
- Do not push objects through openings in the product or enclosure.

Placement

To protect this product against damage from breakage, do the following:

- Place this product close enough to a mains AC outlet to accommodate the length of the product power cord.
- Route all power supply cords so that people cannot walk on, or place objects on, or lean objects against them. This can pinch or damage the cords. Pay particular attention to cords at plugs, outlets, and the points where the cords exit the product.
- Make sure the mounting surface or rack is stable and can support the size and weight of this product.



WARNING:

Avoid personal injury and damage to this product! An unstable surface may cause this product to fall.

When moving a cart that contains this product, check for any of the following possible hazards:

- Move the cart slowly and carefully. If the cart does not move easily, this condition may indicate obstructions or cables that you may need to disconnect before moving this cart to another location.
- Avoid quick stops and starts when moving the cart.
- Check for uneven floor surfaces such as cracks or cables and cords.



WARNING:



Avoid personal injury and damage to this product! Move any appliance and cart combination with care. Quick stops, excessive force, and uneven surfaces may cause the appliance and cart to overturn.

Fuse

When replacing a fuse, heed the following warnings.



WARNING:

Avoid electric shock! Always disconnect all power cables before you change a fuse.



WARNING:

Avoid product damage! Always use a fuse that has the correct type and rating. The correct type and rating are indicated on this product.

Grounding This Product (U.S.A. and Canada Only)

Safety Plugs

If this product is equipped with either a three-prong (grounding pin) safety plug or a two-prong (polarized) safety plug, do not defeat the safety purpose of the polarized or grounding-type plug. Follow these safety guidelines to properly ground this product:

- For a 3-prong plug (consists of two blades and a third grounding prong), insert the plug into a grounded mains, 3-prong outlet.

Note: This plug fits only one way. The grounding prong is provided for your safety. If you are unable to insert this plug fully into the outlet, contact your electrician to replace your obsolete outlet.

- For a 2-prong plug (consists of one wide blade and one narrow blade), insert the plug into a polarized mains, 2-prong outlet in which one socket is wider than the other.

Note: If you are unable to insert this plug fully into the outlet, try reversing the plug. The wide blade is provided for your safety. If the plug still fails to fit, contact an electrician to replace your obsolete outlet.

Safety Precautions

Grounding Terminal

If this product is equipped with an external grounding terminal, attach one end of an 18-gauge wire (or larger) to the grounding terminal; then, attach the other end of the wire to an earth ground, such as an equipment rack that is grounded.

20050727 Headend/Rack

FCC Compliance

Where this equipment is subject to U.S.A. FCC and/or Industry Canada rules, the following statements apply.

United States FCC Compliance

This device has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against such interference when this equipment is operated in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case users will be required to correct the interference at their own expense.

Canada EMI Regulation

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la class A est conforme à la norme NMB-003 du Canada.

20061110 FCC HE

About This Guide

Introduction

This guide describes the following Multiple Quadrature Amplitude Modulation (MQAM) modulator models and includes installation and operation procedures.

- Model D9477-1 120 V AC (part number 592800)
- Model D9477-2 48 V DC (part number 714330)
- Model D9477-3 230 V AC (part number 4000833)

Scope

This guide includes the following topics:

- Descriptions of MQAM modulator functions
- Descriptions of MQAM modulator components
- Installation procedures
- Operation procedures
- Troubleshooting guidelines
- Customer support information
- MQAM modulator technical specifications for installation

Audience

This guide is written for the system administrator of the Digital Broadband Delivery System (DBDS), operators of the Digital Network Control System (DNCS), call center personnel, and system operators who are responsible for installing and operating the MQAM modulator.

Related Publications

You may find the following publications useful as resources when you implement the procedures in this document.

- *DBDS Utilities Version 5.1 Installation Instructions and DNCS Utilities User's Guide* (part number 740020)
- *DBDS Utilities Version 6.1 Installation Instructions and DNCS Utilities User's Guide* (part number 4020695)
- *MQAM Modulator Software Version 2.4.10 Release Notes and Installation Instructions* (part number 732583)
- *MQAM Software Version 2.6.10 Release Notes and Installation Instructions* (part number 745250)

For more information, refer to the following publication: *ITU-T Recommendation J.83. April 1997. Digital multi-programme systems for television, sound and data services for cable distribution. Telecommunication Standardization Sector of the International Telecommunication Union*, available from the ITU.

Document Version

This is the fourth release of this guide. In addition to minor text and graphic changes, the following table provides the technical changes to this guide.

Description	See Topic
Updated all safety information	Throughout document
Removed all references to locking the MQAM front panel	Throughout document

1

Introducing the MQAM

Introduction

This chapter illustrates how the Multiple Amplitude Modulation modulator (MQAM) functions within the Digital Broadband Delivery System (DBDS), describes MQAM processing, and describes the front and back panel of the MQAM.

In This Chapter

■	System Overview	2
■	Input/Output Process	4
■	Front Panel Overview	7
■	Back Panel Overview	9

System Overview

The MQAM delivers compressed and encoded, multi-program Moving Picture Expert Group (MPEG) transport streams of interleaved voice, video, and data in the RF spectrum to Digital Home Communications Terminals (DHCTs). The MQAM performs the following functions within the DBDS:

- Uses two ASI inputs to allow:
 - MPEG stream multiplexing of two MPEG data sources
 - Use of the second input as a redundant port
- Allows direct input from a variety of MPEG data sources at various rates, such as video-on-demand (VOD) servers, SONET-to-ASI converters, Grooming BIGs, and Multiple Decryption Receivers (MDR)
- Processes an MPEG transport stream (TS) at various rates
- Allows Stream Encryption and Management
- Contains four, independent RF Output channels, allowing the MQAM to use only one unit of rack space for the MQAM hardware and one unit of rack space for ventilation while replacing the RF output capabilities of four D9476 QAM Modulators

Features

The MQAM provides many digital broadcast features and innovations for your system. The following table describes these features and innovations.

Feature	Function
Dual ASI Inputs	<ul style="list-style-type: none"> ■ Supports maximum ASI data rate at both inputs (216 Mbps each)
Multiplexing Functionality	<ul style="list-style-type: none"> ■ Program and Packet Identifier (PID) remapping and filtering ■ Full routability of MPEG programs. The MQAM can route any MPEG program from both of its inputs to any combination of outputs. ■ Single programs can be sent to any combination of the four RF outputs simultaneously (multicast).

Feature	Function
MPEG Stream Management	<ul style="list-style-type: none"> ■ Program Clock Reference Timestamp Correction ■ Program Specific Information Reconstruction ■ MPEG Packet Insertion: System Information (SI), Entitlement Control Messages (ECMs), Program Map Tables (PMTs) ■ Transport Stream Monitoring ■ Adaptive Insertion Rate Control
Stream Encryption, Conditional Access, and Management	<ul style="list-style-type: none"> ■ Encryption Mode: PowerKEY® Conditional Access ■ PowerKEY Book One ECM Handling ■ Supports broadcast clear-to-air and encrypted PowerKEY data
Four 16/64/256-QAM RF Output Channels	<ul style="list-style-type: none"> ■ Separate physical connector for each output ■ Independent control of frequency and level ■ Electronically tunable output center frequency range of 91 to 867 MHz ITU-T J.83 Annex-A and Annex-B standards ■ RF output level monitor ■ Switched filter bank for superior broadband combined noise performance ■ Spectral Inversion can be turned on or off ■ Variable Symbol Rate can be set for ITU-T J.83 Annex-A (DVB/DAVIC) modulation modes

Input/Output Process

This section describes how the MQAMs modulate, encrypt, and transmit the signals they receive from external sources.

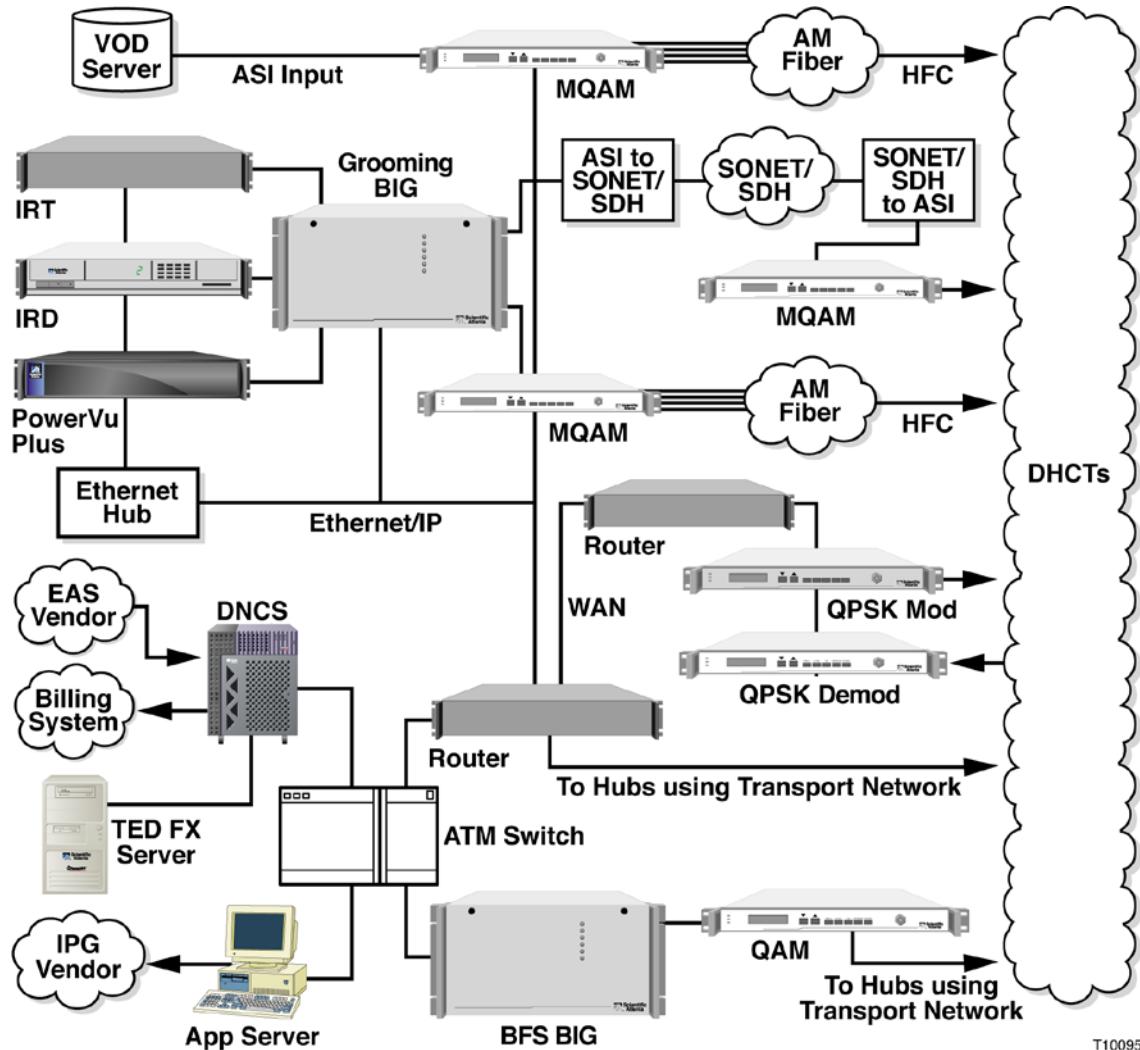
Back Panel Components

The following table describes the back panel components.

Item	Component	Description
1	AC Unit: AC Power Inlet	IEC 320-conductor grounded outlet
2	AC Unit: Power Switch	On/off rocker-type power switch
3	DC Unit: DC Power Inlet	Two-post terminal block DC power input connection
4	Fuse Holder	<ul style="list-style-type: none"> ■ (AC Unit) 2.0 A SLO BLO 250 V fuse (Cisco part number 535391, International T2H) ■ (DC Unit) 2.5 A SLO BLO 250 V fuse (Cisco part number 184428)
5	Cooling Fan	Removes heat from the chassis
6	GND	Ground screw for grounding the MQAM
7	RF OUT 4	F-connector for RF output, 75 Ω
8	RF OUT 3	F-connector for RF output, 75 Ω
9	RF OUT 2	F-connector for RF output, 75 Ω
10	RF OUT 1	F-connector for RF output, 75 Ω
11	Cooling Fan	Removes heat from the chassis
12	DVB ASI INPUT 1	Female BNC, 75 Ω connector. Allows for the input of MPEG 2 TS data at a maximum rate of 216 Mbps
13	DVB ASI INPUT 2	Female BNC, 75 Ω connector. Allows for the input of MPEG 2 TS data at a maximum rate of 216 Mbps
14	CA SYNC	RS-232 connection to a DB-9 9-pin port used for diagnostics. Can be used either locally or in conjunction with a VPN
15	10 BASE T	Ethernet Port. Shares data with Digital Network Control System Ethernet hub

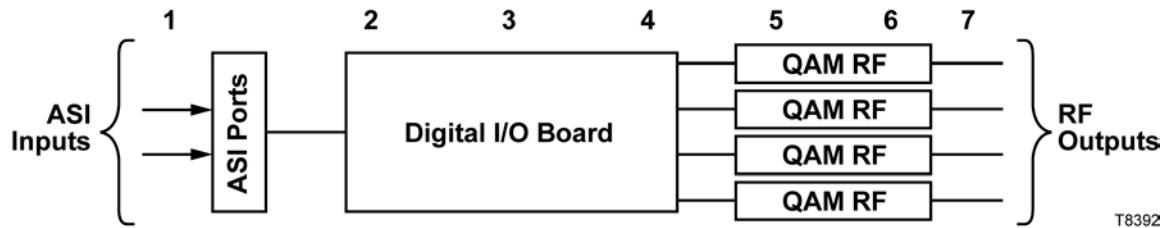
Major DBDS Components

Depending on the system architecture, MQAM can be used in either headends or in hubs. The following illustration provides examples of where the MQAM can be used with the major components of the DBDS.



Input/Output Diagram

The following diagram illustrates the stages of the input/output process for the MQAM.



Note: The stage numbers correspond with the following table.

Input/Output Stage/Description Table

The following table describes the stages of the I/O process of the MQAM. The numbers correspond to the above I/O diagram.

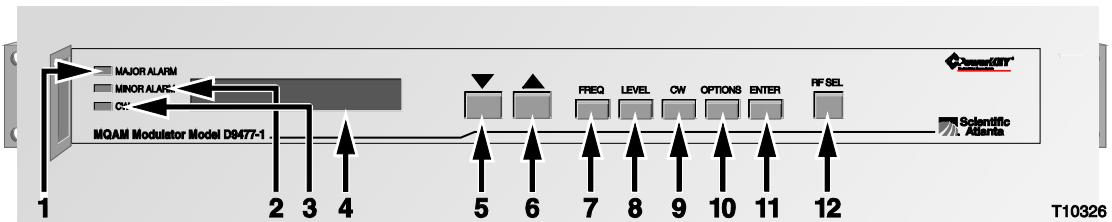
Stage	Description
1	MPEG TS packets are received. The MQAM ASI input ports receive data from different physical layer sources and extract the MPEG TS packets.
2	Packets are routed. The digital I/O board timestamps the packets and filters them according to their PID values.
3	Conditional Access is added. The digital I/O board implements PowerKEY Conditional Access. Note: The digital I/O board also inserts ECMs and Entitlement Management Messages (EMMs) into the MPEG TS packet stream.
4	Packets are transferred to the QAM RF Board. The digital I/O board provides a constant stream of MPEG TS packets to each modulator board. If no packets are available for the modulator boards, the digital I/O board generates an MPEG stuff packet.
5	Data frame is assembled. The QAM RF Board assembles the MPEG packets into a transmission data frame. Forward Error Correction (FEC) parity bytes are added to the data, and interleaving and scrambling are performed on the data for the selected ITU-T specification.
6	Data frame is modulated. The modulator board modulates the data frame.
7	Signal is output through four, independent QAM Modulator output assemblies with a QAM signal frequency between 91 and 867 MHz.

Front Panel Overview

Front Panel Diagram

The following illustration shows the front panel components of the MQAM modulator. The labeled areas are described in the table below.

Note: The front panel components are identical for each model of the MQAM modulator.



Item	Component	Description
1	MAJOR ALARM indicator	This LED is red and lights for a major alarm condition. Major alarms occur for hardware or software conditions that indicate a serious disruption of service or the malfunctioning or failure of important circuits. The LED goes off when all major alarms have cleared.
2	MINOR ALARM indicator	This LED is yellow and lights for a minor alarm condition. Minor alarms indicate a less critical error condition. The modulator may continue to operate with some loss of functionality. The LED goes off when all minor alarms have cleared.
3	CW indicator	This LED is yellow and lights when any one of the RF carriers is set to continuous wave (CW) mode.
4	LCD alphanumeric display screen	This screen displays status and operating screens controlled by the front panel keys.
5		The Down Arrow key decrements a displayed value or navigates through a set of displayed values. This key is only active when the display has a flashing value, which indicates that the value can be changed. This key is primarily used for decreasing a displayed value such as frequency or level.
6		The Up Arrow key increments a displayed value or navigates through a set of values. This key is only active when the display has a flashing value, which indicates that the value can be changed. This key is primarily used for incrementing a displayed value such as frequency or level.

Item	Component	Description
7	FREQ 	The Frequency key selects the frequency display screen on which you can adjust the RF output frequency for each of the RF carriers.
8	LEVEL 	The Level key selects the RF Output Level screen on which you can adjust the RF output power level and mute the RF output (42 to 56 dBmV).
9	CW 	The Continuous Wave (CW) key selects the Continuous Wave Screen on which you can set the modulator to output either a modulated carrier or a continuous carrier for each of the RF carriers. Note: CW mode is used for testing and not for normal operation.
10	OPTIONS 	The Options key scrolls through status information and setup options.
11	ENTER 	The Enter key saves configuration changes to nonvolatile memory.
12	RF SEL 	The RF Port Selection (RF SEL) key selects one of the RF outputs that is controlled or monitored by the front panel.

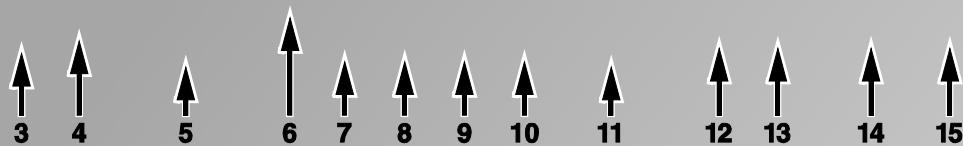
Back Panel Overview

Back Panel Diagram

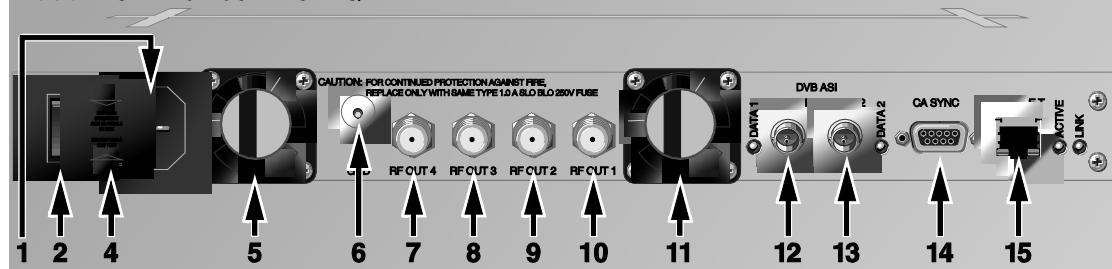
This illustration shows the back panel components for each type of MQAM.

Note: Not all components appear on all models.

Model D9477-1 110V AC MQAM



Model D9477-3 230V AC MQAM



Back Panel Indicator Lights

The following table describes the back panel indicator lights.

Indicator Light	Description
DATA 1 (green)	Lights when the DVB ASI Input 1 port is receiving valid MPEG-2 transport stream (TS) packets
DATA 2 (green)	Lights when the DVB ASI Input 2 port is receiving valid MPEG-2 TS packets
LINK (yellow)	Lights when a valid 10 Base-T Ethernet link connection exists
ACTIVE (green)	Lights when data traffic is on the Ethernet link

2

Installing the MQAM

Introduction

This chapter describes how to install the MQAM into a rack and where to connect the MQAM to the other components within the DBDS. The connections used for the MQAM vary according to its use in your system.

Refer to *Technical Specifications* (on page 85) for additional technical specifications to help you install the MQAM in your system.

In This Chapter

■ Installation Process Summary	12
■ Unpack and Inspect the MQAM.....	14
■ Install the Modulator Into a Rack.....	15
■ Connect Power Sources.....	16
■ Record the MAC Address.....	18
■ Connect the RF OUT Ports	20
■ Connect the DVB ASI Input Ports	22
■ Connect the CA SYNC Port.....	24
■ Connect the 10/100BaseT Ethernet Port.....	26

Installation Process Summary

This section provides the installation process and lists the detailed procedures in this guide that correspond with each process step.

Important: To ensure proper installation, read this entire guide *before* starting installation and then follow these processes in the order shown.

Before You Begin

This process assumes that you have already installed the MQAM software on the DNCS. Refer to the release notes and installation instructions for your version of MQAM software for detailed instructions. Also be sure that you have access to the *Digital Network Control System Online Help* for your system release before installing the MQAM.

MQAM Installation Processes

The following process summary provides the recommendations for an MQAM installation.

Stage	Process	See Procedure
1	Review system requirements and technical specifications.	<ul style="list-style-type: none"> ■ <i>Installation and Operation Requirements</i> (on page 86) ■ <i>Technical Specifications</i> (on page 85)
2	Consult your Bandwidth Management Plan and the MQAM input and output specifications to allocate your bandwidth resources properly.	<ul style="list-style-type: none"> ■ <i>Installation and Operation Requirements</i> (on page 86) ■ <i>Technical Specifications</i> (on page 85)
3	Unpack and inspect the MQAM.	<ul style="list-style-type: none"> ■ <i>Unpack and Inspect the MQAM</i> (on page 14)
4	Install the MQAM into a rack.	<ul style="list-style-type: none"> ■ <i>Install the Modulator Into a Rack</i> (on page 15)
5	Connect the MQAM to an earth ground and then the power source. <ul style="list-style-type: none"> ■ For the 120/230 V AC MQAM, connect the power cord. ■ For the 48V DC MQAM, connect the power wires to the DC power inlet. 	<ul style="list-style-type: none"> ■ <i>Connect Power Sources</i> (on page 16)

Stage	Process	See Procedure
6	Do the following: <ul style="list-style-type: none"> ■ Power up the MQAM. ■ Record the MQAM MAC address from the front-panel display. ■ Turn off the MQAM. 	<ul style="list-style-type: none"> ■ <i>Record the MAC Address</i> (on page 18)
7	Connect other network devices to the MQAM, <u>except</u> the RF OUT ports.	<ul style="list-style-type: none"> ■ <i>Connect the DVB ASI Input Ports</i> (on page 22) ■ <i>Connect the CA SYNC Port</i> (on page 24) ■ <i>Connect the 10/100BaseT Ethernet Port</i> (on page 26)
8	Define the MPEG sources and provision the MQAM using DNCS Element Provisioning according to your network wiring diagram.	<ul style="list-style-type: none"> ■ <i>Provision the MQAM</i> (on page 29) ■ <i>Digital Network Control System Online Help</i> for your system release
9	Power up the MQAM	<ul style="list-style-type: none"> ■ <i>Connect Power Sources</i> (on page 16)
10	Ensure that the MQAM boots correctly and check for alarms from the front panel.	<ul style="list-style-type: none"> ■ <i>Understand the Boot Process</i> (on page 42) ■ <i>Troubleshooting Alarm Messages</i> (on page 72) ■ <i>Troubleshooting Boot Screen Error Messages</i> (on page 79)
11	If sessions have been defined for the MQAM path, verify the correct session count by pressing the OPTIONS button.	<ul style="list-style-type: none"> ■ <i>Monitor Setup Options</i> (on page 54)
12	If encrypted, check the program count.	<ul style="list-style-type: none"> ■ <i>Viewing the Program Count</i> (on page 55)
13	Connect the RF output ports.	<ul style="list-style-type: none"> ■ <i>Connect the RF OUT Ports</i> (on page 20)
14	Set the power output level for each RF Module in accordance with your network wiring diagram and spectrum analyzer measurements.	<ul style="list-style-type: none"> ■ <i>Adjust the RF Output Level of a Selected RF Module</i> (on page 51)
15	Verify video and audio from a local DHCT.	See the post-upgrade procedures for your current System Release contained in the upgrade installation instructions.

Unpack and Inspect the MQAM

Carrier's Responsibility

Cisco thoroughly inspects and carefully packs all products before shipment. The carrier is responsible for safe shipping and delivery.

- If there are any missing parts or if there is damage to the product contact Cisco Services.
- Retain all boxes for future equipment shipping needs. The boxes are specifically designed for shipping the MQAM.

Unpacking and Inspecting Procedure

Complete the following steps to unpack and inspect the modulator.

- 1 Review the Safety Precautions.
- 2 Inspect the shipping carton for visible damage.
- 3 Open the shipping carton.
- 4 Remove all packing material.
- 5 Inspect the product for visible damage.
- 6 Inspect for loose items that may indicate concealed damage.
- 7 Inspect for missing parts using the packing slip as a guide.

Install the Modulator Into a Rack

The front bezel of the MQAM mounts to the front of the equipment rack. The MQAM fits into an EIA RS-310 rack mount.

Refer to *Installation and Operation Requirements* (on page 86) for rack size, power, and environmental requirements.

Installing the Modulator into a Rack



CAUTION:

Do not tangle or strain interconnecting cables.

Use caution when installing wiring and racks to avoid obstruction of airflow into the side air vents of the MQAM or out of the vent fans on the side of the MQAM.

IMPORTANT: You must use the supplied notched rack mounts to provide additional support and to allow correct air circulation through the unit.

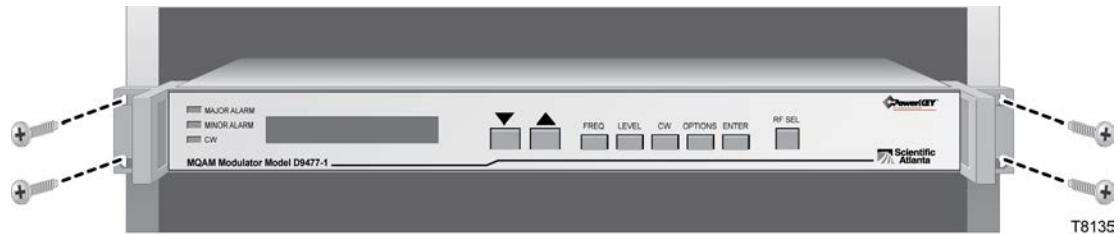
- 1 Install the rack mounts.

Important: Additional mechanical support for the MQAM is strongly recommended due to the stress of cabling. Angle Support Brackets (Cisco part number 345763), which provide additional support, provide the following:

- Attaches directly to the rack
- Allows you to slide modulators partially out of the rack for service
- Allows appropriate air circulation throughout the unit

- 2 Place the modulator in the rack.

- 3 Insert a mounting screw through each of the four-bezel mounting holes on the front panel of the MQAM and then into the rack.



- 4 Firmly tighten each mounting screw.

- 5 Install 1 RU vent panel above the MQAM.

Note: The Cisco part number for a V-1 spacer louvered vent panel is 279070.

Connect Power Sources

This section contains instructions for connecting the DC and AC power sources to the modulator.

Connecting an Earth Ground

Complete the following steps to connect an earth ground to either the DC or AC versions of the MQAM.



CAUTION:

The 48 V DC MQAM must be connected to an earth ground.

- 1 Place a ground wire onto the ground lug (marked **GND**) on back of the MQAM; then, use your fingers to tighten the ground lug to secure the ground wire.
- 2 Connect the other end of the ground wire to the rack or earth ground.

Connecting a DC Power Source

Complete the following steps to connect a DC power source to the 48 V DC Dual SFP GQAM.

- 1 Verify that the DC power source is set to the **Off** position.
- 2 Insert the wires from the DC power source into the terminal block connector. Use a small flat-blade screwdriver to tighten the screws at the top of the terminal block connector to secure the wires.



T8786

- 3 Insert the terminal block connector into the terminal block on the back panel of the 48 V DC MQAM.
- 4 Keep the DC power source set to the **Off** position until you are ready to power on the modulator.

Connecting an AC Power Source

Complete the following steps to connect an AC power source to the 120/230 V AC Model D9477-1 or Model D9477-3 MQAM.

- 1 Verify that the power switch on the back panel is placed in the **Off** position.
- 2 Connect the power cord to the AC power inlet on the back panel of the 120/230 V AC Model D9477-1 or Model D9477-3 MQAM.
- 3 Connect the other end of the power cord to an AC electrical outlet.
- 4 Keep the power switch in the **Off** position until you are ready to power on the device.

Record the MAC Address

This section contains instructions for recording the Media Access Control (MAC) address by powering on the MQAM to record the MAC address as part of the installation process.

Note: Refer to *Connect Power Sources* (on page 16) before you power up an MQAM to record the MAC address.

Recording the MAC Address

Follow these steps to power up the MQAM and record the MAC address.

1 Choose one of the following:

- For the 120 or 230V AC MQAM, verify that the power switch on the back of is placed in the **Off** position.
- For the 48V DC MQAM, verify that the DC power supply is set to the **Off** position.

2 Choose one of the following:

- For the 120 or 230V AC MQAM, press the power switch on the back panel to the **On** position.
- For the 48V DC MQAM, switch the power supply to the **On** position.

Result: The MQAM begins the boot process during which time it displays the MAC address.

Example:

MAC Address
00:02:DE:81:E7:DB

3 Record the MAC address when it appears on the front panel LCD.

Notes:

- When the MQAM is set to boot mode 2 (default setting), it cycles through the boot process and displays the MAC Address window repeatedly, as long as the MQAM is not connected to the network.
- If the MQAM is set to boot mode 0 or 1, the MQAM also displays the MAC address as it boots. After the boot process is complete, the MQAM displays the default status window.

Example:

RF1 285.00 MHz	50.0dBmV
ITUB 256QAM	ALARM 0

Note: After the default status window appears, press the OPTIONS button until the MAC address displays. See *Read the Default Status Screen* (on page 47) for more information.

Record the MAC Address

4 Choose one of the following:

- For the 120 or 230V AC MQAM, press the power switch on the back panel to the **Off** position.
- For the 48V DC MQAM, switch the power supply to the **Off** position.

Connect the RF OUT Ports

The RF OUT ports of the MQAM should be connected to a system of combiners, through the cable system, and eventually to subscribers' DHCTs. Each RF port provides for the transport of MPEG-2 TS data. The ports use F-connectors and $75\ \Omega$ coaxial cable interfaces.



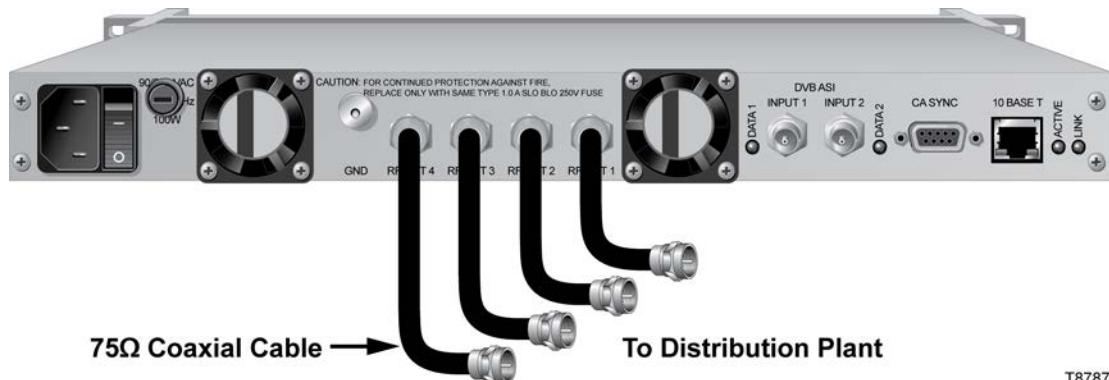
CAUTION:

Turning on the MQAM with default RF output level may cause RF interference with the services of other units connected to the network. Therefore, set the RF output frequency and RF output level before you connect any RF OUT ports to the network.

Important! We strongly recommend that you configure and adjust frequencies from the Set Up GQAM window on the DNCS. See *Provisioning the MQAM on the DNCS (on page 38)* for detailed instructions.

Location of RF OUT Ports

The following illustration shows an example of the four RF OUT ports connected to the distribution plant.



T8787

Connecting the RF OUT Ports

Follow these steps to connect the RF OUT ports.



CAUTION:

Turning on the MQAM with default RF output level may cause RF interference with the services of other units connected to the network. Therefore, set the RF output frequency and RF output level before you connect any RF OUT ports to the network.

Important! We strongly recommend that you configure and adjust frequencies from the Set Up GQAM window on the DNCS. See *Provisioning the MQAM on the DNCS (on page 38)* for detailed instructions.

- 1 Refer to your network wiring diagram to connect the MQAM properly.
- 2 Locate the RF OUT or IF OUT ports on the back panel of the MQAM.
- 3 Connect one end of a 75Ω coaxial cable to each port to be used for the MQAM.
- 4 Verify that you have established the correct output level for the RF OUT ports by completing the following steps:
 - a Connect the MQAM to a spectrum analyzer to measure radio frequency levels.
 - b Set the RF output levels from the front panel of the MQAM.
 - c Provision the MQAM from the DNCS.
- 5 Connect the other end of each 75Ω coaxial cable to the distribution plant.

Connect the DVB ASI Input Ports

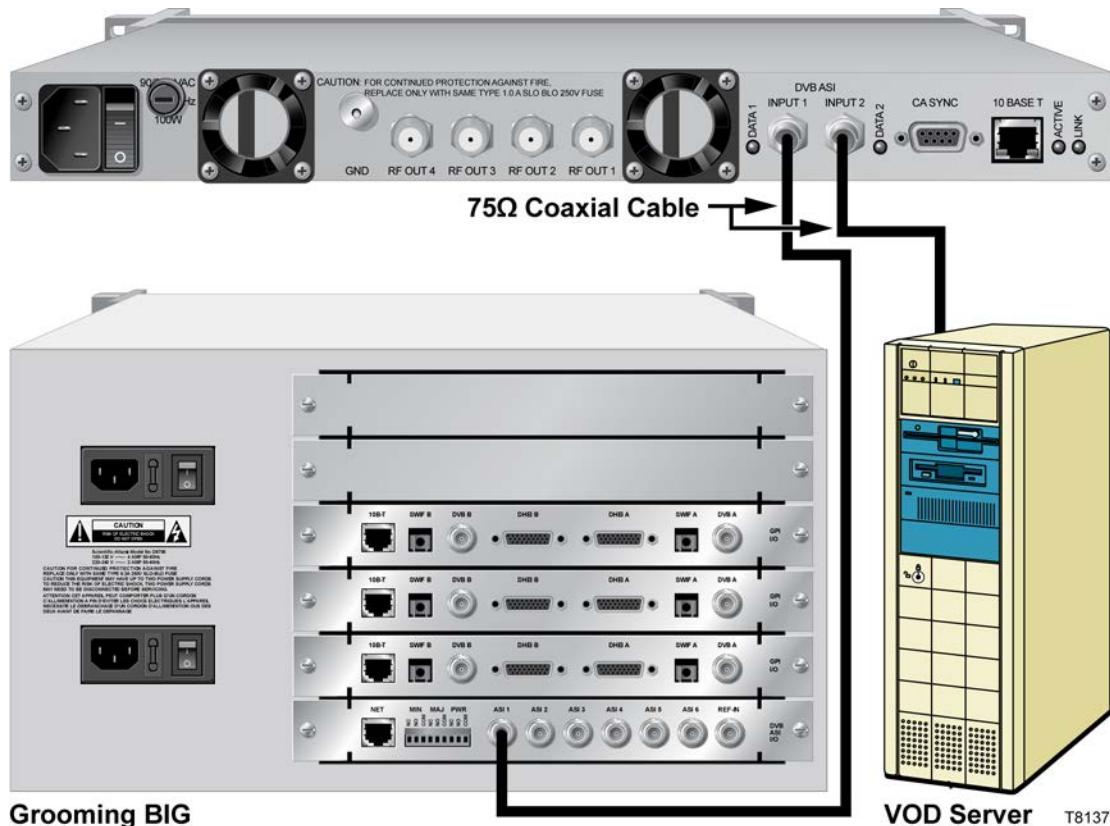
The MQAM uses two asynchronous interface (ASI) input ports to receive data from the following types of DVB ASI-compliant transmitting devices:

- VOD Server
- PowerVu Plus
- Multiple Decryption Receiver (MDR)
- Grooming BIG
- SONET-ASI Interface

These ports conform to the DVB document A010. The DVB ASI Input ports are BNC-type connectors and connect to 75Ω coaxial cables. Each DVB ASI Input port allows for the input of MPEG-2 TS data at a maximum rate of 216 Mbps.

Location of DVB ASI Input Ports

The following illustration shows an example of an MQAM connected to DVB ASI sources.



Connecting the DVB ASI Ports

Refer to your network wiring diagram to cable the MQAM in accordance with your bandwidth allocation plan.

Follow these steps to connect each of the DVB ASI Input ports.

- 1 Locate the DVB ASI I/O Card on the back of an output device, such as a Grooming BIG or a VOD server.
- 2 Connect one end of a 75Ω coaxial cable to a DVB ASI source in accordance with your network wiring diagram.

Note: The maximum recommended length for the 75Ω coaxial cable is 100 meters.

- 3 Connect the other end of the 75Ω coaxial cable to the DVB ASI INPUT 1 or the INPUT 2 port on the MQAM.

Note: If you do not use both ASI inputs, the MQAM displays an ASI - Loss of Input Signal alarm for the unused port.

Connect the CA SYNC Port

The MQAM contains a DB-9 9-pin male CA SYNC port to connect to a diagnostic PC or a virtual private network (VPN). This port is for diagnostic use, and is not designed to be connected for normal operation.



CAUTION:

Improper use of the CA SYNC port could cause the MQAM to malfunction. Untrained personnel should not use this port.

Location of CA SYNC Port

The following illustration shows a diagnostic PC connected to the CA SYNC port.



Guidelines for Connecting the CA SYNC Port

Follow these guidelines when connecting a diagnostic PC:

- Use a DB-9-female-to-DB-9-male data cable, connected straight through.
- The default baud rate is 9600 with no flow control. Additional baud rate settings are as follows:
 - "N" for flow control
 - 8 bytes
 - 1 for stop bits

Connecting the CA SYNC Port

Follow these steps to connect the CA SYNC port to a diagnostic PC.

- 1 Connect the male end of a DB-9 data cable to the CA SYNC port on the back of the MQAM.

Note: The cable connection is straight through.

- 2 Connect the other end of a DB-9 data cable to one of the following:

- An available serial port on the diagnostic PC
- A terminal server of a VPN

Note: The maximum length for the ribbon cable is 50 ft.

Connect the 10/100BaseT Ethernet Port

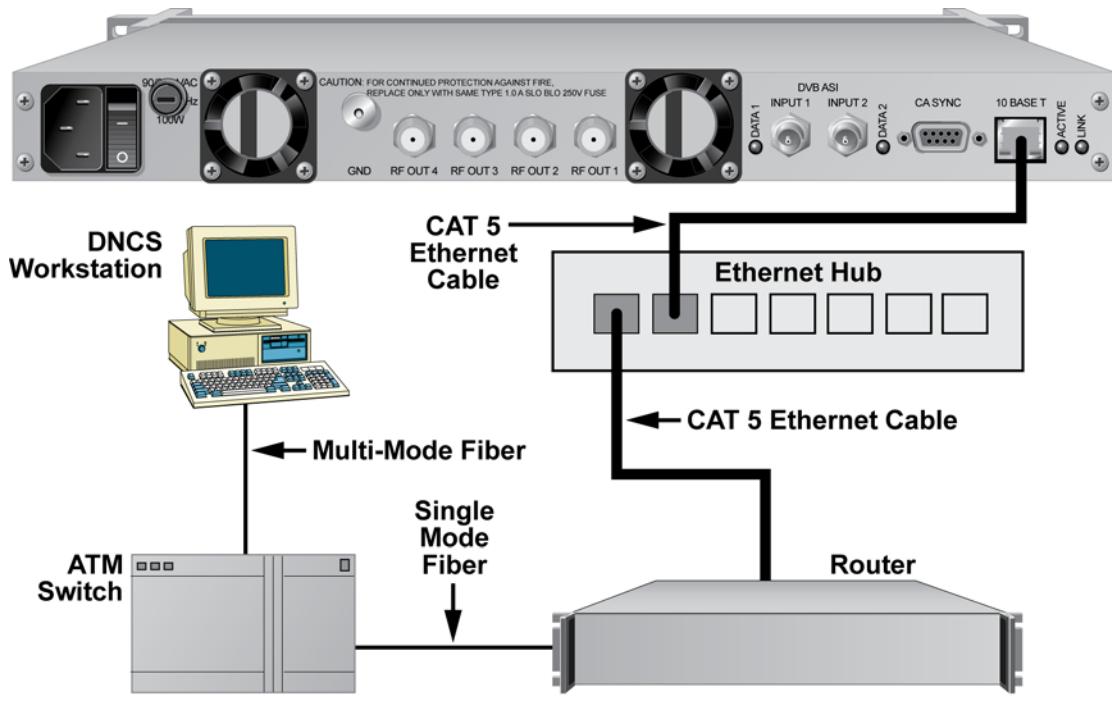
Description

The MQAM shares data with the DNCS through an ATM switch, a router, and an Ethernet hub. An Ethernet connection enables the DNCS to perform software downloads, provision the MQAM, set up broadcast sessions, monitor alarms, and check system performance.

Note: Connect the 10/100BaseT Ethernet port on the MQAM to an Ethernet hub as part of an Ethernet connection. Do not connect it directly to a DNCS workstation or another PC.

Location of 10/100BaseT Ethernet Port

The following illustration shows an example of a 10/100BaseT Ethernet connection for the MQAM.



T8139

Connecting the 10/100BaseT Ethernet Port

Follow these steps to connect the MQAM to the Ethernet network.

- 1 Connect the DNCS to the ATM switch using multi-mode fiber.
- 2 Connect the ATM switch to the router using single-mode fiber.
- 3 Connect the router to the 10/100BaseT Ethernet hub using CAT-5 Ethernet 10/100BaseT wiring with RJ-45 connectors.
- 4 Connect the 10BaseT port on the MQAM to the QAM 10BaseT Ethernet hub using 8-conductor Unshielded/Shielded Twisted Pair (UTP/STP) Ethernet 10BaseT wiring with RJ-45 connectors.

Note: For the Model D9477-3 MQAM, use a screened or shielded cable to connect the MQAM to the QAM 10BaseT Ethernet hub. Place one ferrite clamp (part number 1000636) within 0.5 inch of the connector on the MQAM end of the cable.

3

Provision the MQAM

Introduction

This chapter provides examples and descriptions of the DNCS graphical user interfaces (GUIs) used for provisioning (configuring) the MQAM as a network element from the DNCS.

Note: See *Technical Specifications* (on page 85) for the technical specifications of the MQAM and consult your network wiring diagram when you provision the MQAM to ensure a proper allocation of bandwidth.

In This Chapter

■ Overview.....	30
■ Basic Parameters Tab.....	31
■ Advanced Parameters Tab	33
■ Connectivity Tab.....	36
■ Provisioning the MQAM on the DNCS.....	38

Overview

Provisioning the MQAM establishes communication between the DNCS and the MQAM. To provision the MQAM, the system administrator must do the following:

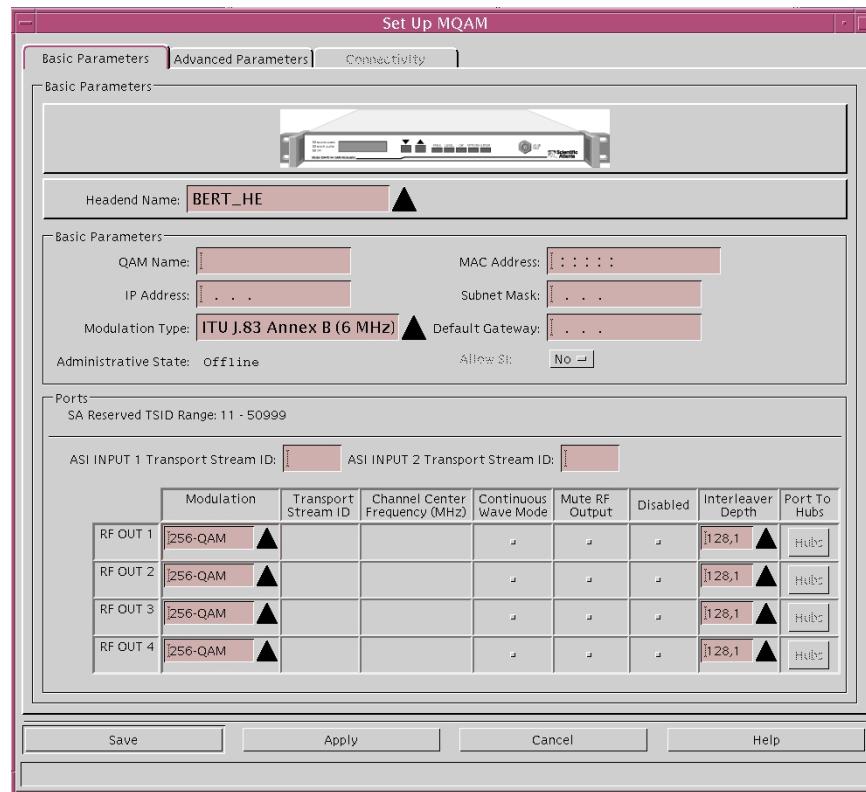
- Enter the IP and physical (MAC) addresses of the MQAM.
- Assign a name to the MQAM.
- Associate the MQAM with a headend.
- Set the RF frequencies for the MQAM.

Basic Parameters Tab

The Basic Parameters tab on the Set Up MQAM window appears when you do the following:

- 1 From the DNCS Administrative Console, select one of the following tabs:
 - For SR 2.7/3.7/4.2 and later, click the **Network Element Provisioning** tab.
 - For SR 2.5/3.5/4.0 and earlier, click the **Element Provisioning** tab.
- 2 Click **QAM**. The QAM List window opens.
- 3 From the **File** menu of the QAM List window, choose **New** and select **MQAM**. The Set Up MQAM window opens, with the Basic Parameters tab selected.

The Basic Parameters tab allows you to identify the MQAM, assign it to a headend, and specify the modulation type for each of the four RF Out ports. The following diagram shows an example of the Basic Parameters tab of the Set Up MQAM window.



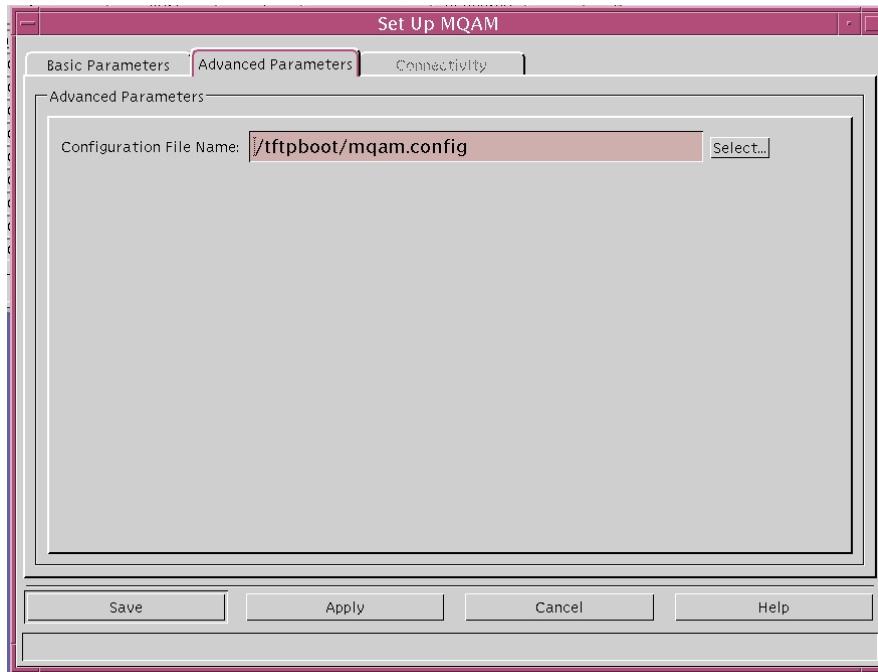
The following table lists field descriptions on the Basic Parameters tab.

Field	Description
Headend Name	The name of the headend with which the MQAM is associated.
QAM Name	The name used for the MQAM.
IP Address	The Internet Protocol address for the MQAM assigned by the system administrator.
Physical Address	The MAC address of the MQAM .
Subnet Mask	IP Subnet Mask. For a class B IP network, the standard mask is 255.255.0.0.
Administrative State	Specifies whether the MQAM is active within the system. The values are: <ul style="list-style-type: none"> ■ Offline - Default ■ Online - The MQAM is active in the system
ASI INPUT 1 Transport Stream ID	Represents the identifier of the MPEG transport stream generated upstream of the MQAM. A unique value is assigned to the ASI INPUT 1 port on the MQAM. MQAMs only accept DVB-ASI input.
ASI INPUT 2 Transport Stream ID	Represents the identifier of the MPEG transport stream generated upstream of the MQAM. A unique value is assigned to the ASI INPUT 2 port on the MQAM. MQAMs only accept DVB-ASI input.
Transport Stream ID	The identifier of the MPEG transport stream generated by the corresponding RF output of the MQAM. A unique value must be assigned to each of the 4 RF output ports.
Modulation Type	Allows you to specify one of five modulation types for each of the four RF OUT ports. The following modulation types are valid: <ul style="list-style-type: none"> ■ DAVIC 1.0, 16 QAM ■ DAVIC 1.0, 64 QAM ■ DAVIC 1.0, 256 QAM ■ ITUB 64 QAM ■ ITUB 256 QAM
Channel Center Frequency (MHz)	The frequency assigned to each RF output port (range is 91 to 867 MHz). Valid frequencies use the following format, with X representing some number: <ul style="list-style-type: none"> ■ XXX.000 ■ XXX.25 ■ XXX.75

Advanced Parameters Tab

The Advanced Parameters tab of the Set Up MQAM window allows you to select the configuration file for the MQAM.

The following diagram shows an example of the Advanced Parameters tab of the Set Up MQAM window.



The following table lists field descriptions on the Advanced Parameters tab.

Field	Description
Configuration File Name	The name of the configuration file used by the MQAM to determine whether it is running the correct version of application code.

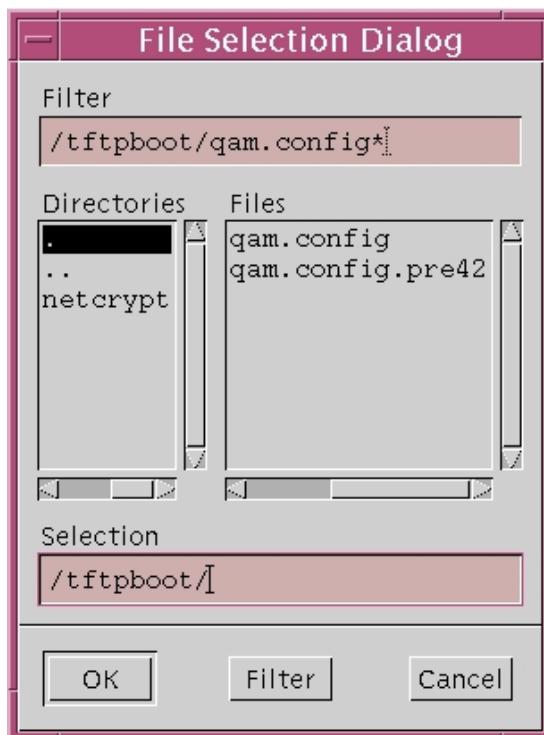
File Selection Dialog Window

The File Selection Dialog window appears when you click the **Select** button on the Advanced Parameters tab. This window lets you specify the configuration file for the MQAM.

The boot/tftp process allows the MQAM, after power up or reset, to request and receive configuration parameters, application downloads, and provisioning from the network bootp server.

When an MQAM boots, it sends a bootp request to get an IP address. The DNCS, which is a bootp server, uses a bootp reply to assign an IP address to the MQAM, if the unit is provisioned in the DNCS database. The configuration file selected in the File Selection Dialog window is included in the bootp reply. The MQAM uses the information in the configuration file to determine whether it is running the correct version of application code. If the MQAM is not running the correct version of application code, it requests the correct image file from the DNCS.

The following diagram shows an example of the File Selection Dialog window.



The following table lists field descriptions on the File Selection Dialog window.

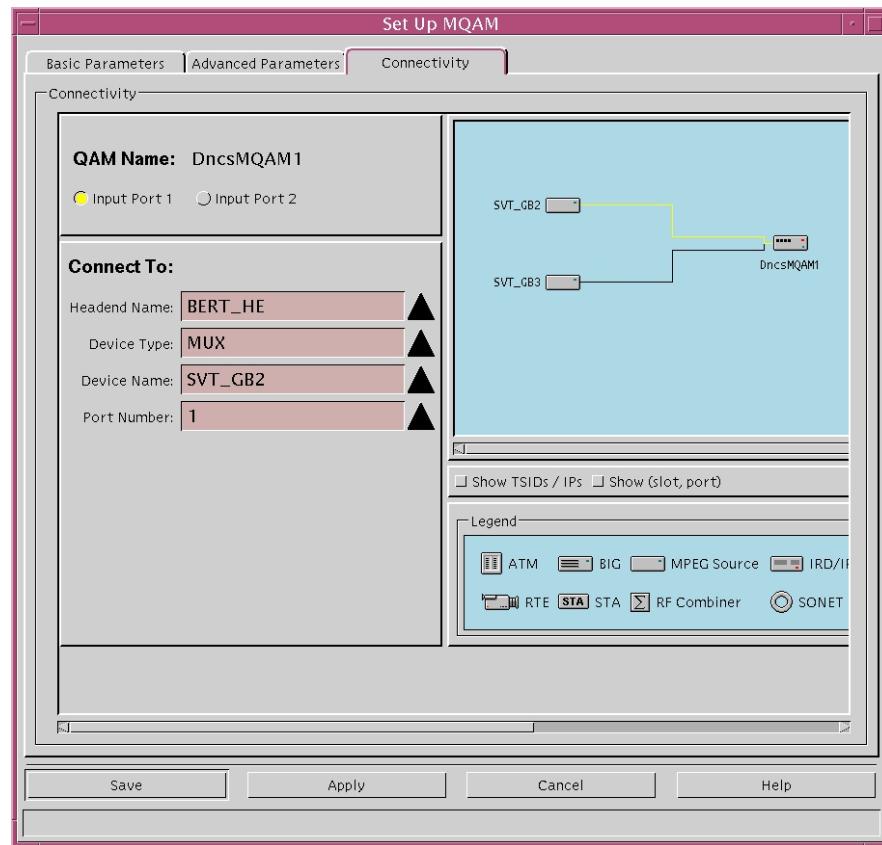
Field	Description
Filter	The path and filename wildcard used by the system to search for files. Enter the UNIX path, ending with /*. This displays the contents of directory in the Directories and Files fields of this window when you click Filter .
Directories	Displays a list of available directories at the current path specified in the Filter field.
Files	Displays a list of files within the current path specified in the Filter field.
Selection	This field displays the selected file.

Connectivity Tab

The Connectivity tab of the Set Up MQAM window allows you to specify the input device connected to each of the Input ports on the MQAM.

Note: When you first provision the MQAM, the Connectivity is active only after you click **Apply** or **Save** from the Set Up MQAM window. Thereafter, the Connectivity tab is accessible for viewing or modification.

The following diagram shows an example of the Connectivity tab of the Set Up MQAM window.



The following table lists field descriptions on the Connectivity tab.

Field	Description
QAM Name	Identifies the name of the selected MQAM (also identified on the DNCS as a QAM or Service QAM). Allows you to specify the Input 1 Port or Input 2 Port.
Headend Name	Identifies the headend in which the input device exists.
Device Type	Identifies the type of input device, such as a VOD Server, SONET to ASI converter, or BIG to which the MQAM is connected.
Device Name	Identifies the name of the input device to which the MQAM is connected.
Card Type	Identifies the type of card connected to the MQAM. Only displayed when a BIG is connected to the MQAM.
Slot Number	Identifies the slot number of the card connected to the MQAM. Only displayed when a BIG is connected to the MQAM.
Port Number	Identifies the port number on the card that is connected to the MQAM. Only displayed when a BIG is connected to the MQAM. The server should be entered in the DNCS as a generic MPEG source. Create as many ports as are available for the server and connect to the MQAM.
Show TS IDs	Selecting this option displays the Transport Stream (TS) IDs.
Show (slot, port)	Selecting this option displays the slot and port of the card connected to the MQAM.
Legend	Displays a group of icons that represent network elements that may be displayed in the graphical drawing area.

Provisioning the MQAM on the DNCS

Follow these steps to provision a new MQAM or adjust the settings for an existing MQAM from the DNCS.

Note: Provision the MQAM in accordance with your network wiring diagram and the input/output specifications for both the MQAM and other network devices.

- 1 From the DNCS Administrative Console, select one of the following tabs:
 - For SR 2.7/3.7/4.2 and later, click the **Network Element Provisioning** tab.
 - For SR 2.5/3.5/4.0 and earlier, click the **Element Provisioning** tab.
- 2 Click **QAM**. The QAM List window appears.
- 3 Choose one of the following options:
 - To provision a new MQAM, select **File> New > MQAM**. The Set Up MQAM window opens.
 - To change the settings for an existing MQAM, highlight an MQAM in the list, select **File > Open**. The Set Up MQAM window opens.
- 4 Enter or change the information on the **Basic Parameters** tab. Refer to the field descriptions in *Basic Parameters Tab* (on page 31) for more details.
- 5 Click the **Advanced Parameters** tab.
- 6 Enter or change the desired information on the Advanced Parameters tab. Refer to the field descriptions in *Advanced Parameters Tab* (on page 33) for more details.
- 7 To define the QAM Configuration File Name, click **Select**. The File Selection Dialog window appears.
- 8 Enter the configuration file in the Selection field; then, click **OK**. The File Selection Dialog window closes. Refer to *File Selection Dialog Window* (on page 34) for more information.
- 9 Choose one of the following options:
 - To provision the connectivity settings for a new MQAM, go to step 10.
 - To adjust the settings for an existing MQAM, go to step 11.
- 10 On the Set Up MQAM window, click **Apply**.

Results:

- Settings for the new MQAM are saved.
- The Connectivity tab becomes active.

Note: When you first provision the MQAM, the Connectivity only appears after you click **Apply** or **Save** from the Set Up MQAM window. Thereafter, the Connectivity tab is accessible for viewing or modification.

- 11 Click the **Connectivity** tab.
- 12 Select the MQAM input port you want to connect to the network.
- 13 Select the device you want to connect to the MQAM in the **Connect To** fields of the Connectivity tab; then, click **Save**. The QAM List is updated to include the MQAM.

Notes:

- The fields available in the **Connect To** panel of the Connectivity tab vary according to which device is selected.
- Refer to *Connectivity Tab* (on page 36) for descriptions of each field.

4

Operating the Modulator

Introduction

This chapter contains procedures for viewing and changing MQAM settings, descriptions of screens and messages, and instructions for performing routine maintenance.

Note: Actual screen settings may differ slightly from the examples presented in this guide.

In This Chapter

■ Understand the Boot Process	42
■ Change the Boot Mode.....	45
■ Read the Default Status Screen	47
■ Use the Front Panel Keys to Change Configuration Settings.....	48
■ Adjust the Frequencies of a Selected Carrier	50
■ Adjust the RF Output Level of a Selected RF Module.....	51
■ Mute the RF Output of a Selected RF Module.....	52
■ Change the Carrier Mode of a Selected RF Module.....	53
■ Monitor Setup Options	54
■ Inspect the Modulator	60
■ Select an RF Module	61
■ Inspect the MQAM	62
■ Replace the Fuse.....	63
■ Diagnose the Fan.....	65
■ Replace the Fan	66

Understand the Boot Process

This section describes the boot process and lists examples of the screens that appear during a normal boot process. The Bootstrap (BOOTP) protocol is used to initialize and to acquire the following configuration information:

- IP address
- Address mask
- Location of default gateway
- Addresses of important servers
- Name and location of software download file(s) from the network BOOTP server

Note: The MQAM downloads software using Trivial File Transfer Protocol (TFTP), which is a simplified version of FTP.

See *Change the Boot Mode* (on page 45) for a description of the boot modes available and instructions for changing the boot mode.

See *Troubleshooting Boot Screen Error Messages* (on page 79) for troubleshooting booting conditions.

- 1 The MQAM sends a BOOTP request to the DNCS.
- 2 The DNCS responds to the BOOTP request, sending the IP address for the MQAM.
- 3 The MQAM sends a TFTP request for the configuration file.
Note: The configuration file (mqam.config) contains environment variables, download files, and server addresses.
- 4 The DNCS sends the TFTP mqam.config file.
- 5 If the files in the mqam.config file are different from those stored in the MQAM, then the MQAM requests the download files, which consist of the following:

- Boot code
- Application code
- RF module code

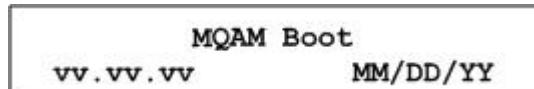
Note: The messages that appear on the front panel of the MQAM during the boot process are described in *Initial Boot Screens* (on page 43) and *Code Download Messages* (on page 44).

Initial Boot Screens

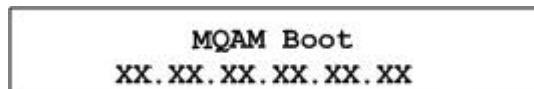
The following illustrations show examples of the initial boot screens.

Note: Actual screen settings may differ from the examples presented in this guide.

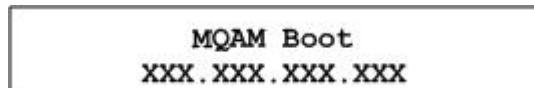
When the MQAM boots, the boot code version and release date appear.



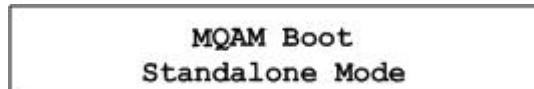
After a brief period, the MAC address of the MQAM appears.



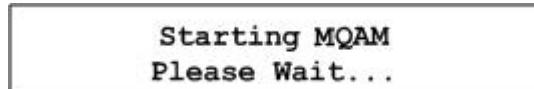
If BOOTP completes successfully, the IP address boot screen appears.



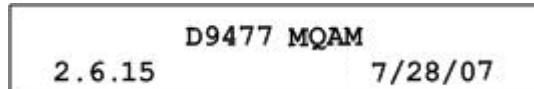
Note: Although it is not a typical setting, if the MQAM is set to run in a Standalone mode (boot mode 0), the following Standalone mode boot screen appears instead of the “Starting MQAM” boot screen.



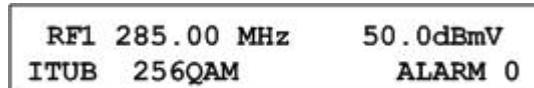
The IP address boot screen remains visible for approximately 2 seconds. If no errors occur and no downloads are attempted, the boot code starts the application code and a screen similar to the following appears.



Next, a screen similar to the following appears.



Then, the default status screen appears.



Code Download Messages

The boot code, application code, and RF Module code messages appear on the front panel LCD screen during code download or during a download attempt. The following table shows the message that appear during these downloads.

Code Download	Message Displayed
Boot Code	Downloading Boot Code !!!!Do Not Power OFF!!!!
Application Code	Downloading App Code Please Wait!
RF Module Code	Downloading RF # Code Please Wait...

Change the Boot Mode

This section describes the available boot modes available and contains instructions for changing the boot mode from the craft port using a diagnostic PC.

See *Connect the CA SYNC Port* (on page 24) for connection instructions.

Boot Modes

Three boot modes (0 through 2) exist and are described in the following list:

- **0 - Skip BootP** (Standalone mode) – This mode bypasses the boot mode when you power on the MQAM. Use the Skip BootP mode when operating in Standalone mode, when provisioning and monitoring the MQAM from the front panel or the craft port, or when operating without the control of the DNCS. This mode skips the BOOTP and TFTP processes and jumps directly to the application code.
- **1 - Attempt BootP One Time** (Attempt Bootp Once mode) – This mode is not normally used in network operation. If used when the MQAM is connected to the network and the network connection is lost or reset, the MQAM must be rebooted. This mode attempts each BOOTP and TFTP step only once. If a failure occurs during any step, the step is skipped; the MQAM attempts the remaining steps and eventually attempts to start the application. If the BOOTP and/or configuration file TFTP steps are aborted due to errors, the MQAM may not communicate with the DNCS.
- **2 - Bootp Until Successful** (Boot Until Successful mode) – This is the default mode. This mode continues to boot until the MQAM receives an IP address and all download images. This setting is useful when upgrading the software. Booting until successful ensures that the MQAM completes all startup procedures successfully. Use the standard mode (boot forever until successful) when a network controller such as the DNCS monitors and provisions the MQAM through the Ethernet port. This mode attempts to boot and to TFTP the configuration file and any requested boot and/or application code files until the entire process is successful. If an error occurs at any step, the MQAM restarts until a successful boot occurs.

Important! Do not select this setting when operating the MQAM outside a DNCS environment.

Changing the Boot Mode

- 1 Connect a diagnostic PC to the **CRAFT PORT** on the back panel of the MQAM.
- 2 Power on the diagnostic PC and activate a Procomm or Hyperterminal window using the following modem connection settings:
 - 9600 baud
 - 1 stop bit
 - No parity
 - 8 data bits
 - No flow control
- 3 Power on the MQAM; then, during the boot sequence, watch for the following message on the PC monitor screen:

Type any key within 2 seconds to get shell prompt

Note: See the *Connect Power Sources* (on page 16) section for more details about powering on the MQAM.

- 4 Press any key on the PC to display the boot prompt. The following boot prompt appears: **boot>**

Note: If you do not press a key in time to get the boot prompt, do one of the following:

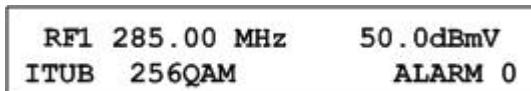
- Cycle power to the MQAM, and repeat this step. See Resetting the Modulator for more details.
 - At the **MQAM>** prompt, type **boot**; then, after the **Type any key** message appears, press any key to display the boot prompt.
- 5 At the boot prompt, type **setbootmode** and press **Enter**. The current boot mode setting appears.
 - 6 Type one of the following numbers to select the boot mode:
 - **0** - Skip BootP
 - **1** - Attempt BootP One Time
 - **2** - Bootp Until Successful
- Result:** The system saves the new boot mode to nonvolatile memory (NVRAM) with the new setting.
- 7 Type **exit** and press **Enter**. The MQAM reboots using the new boot mode.
 - 8 Disconnect the diagnostic PC.

Read the Default Status Screen

The Default Status screen provides status information such as the channel frequency setting, RF level settings, modulation type, and the number of active alarms. The default status screen displays after one of the following occurs:

- The reset process is complete.
- You press **ENTER** to complete a command.

The following is an example of the Default Status screen.



Reading the Default Status Screen

The following table describes the information displayed on the default status screen.

Display	Function
RF1	Current RF Channel output selected. The RF number corresponds to the number of the RF OUT port on the back panel of the MQAM.
285.00 MHZ	Established RF frequency setting for the selected RF modulator (91 to 869 MHz).
50.0 dBmV	Configured RF level setting (42 to 56 dBmV).
ITUB 256QAM	Selected modulation type. Values are: <ul style="list-style-type: none"> ■ ITUB 64 QAM ■ ITUB 256 QAM ■ DAVIC 256 QAM ■ DAVIC 16 QAM ■ DAVIC 64 QAM
Alarm 0	Current number of active alarms

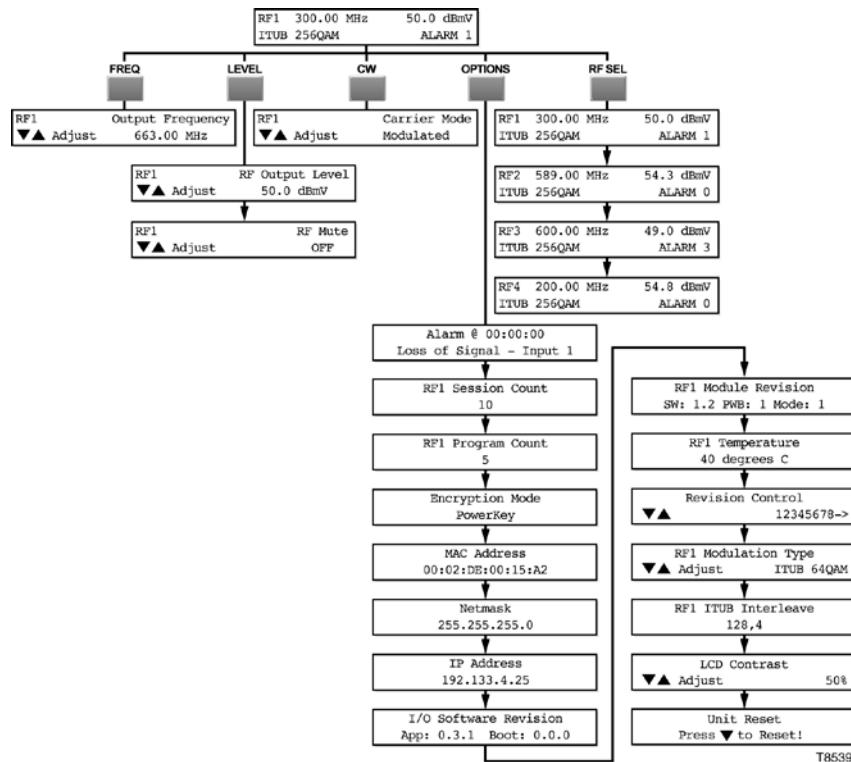
Use the Front Panel Keys to Change Configuration Settings

The front panel of the MQAM contains an alphanumeric LCD screen and three alarm indicators. There are also several keys on the front panel to allow you to change parameters. See the *Front Panel Overview* (on page 7) section for more information on the front panel components.

Diagram of MQAM Menu Structure

The following diagram illustrates the MQAM menu structure in sequential order.

Note: The settings on this menu are examples, not recommended settings.



Accessing the MQAM Menus

You can access MQAM menus and screens by pressing the **FREQ**, **LEVEL**, **CW**, or **OPTIONS** keys on the front panel.

Pressing these keys repeatedly scrolls through their respective sequential menus.

The following sections in this chapter describe the functions associated with each key:

- **FREQ** - *Adjust the Frequencies of a Selected Carrier* (on page 50)
- **LEVEL**
 - *Adjust the RF Output Level of a Selected RF Module* (on page 51)
 - *Mute the RF Output of a Selected RF Module* (on page 52)
- **CW** - *Change the Carrier Mode of a Selected RF Module* (on page 53)
- **OPTIONS** - *Monitor Setup Options* (on page 54)
- **RF SEL** - *Adjusting the Output Frequency* (on page 50)

Note: See *Front Panel Overview* (on page 7) for detailed descriptions of these keys.

Navigating Within a Menu or Changing a Screen Value

The Up and Down arrow keys are used in conjunction with the other front panel keys to increment or decrement the values of a selected parameter within a screen or to scroll up and down through a set of selections.

Saving Changes to Configuration Settings

Pressing the **Enter** key saves changes to the configuration settings. You must also press the **Enter** key to return to the default status screen. Changes to any settings are saved into NVRAM. This memory is located on the digital board and is used to restore settings in the event of a power reset of the device.

Adjust the Frequencies of a Selected Carrier

Pressing the **FREQ** key allows you to access the output frequency screen, from which you can select an RF output and adjust its output frequency.

Important! Frequencies set from the front panel of the MQAM are not recorded by the DNCS. At the next MQAM restart, the frequencies are reset to the values stored in the DNCS.

Adjusting the Output Frequency

Follow these steps to adjust the output frequency.

Important! Frequencies set from the front panel of the MQAM are not recorded by the DNCS. At the next MQAM restart, the frequencies are reset to the values stored in the DNCS.

- 1 Press **FREQ** on the front panel of the MQAM. The Output Frequency screen appears with the frequency number flashing.

RF1	Output Frequency
▼▲ Adjust	663.00 MHz

- 2 Press **RF SEL** to select an RF module.

Note: Press the **RF SEL** key repeatedly to scroll through the four RF modules.

- 3 Press the Up or Down Arrow keys to increase or decrease the output frequency value of a selected RF module.

Note: The output frequency can be changed in 0.25 MHz increments from 91 to 869 MHz. To increment or decrement the frequency value in 6 MHz steps, press and hold the Up or Down Arrow keys for about 2 seconds.

- 4 Press **ENTER**. The system saves the output frequency changes to NVRAM and the default screen appears.

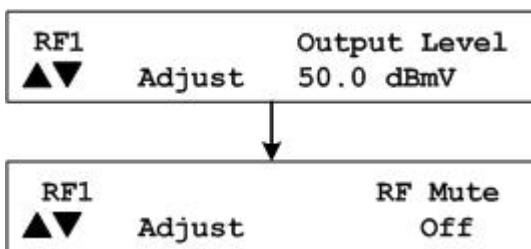
Adjust the RF Output Level of a Selected RF Module

Pressing the **LEVEL** key displays screens that allow you to perform the following functions:

- Set the RF output level of a selected RF modulator
- Enable or disable a muting option for the selected RF output

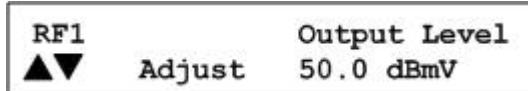
LEVEL Button Menu Flow

The following diagram shows the sequence of screens that appear when the LEVEL button is repeatedly pressed.



Adjusting the RF Output Level

- 1 Press **LEVEL**. The RF Output Level screen appears.



- 2 Press **RF SEL** to choose an RF module (RF1-RF4).
- 3 Press and hold the Up or Down Arrow keys to increase or decrease the output level.

Notes:

- The level changes in 0.1 dB increments from 42 to 56 dBmV. The output level is valid in the range between 44 and 54 dBmV. The range on the front panel extends 2 dB above and below this range to compensate for variations between the displayed level and the actual level due to temperature fluctuations and the tuning range.
- The system automatically saves the output level changes to NVRAM.

- 4 Press **OPTIONS** to return to the default screen.

Mute the RF Output of a Selected RF Module

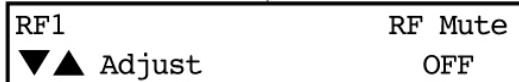
This section contains instructions for enabling the RF mute option. During installation, for example, use this procedure to mute the RF output before you connect the RF OUT ports to the distribution plant.

Enabling or Disabling a Muting Option

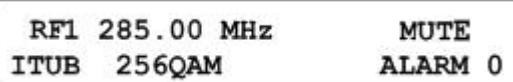
Follow these steps to enable or disable a muting option for a selected RF output.

Important: The RF output state established from the front panel of the MQAM is not recorded by the DNCS. At the next MQAM restart, the RF output state reverts to the value stored in the DNCS.

- 1 On an MQAM that has power connected and has finished booting, press the **LEVEL** until the Output Mute screen appears.



- 2 Press **RF SEL** to choose an RF output.
- 3 Press the Up and Down Arrow keys to toggle the selected RF Mute between **Off** and **Mute**.
- 4 Press **ENTER**. The system saves the output muting changes to NVRAM and the default screen appears.



Note: **Mute** appears on the default status screen for the selected channel.

Change the Carrier Mode of a Selected RF Module

This function allows you to toggle RF output to either a modulated (normal) carrier mode or a continuous wave (CW) carrier mode.

Important! The carrier mode established from the front panel of the MQAM is not recorded by the DNCS. At the next MQAM restart, the carrier mode for the MQAM reverts to the value stored in the DNCS.

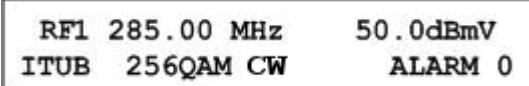
Selecting Modulated or Continuous Wave Carrier Mode

Follow these steps to change the carrier mode for an RF module.

- 1 Press **CW**. The Carrier Mode screen appears.



- 2 Press **RF SEL** to choose a channel (CH1 or CH2).
 - 3 Press the Up and Down Arrow keys to toggle the carrier mode between Modulated (normal) and CW (not modulated or continuous wave).
- Note:** The factory default for the carrier mode setting is Modulated.
- 4 Press **ENTER**. The system saves the carrier mode setting changes to NVRAM and the default screen appears.



Note: When choosing CW mode, the CW LED on the front panel of the MQAM lights and CW appears on the default screen.

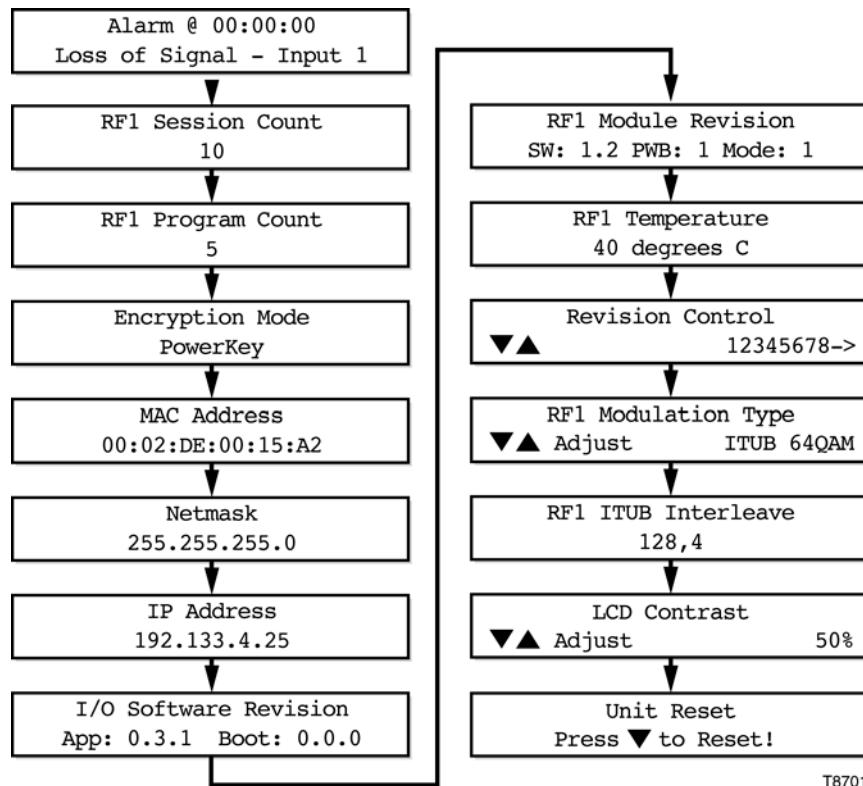
Important! The carrier mode established from the front panel of the MQAM is not recorded by the DNCS. At the next MQAM restart, the carrier mode for the MQAM reverts to the value stored in the DNCS.

Monitor Setup Options

OPTIONS Menu

The following RF MQAM setup screens appear, in sequential order, when you press the OPTIONS key repeatedly. These screens allow you to monitor alarms, the number of sessions, and the program count for the MQAM. This section provides instructions for viewing the MQAM settings on each screen and explanations of screen.

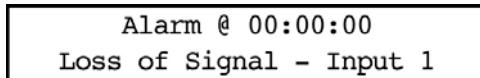
Important: The screens in the following diagram are examples, not recommended settings.



Displaying Alarm Status

Follow these steps to display the list of active alarms.

- 1 Press **OPTIONS**. The Alarm Status screen appears.



Notes:

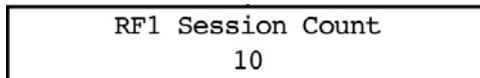
- Each alarm description appears for approximately 1 second before displaying the next alarm. If no alarms are active, a **No Active Alarms** message appears.
- See *Troubleshooting Alarm Messages* (on page 72) for detailed descriptions of alarms.

- 2 Press **ENTER**. The default screen appears.

Viewing the Session Count

The Session Count screen displays the count of all active sessions for the selected RF output. Follow these steps to view the total number of active sessions.

- 1 Press **OPTIONS** until the Session Count screen appears.



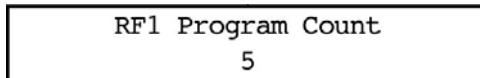
Note: The session count for the MQAM will differ from the session count on the DNCS if the MQAM does not find needed MPEG programs within MPEG Program Specific Information (PSI). By design, the MQAM responds positively to a session setup request even if the requested MPEG program is not present on the input transport stream.

- 2 Press **RF SEL** to view the session count for each RF module.
- 3 Press **ENTER** to return to the default screen.

Viewing the Program Count

The Program Count screen displays the encrypted programs currently running on the selected RF output. Follow these steps to view the program count for an RF module.

- 1 Press **OPTIONS** until the Program Count screen appears.

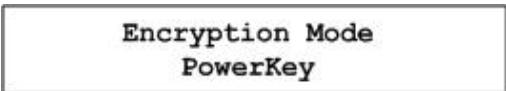


- 2 Press **RF SEL** to view the program count for each channel.
- 3 Press **ENTER** to return to the default screen.

Viewing the Encryption Mode

The Encryption Mode screen displays the current encryption mode setting. The mode is saved in the NVRAM and is selected during the boot process. To display the current encryption mode, complete the following steps.

- 1 Press **OPTIONS** until the Encryption Mode screen appears.



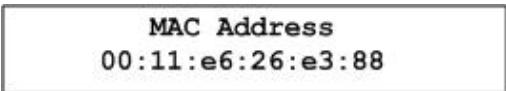
Encryption Mode
PowerKey

- 2 Press **ENTER** to return to the default screen.

Viewing the MAC Address

To view the MAC address used for MQAM Ethernet communication, complete the following steps.

- 1 Press **OPTIONS** until the MAC Address screen appears.



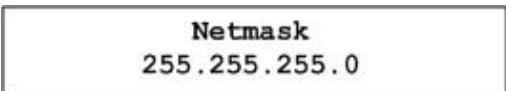
MAC Address
00:11:e6:26:e3:88

- 2 Press **ENTER** to return to the default screen.

Viewing the Netmask Screen

To display the currently assigned Netmask for all Ethernet communications, complete the following steps.

- 1 Press **OPTIONS** until the Netmask screen appears.



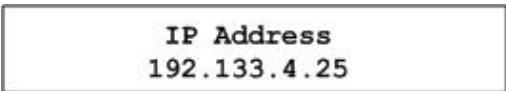
Netmask
255.255.255.0

- 2 Press **ENTER** to return to the default screen.

Viewing the IP Address

To display the currently assigned IP address for all Ethernet communications, complete the following steps.

- 1 Press **OPTIONS** until the IP Address screen appears.



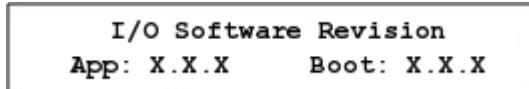
IP Address
192.133.4.25

- 2 Press **ENTER** to return to the default screen.

Viewing the I/O Board Software Revision Level

The Software Package Release version screen displays the top-level software release version for the modulator. To display the Software Package Release version screen, follow these steps.

- 1 Press **OPTIONS** until the Software Package Release version screen appears.



Notes:

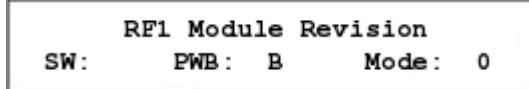
- In the above example, **App** is the application code and **Boot** is the boot code.
- This revision number for the application code and boot code, represented in the above example by X.X.X, contains the major release number, the minor release number, and the point release number.

- 2 Press **Enter** to return to the default screen.

Viewing the RF Module Revision Numbers

The RF Module Revision screen displays the revision numbers for the hardware and software of the selected RF Module. To display the RF Module Revision screen, follow these steps.

- 1 Press **OPTIONS** until the RF Module Revision screen appears.



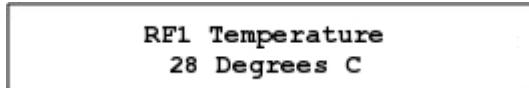
Notes:

- SW shows the RF board microprocessor firmware revision displayed as major release and minor release.
- PWB shows the Printed Wiring Board revision of the RF board.
- Mode is the PWB assembly of configuration. The 0 indicates a Standard/Domestic Mode (Baseband to RF Output) PWB assembly.

- 2 Press **RF SEL** to display information about each RF module (RF1-RF4).
- 3 Press **ENTER** to return to the default screen.

Checking the Temp of an RF Module

- 1 Press **OPTIONS** until the Temperature screen appears.

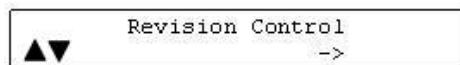


- 2 Press **RF SEL** to display information for each RF module.
- 3 Press **ENTER** to return to the default screen.

Viewing the Hardware Revision String

The Revision Control screen displays the hardware revision string of the MQAM. This string is 31 bytes long and is stored in non-volatile memory. Only eight characters of the string can be viewed at a time.

- 1 Press **OPTIONS** until the Revision Control screen appears.



- 2 Press the Up or Down Arrow keys to display the next or previous eight characters of the hardware revision string.

Note: The “->” indicates that more characters are available.

- 3 Press **ENTER** to return to the default screen.

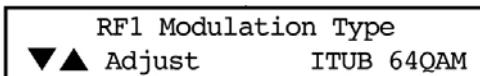
Setting the Modulation Type

The Modulation Type screen allows you to set the modulation type for each of the RF modulators (channels).

Important: The modulation type established from the front panel of the MQAM is not recorded by the DNCS. At the next MQAM or DNCS restart, the modulation type for the MQAM will revert to the value stored in the DNCS.

To set the modulation type, follow these steps.

- 1 Press **OPTIONS** until the Modulation Type screen appears.



- 2 Press the **RF SEL** key to display information for each RF module.
- 3 Press the Up or Down Arrow keys to scroll through the following available modulation types:
 - DAVIC 16QAM
 - DAVIC 64QAM
 - DAVIC 256QAM
 - ITUB 64QAM
 - ITUB 256QAM
- 4 Press **ENTER**. The system saves the selected modulation type in NVRAM memory and the default screen appears.

ITUB Interleave Screen

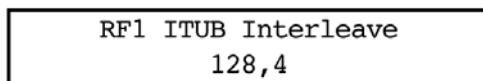
The ITUB Interleave screen displays the interleave depth factor for all ITU-B modulation settings. The interleave depth factor specifies the spacing for the forward error correction (FEC) code within the MPEG transport data. Interleaving evenly disperses the data to transport it reliably over the cable channel.

Important: The recommended setting for this screen is 128,4. Only Cisco Services representatives should modify this setting.

Viewing the Interleave Values

To display the ITUB Interleave screen, follow these steps.

- 1 Press **OPTIONS** until the ITUB Interleave screen appears.



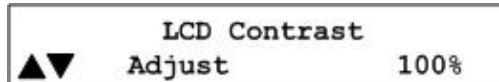
- 2 Press **RF SEL** to choose an RF module.

Important: You can edit this value from the front panel, but this value will be overwritten by the value stored on the DNCS.

- 3 Press **ENTER** to return to the default screen.

Adjusting the LCD Contrast

- 1 Press **OPTIONS** until the LCD Contrast screen appears.



- 2 Press the Up or Down Arrow keys to decrease or increase the contrast from 0% to 100% in 5% increments.

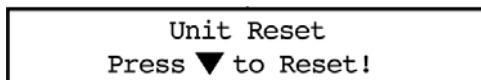
Note: The default contrast setting is 80%.

- 3 Press **ENTER** to save the changes to NVRAM and return to the default screen.

Resetting the MQAM

Follow these steps to reboot the MQAM from the front panel.

- 1 Press **OPTIONS** until the Unit Reset screen appears.



- 2 Press the down arrow key. The MQAM reboots.

Inspect the Modulator

Although, the modulator can operate unattended for extended periods. Cisco recommends that you perform a visual inspection once every 3 months.

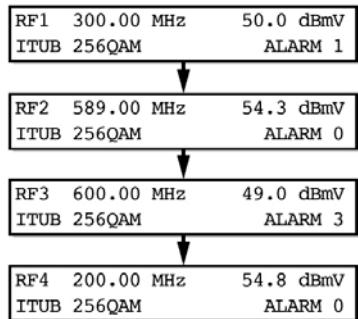
Important: Only qualified personnel should maintain and service the MQAM.

Check the following items during a visual inspection:

- **Cables and connectors**—Verify that all cables are mated properly and all retaining screws are tight. Inspect cables for stress and chafing.
- **Cover and rear panel**—If necessary, clean the cover and rear panel with a soft cloth dampened with a mild detergent solution.
- **Fan intakes on side panel**—Check the fan intakes on the side panel for excessive lint or dust buildup. Remove the lint and dust from the intakes using a damp cloth or a small hand vacuum.

Select an RF Module

The RF SEL key allows you to select the default screens for each of the RF Modules (channels).



Selecting an RF Module

Follow these steps to change the selected RF Module.

- 1 Press the **RF SEL** key on the front panel of the MQAM. The Default Status screen changes to the next available RF Module.
- 2 Press the **RF SEL** key to scroll through the list of RF Modules until you select the desired module.

Note: The selected RF Module is saved as the Default Status screen.

Inspect the MQAM

Performing routine maintenance helps prevent the need for troubleshooting. For troubleshooting information, see *Troubleshooting the MQAM* (on page 69) for instructions on addressing alarm conditions for the MQAM.

Quarterly Inspection

The MQAM can operate unattended for extended periods. However, you should perform a visual inspection once every 4 months.

Important: Only qualified personnel should attempt maintenance and service of the MQAM.

Check the following items during a visual inspection:

- Cables and connectors - Make sure all cables are mated properly and all retaining screws are tight. Inspect cables for stress and chafing.
- Cover and rear panel - If necessary, clean the cover and rear panel with a soft cloth dampened with a mild detergent solution.

Replace the Fuse

Each MQAM contains a power fuse. We recommend keeping spare 4.0 A, SLO BLO 250V fuses (Cisco part number 188106) for the 120/230V AC model MQAM and spare 6.3 A, SLO BLO 250V fuses (Cisco part number 180522) for the 48V DC model MQAM.

Replacing the Fuse



WARNING:

Avoid electric shock! Disconnect the power cord on this product before you remove the fuse and only use a fuse that has the correct type and rating.

To replace the SLO BLO 250 V fuse, follow these steps.

- 1 Power down the MQAM and remove the power cord.
- 2 Locate the fuse holder on the left side of the back panel of your MQAM model.
 - Model 9477-1 120V AC MQAM



- Model 9477-2 48V DC MQAM



- Model 9477-3 230V AC MQAM



- 3** Choose one of the following options:
 - For the 120/230V AC model, use a small flat-blade screwdriver to pry out the fuse holder, then go to step 7.
 - For the 48V DC model, go to step 4.
- 4** Loosen the fuse holder by using a small flat-blade screwdriver to turn the fuse holder counter-clockwise.
- 5** Remove the fuse.
- 6** Insert a new fuse into the fuse holder, then go to step 10.
- 7** Locate and remove the spare fuse from the hidden compartment on the fuse holder.
- 8** Remove and discard the blown fuse, and then replace the blown fuse with the spare fuse.
- 9** Place a new fuse in the hidden compartment where you removed the spare. This fuse will now be your spare fuse.
- 10** Insert the fuse holder into the back panel.
- 11** Choose one of the following options:
 - For the 120/230V AC model, snap the fuse holder in place.
 - For the 48V DC model, tighten the fuse holder by using a small flat-blade screwdriver to turn the fuse holder clockwise.
- 12** Replace the power cord and power on the MQAM, if applicable.

Diagnose the Fan

If a fan fails or is failing, either the **MAJOR** LED or the **MINOR** LED on the front panel will light and you will see *either* a fan failure alarm message or an excessive temperature alarm message on the front panel LCD screen, or perhaps both.



WARNING:

Avoid electric shock and damage to this product! Replace the fan only with a genuine replacement fan from Cisco. Contact Cisco Services to order replacement fans.

Diagnosing the Fan

The following illustrations are examples of the alarm displays you will see on the front panel LCD screen.

Fan Failure Alarm

Alarm at 16:20:32
Fan Failure #1

Notes:

- The fan failure alarm is a Major alarm.
- The fan failure alarm can display for fan number 1 through fan number 6.

Excessive Temperature Alarm

Alarm at 16:20:48
RF1 Exceeded max temp

Notes:

- The excessive temperature alarm is a Minor alarm.
- The excessive temperature alarm can display for RF module 1 through RF module 4.

Replace the Fan

The MQAM modulator has three dual fan units on the side panel. Each of these units contains two fan rotors. You must replace the *entire* dual fan unit if one of the fan rotors should fail. The fan units are designed to be “hot swappable,” meaning that you do not necessarily have to power down the MQAM to replace a fan unit that has failed.

Important: In order to hot swap a dual fan unit, you must have the following:

- Sufficient length in all cords and cables so you can slide the device forward in the rack far enough to fully access the dual fan units on the side panel.
- The ability to externally support the MQAM with a cart or table or with the assistance of another person.

Notes:

- The part number for the replacement fan unit is **4003088**.
- The part number for the kit that includes the replacement fan and instruction sheet is **4007620-40**.
- If you do *not* have sufficient length in all cords and cables, you will have to power off the unit, disconnect all cords and cables, and completely remove the MQAM from the rack to replace a dual fan unit that has failed.

This section provides the procedure for replacing a dual fan unit on the MQAM by either hot swapping the fan unit, or by powering off, disconnecting, and removing the MQAM completely from the rack.

When Can I Perform This Procedure?

If you cannot hot swap the dual fan unit, you need to replace the fan unit during a maintenance window. This is necessary because you will have to power off and disconnect the MQAM to replace the fan unit, thereby temporarily disrupting all broadcast services configured and provisioned on this MQAM.

Important! Schedule the maintenance window to replace the fan as soon as possible to avoid damage to the MQAM.

Location of Fans

The fans are located on the MQAM side panel as follows:

- Fans 1 and 2 are located nearest to the back panel.
- Fans 3 and 4 are the middle fans.
- Fans 5 and 6 are located nearest to the front panel.

Replacing the Fan

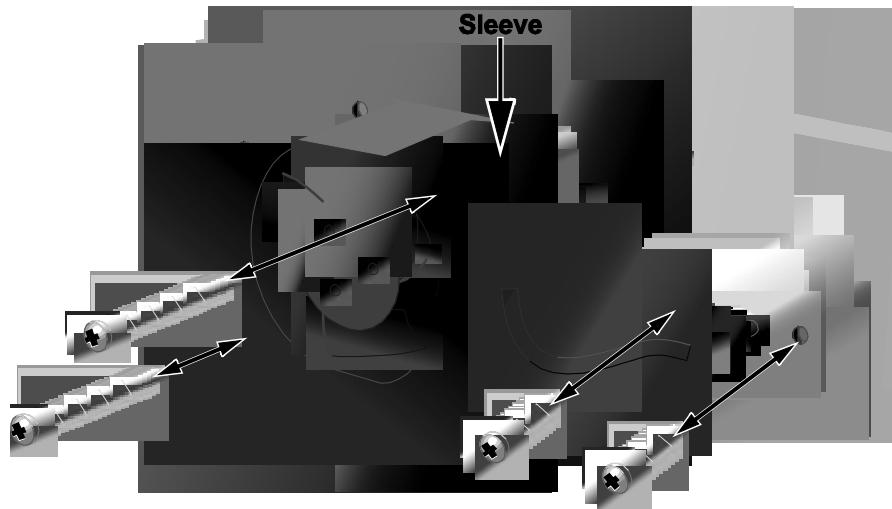


WARNING:

Avoid damage to this product! Replace the dual fan unit only with a genuine replacement fan unit from Cisco. Contact Cisco Services to order replacement fan units.

- 1 Are the cables connected to the back panel long enough to allow you to slide the MQAM forward into the rack to sufficiently access the side panel where the fan units are located?
 - If **yes**, carefully remove the screws that secure the MQAM in the rack, and carefully slide the MQAM forward in the rack until you can access the fan units. Then, go to step 5.
 - If **no**, go to step 2.
- 2 If you cannot slide the MQAM forward in the rack because some or all of the cables in the rack are not long enough to access the fan, wait to replace the fan until you have a maintenance window. Then, choose one of the following options:
 - If *some* of the cables are not long enough, you must power off the MQAM and disconnect any cables that are not long enough.
 - If *all* of your cables are too short, you must power off the MQAM and disconnect all the cables, including the power cable.
- 3 Remove the screws that secure the MQAM in the rack. Then, remove the MQAM completely from the rack to replace the fan unit.
- 4 After removing the MQAM, place it carefully on a sturdy flat surface.
- 5 Carefully remove the screws that secure the 9-pin connector to the side panel and place them in a safe location nearby.
- 6 Carefully remove the screws and sleeves that secure the fan unit to the side panel and place them in a safe location nearby.

Important: The sleeves are loose and are not connected to the fan. Be careful not to drop them.



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- 7 Remove the non-functioning fan unit and carefully disconnect the 9-pin connector. Set this fan unit aside for safe disposal later.
 - 8 Hold the new fan unit in place on the side panel of the MQAM so that the rotor with three fan blades is visible.
 - 9 Place the sleeves in the proper location on the fan (as shown in the diagram), insert the screws through the sleeves, and then carefully tighten the screws that secure the fan to the side panel.
- Important:** Do not over tighten or cross thread the screws!
- 10 Carefully insert the 9-pin connector into the 9-pin socket, and then replace and carefully tighten the screws that secure the 9-pin connector to the side panel.
- Important:** Do not over tighten or cross thread the screws!
- 11 Did you have to remove the MQAM completely from the rack?
 - If yes, go to step 13.
 - If no, go to step 12.
 - 12 Replace the MQAM into its original position in the rack and secure it in the rack using the original screws. Then, go to step 14.
 - 13 Replace the MQAM into its original position in the rack, secure it in the rack using the original screws, reconnect all cables, reconnect the power cord, and then power on the MQAM.
 - 14 Does the new fan unit operate properly?
 - If yes, you have completed this procedure.
 - If no, contact Cisco Services for assistance.

5

Troubleshooting the MQAM

Introduction

This chapter provides explanations of major, minor, and status alarm conditions and instructions for checking alarms. This chapter also includes an alarm troubleshooting table, arranged alphabetically according to the front panel LCD message, with additional information for resolving alarm conditions. In addition, this chapter provides examples of boot screen error messages identifying booting and software loading errors or failures.

In This Chapter

- Alarm Conditions 70
- Troubleshooting Alarm Messages 72
- Troubleshooting Boot Screen Error Messages 79

Alarm Conditions

This section describes major, minor, and status alarms and explains how to access and read the alarms displayed on the front panel LCD of the MQAM. Refer to *Troubleshooting Alarm Messages* (on page 72) for a list of alarm messages that appear on the LCD screen, their level of severity, and possible solutions.

Purpose and Severity Levels of MQAM Alarms

Alarms provide system operators with an indication of an abnormal condition. Alarm messages appear on the Alarm Status screen when hardware or software conditions occur that might cause the MQAM to operate incorrectly or fail. Examples of such conditions include temperature fluctuations, power supply failure, communication problems, or the detection of bad data. All alarms are automatically enabled after powering up the MQAM.

Alarm levels are classified as major, minor, and status alarms. Each level is described as follows:

- **Major Alarms** – A major alarm indicates a fatal error, that is, a complete loss of functionality. Major alarms occur for hardware or software conditions that indicate a serious disruption of service or the malfunctioning or failure of important circuits. These situations require the immediate response of the technician to restore or maintain system operability. The front panel of the MQAM contains a MAJOR LED to alert the operator that a major alarm is pending.
- **Minor Alarms** – A minor alarm indicates a non-fatal error condition. The MQAM may continue to operate with some loss of functionality. The front panel of the MQAM contains a MINOR LED to alert the operator that a minor alarm is pending.
- **Status Alarms** – The status alarm indicates that some state in the MQAM has changed. Status alarms are provided to alert the DNCS operator that possible changes are occurring at the MQAM site by someone pressing the front panel keys or by someone using the craft port. These are generally one-time events, such as a front panel event change. In this case, the alarm is issued with the level "status" each time you press the ENTER key on the front panel of the MQAM. Status alarms might not affect MQAM functionality.

LCD Alarm Display

The front panel of the MQAM displays alarm messages in the following standard display.

```
Alarm at 11:51:40
Input1 loss of signal
```

The alarm message appears on the second line of the display. In this example, the message indicates a loss of signal to the ASI Input, which is a major alarm condition.

Reading the Display

To display the list of active alarms, follow these steps.

- 1 Press **OPTIONS**. The Alarm Status Level screen appears.

```
Alarm at 11:51:40
Input1 loss of signal
```

Note: Each alarm description appears for approximately 1 second before displaying the next alarm. If no alarms are active, a **NO Active Alarms** message appears.

- 2 Press **ENTER**. The default screen appears.

Troubleshooting Alarm Messages

If the MQAM displays an alarm condition, fails a self-test, or does not work properly, refer to the table in this section to find and correct the cause. Some alarm conditions may require you to contact Cisco Services..

See *Troubleshooting Boot Screen Error Messages* (on page 79) for resolving problems encountered during the start-up process.

Front Panel LCD Alarm Messages

The following table lists Alarm Messages displayed on the front panel LCD of the MQAM, the default level of severity defined for the MQAM, a probable cause for the alarm, and suggestions for correcting the alarm condition.

Notes:

- The LCD descriptions for each alarm are arranged in alphabetical order.
- Alarm messages that occur for the four RF outputs or the two ASI input ports are listed only once. The numbers in parentheses indicate the range of port numbers that might be affected by the alarm.

Example: The “Input (1-4) errored MPEG packet” description corresponds to the Input port that is affected.

LCD Description	Alarm Level	Probable Cause	Check and Correct
ASI (1-2) errored MPEG packets	Minor	An error occurred in the header of MPEG packets as they arrived at the indicated Input port	Contact Cisco Services
ASI (1-2) FIFO overflow See also ASI (1-2) packets were dumped	Minor	<p>A first-in first-out (FIFO) overflow occurred and packet data has been lost. This indicates one or more of the following conditions:</p> <ul style="list-style-type: none"> ■ Too many sessions defined from the DNCS for the MQAM ■ The data rate as defined from the DNCS for the MQAM session is too low, which also means that the data rate of the ASI input to the MQAM is too high ■ Hardware problem ■ Incorrect modulation mode 	<ul style="list-style-type: none"> ■ Reduce the data rate of input to the MQAM by doing the following: <ul style="list-style-type: none"> – Reducing the amount of incoming data – Reducing the amount of data added to the stream – Increasing the MQAM modulation mode ■ Verify and correct session rate targets and threshold values ■ Contact Cisco Services
ASI (1-2) loss of signal	Major	<p>No ASI signal. This indicates one or more of the following conditions:</p> <ul style="list-style-type: none"> ■ An upstream device that provides input to the MQAM has failed or is offline ■ A cable has been disconnected 	<ul style="list-style-type: none"> ■ Check for loose or broken DVB ASI cable connections to the MQAM ■ Check that the DVB ASI outputs of upstream devices are active ■ Run the Doctor Report to troubleshoot any network connectivity issues ■ Contact Cisco Services

LCD Description	Alarm Level	Probable Cause	Check and Correct
ASI (1-2) Packets were dumped. See also (ASI (1-2) FIFO Overflow.	Minor	A FIFO overflow occurred and packet data has been lost. This indicates one or more of the following conditions: <ul style="list-style-type: none"> ■ Too many sessions defined from the DNCS for the MQAM ■ The data rate as defined from the DNCS for the MQAM session is too low, which also means that the data rate of the ASI input to the MQAM is too high ■ Hardware problem ■ Incorrect modulation mode 	<ul style="list-style-type: none"> ■ Reduce the data rate of input to the MQAM by doing the following: <ul style="list-style-type: none"> – Reducing the amount of incoming data – Reducing the amount of data added to the stream – Increasing the MQAM modulation mode ■ Run the Doctor Report to troubleshoot network connectivity issues ■ Contact Cisco Services
Craft event change	Status	Someone changed the MQAM setting from the craft port.	No response required.
Front panel event change	Status	Someone changed the MQAM setting from the front panel.	No response required.
Hardware error	Major	General-purpose hardware error. Suspect broken hardware.	Contact Cisco Services.
MPEG Continuity error	Minor	MPEG continuity error counter. One or more of the MPEG packets are being dropped.	<ul style="list-style-type: none"> ■ Check one or more upstream devices connected to the DVB ASI input ports ■ Contact Cisco Services
MPEG Transport error	Minor	MPEG transport error indicator counter. An error occurred in the header of the MPEG packet.	<ul style="list-style-type: none"> ■ Check one or more upstream devices connected to the DVB ASI input ports ■ Run the Doctor Report to troubleshoot network connectivity issues ■ Contact Cisco Services

LCD Description	Alarm Level	Probable Cause	Check and Correct
OUT (1-4) FIFO overflow	Minor	<p>A FIFO overflow occurred and packet data has been lost indicating one or more of the following conditions:</p> <ul style="list-style-type: none"> ■ Too many sessions defined from the DNCS for the MQAM ■ The data rate as defined from the DNCS for the MQAM session is too low, which also means that the data rate of the ASI input to the MQAM is too high ■ Hardware problem ■ Incorrect modulation mode 	<ul style="list-style-type: none"> ■ Reduce the data rate of input to the MQAM by doing one of the following: <ul style="list-style-type: none"> – Reducing the amount of incoming data – Reducing the amount of data added to the stream – Increasing the MQAM modulator mode ■ Verify and correct session rate targets and threshold values ■ Contact Cisco Services
OUT (1-4) Packets dropped. See also ASI (1-2) FIFO overflow	Minor	<p>Low-priority packets are being dropped. The number of packets at the identified RF output carrier exceeds its capacity. This indicates one or more of the following conditions:</p> <ul style="list-style-type: none"> ■ Too many sessions defined from the DNCS for the MQAM ■ The data rate as defined from the DNCS for the MQAM session is too low, which also means that the data rate of the ASI input to the MQAM is too high ■ Hardware problem ■ Incorrect modulation mode 	<ul style="list-style-type: none"> ■ Reduce the data rate of input to the MQAM by doing the following: <ul style="list-style-type: none"> – Reducing the amount of incoming data – Reducing the amount of data added to the stream – Increasing the MQAM modulation mode ■ Verify and correct session rate targets and threshold values ■ Reduce the total number of MPEG programs by deleting sessions ■ Use a TV to verify program availability ■ Contact Cisco Services

LCD Description	Alarm Level	Probable Cause	Check and Correct
Reset detected	Status	The MQAM has been reset by either a power loss or a manual reset	<p>Session and alarm provisioning are sent to the MQAM again automatically from the DNCS. However, you should also check the following:</p> <ul style="list-style-type: none"> ■ Verify that there are still broadcast services on this MQAM ■ Verify that the reset did not adversely affect broadcast services ■ Run the Doctor Report to troubleshoot any network connectivity issues ■ Contact Cisco Services
RF (1-4) ASIC init failure	Major	Modulator IC initialization failure. The modulator MCU could not communicate with the IC when attempting to initialize it.	■ Contact Cisco Services
RF (1-4) Comm. Failure	Major	The digital I/O board is not able to communicate with the modulator RF board MCU at the specified RF OUT module (1-4). This problem could be caused by a loose or broken cable or by the modulator MCU not being programmed correctly.	■ Contact Cisco Services
RF (1-4) DC Lock detect error. See also RF (1-4) UC Lock detect error.	Major	Modulator Down Converter (DC) lock detect signal not working. During modulator MCU Power On Self-Test (POST), the lock detect signal from the downconverter PLL did not indicate an unlocked condition when one existed. Since the MCU cannot correctly sense locked vs. unlocked, the RF Output is muted. The output synthesizer lock detect circuitry has malfunctioned.	■ Contact Cisco Services

LCD Description	Alarm Level	Probable Cause	Check and Correct
RF (1-4) DC PLL unlocked	Major	The Down Converter (DC) Phase Locked Loop (PLL) synthesizer cannot lock. The output frequency may not be corrected. The RF Output field displays MUTED when this condition exists.	<ul style="list-style-type: none"> ■ Contact Cisco Services
RF (1-4) EEPROM failure	Minor	Modulator EEPROM failure. The EEPROM on the modulator board is not present or not operational. If this alarm is set, RF calibration data will not be available, activating the "RF (1-4) Level not calibrated" alarm.	<ul style="list-style-type: none"> ■ Contact Cisco Services
RF (1-4) Exceeded max temp	Minor	The internal temperature of the MQAM is more than 70°C.	<ul style="list-style-type: none"> ■ Remove vent obstructions ■ Provide more cooling and ventilation ■ Check temperature-sensing hardware ■ Check exhaust fan
RF (1-4) FEC sync error	Minor	Modulator FEC synchronization error.	<ul style="list-style-type: none"> ■ Contact Cisco Services
RF (1-4) Level not calibrated	Minor	One of the RF Level settings on the MQAM is not calibrated to its frequency or the EEPROM that stores the calibration data is not operational.	<ul style="list-style-type: none"> ■ Contact Cisco Services
RF (1-4) Output load error	Minor	Incorrect modulator RF output load impedance. The modulator MCU detected a large amount of reflected RF power at the output, indicating that the RF load impedance at the output is not correct. A disconnected RF output cable or a cable that has a short usually causes this condition.	<ul style="list-style-type: none"> ■ Check the cable connections to the RF OUT ports on the back panel of the MQAM ■ Contact Cisco Services
RF (1-4) Power supply failure	Minor	At least one internal power regulator failed. The RF output is MUTED when this condition exists.	<ul style="list-style-type: none"> ■ Contact Cisco Services
RF (1-4) UC Lock detect error	Major	The Up Converter (UC) PLL lock detect signal is not working. The RF output is MUTED when this condition exists.	<ul style="list-style-type: none"> ■ Contact Cisco Services
RF (1-4) UC PLL unlocked	Major	The modulator UC PLL is unlocked. The output frequency may not be correct. The RF output is MUTED when this condition exists.	<ul style="list-style-type: none"> ■ Contact Cisco Services

LCD Description	Alarm Level	Probable Cause	Check and Correct
Runtime error (operating system)	Major	General-purpose software error.	<ul style="list-style-type: none"> ■ Reset the MQAM by the power switch or through the DNCS ■ Contact Cisco Services
Session XXXX ca error (where XXXX is a number from 0 to 1023)	Minor	A signal encryption fault has been detected. This could mean that an unencrypted signal is being transmitted.	<ul style="list-style-type: none"> ■ Check hardware settings ■ Contact Cisco Services
Session XXXX ca error (where XXXX is a number from 0 to 1023)	Minor	The data flow for the session is more or less than what has been defined by the DNCS for the session.	<ul style="list-style-type: none"> ■ Verify and correct the session data rate targets and threshold values. ■ If session data is correct, data may be corrupted because of hardware problems. ■ Contact Cisco Services
Session XXXX program error (where XXXX is a number from 0 to 1023)	Minor	Program-Specific Information (PSI) table data for the session contains errors.	<ul style="list-style-type: none"> ■ Check the upstream MPEG input sources connected to the MQAM. ■ Contact Cisco Services

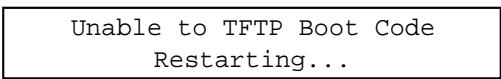
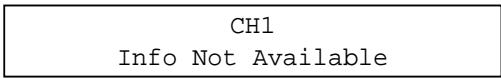
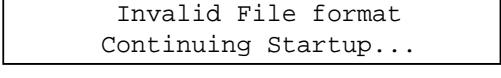
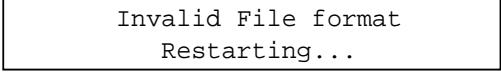
Troubleshooting Boot Screen Error Messages

This section contains examples of warning screens associated with booting error conditions. Some booting error conditions may require you to contact Cisco Services.

Booting Error Messages

The following table lists booting error conditions sorted alphabetically by error type, and provides suggestions for correcting the error condition.

Error Condition	LCD Messages	Check and Correct
Application Code Download Failure Screens	<ul style="list-style-type: none"> ■ Bad TFTP Checksum The following message appears if the MQAM is unable to download application code execution files from the TFTP server due to a bad checksum. <div style="border: 1px solid black; padding: 5px; text-align: center;">Bad TFTP App Checksum Restarting...</div> The MQAM automatically reboots. ■ Unable to TFTP App Code (Boot Mode=2) The following message appears if the MQAM is unable to download application code execution files from the TFTP server during boot mode 2. <div style="border: 1px solid black; padding: 5px; text-align: center;">Unable to TFTP App Code Restarting...</div> The MQAM automatically reboots. ■ Unable to TFTP App Code (Boot Mode=1) The following message appears if the MQAM is unable to download the application code execution files from the TFTP server during boot mode 1. <div style="border: 1px solid black; padding: 5px; text-align: center;">Unable to TFTP App Code Continuing Startup...</div> The MQAM then starts the application program. 	<ul style="list-style-type: none"> ■ A corrupted application file may cause this condition. ■ Reinstall the MQAM package on the DNCS if all MQAMs have this error condition. ■ Check IP connectivity. ■ Contact Cisco Services. <p>Note: Refer to <i>Understand the Boot Process</i> (on page 42) for detailed descriptions of the boot process.</p>

Error Condition	LCD Messages	Check and Correct
Boot Download Failure Screens	<ul style="list-style-type: none"> ■ Unable to TFTP Boot Code (Boot Mode=1) The following message appears if the MQAM is unable to download the boot code execution file from the TFTP server during boot mode 1.  <p>The MQAM then starts the application program.</p> ■ Unable to TFTP Boot Code (Boot Mode=2) The following message appears if the MQAM is unable to download the boot code execution file from the TFTP server during boot mode 2.  <p>The MQAM then automatically reboots.</p> 	<ul style="list-style-type: none"> ■ An incorrect DNCS configuration may also cause this condition. ■ Reinstall the MQAM package on the DNCS if all MQAMs have this error condition. ■ Check IP connectivity. ■ Contact Cisco Services.
Default Status Screen	<p>If an RF carrier channel cannot be accessed or is missing, the following message appears:</p> 	<ul style="list-style-type: none"> ■ A possible RF hardware problem occurred. ■ Contact Cisco Services.
Incorrect Configuration File Screens	<ul style="list-style-type: none"> ■ Invalid Config File (Boot Mode 1) The following message appears when in boot mode 1 and the configuration file type is incorrect for the MQAM. The first line of the configuration file contains GqamBootpFileType=1.0.  <p>The MQAM then starts the application program.</p> ■ Invalid Config File (Boot Mode 2) The following message appears when in boot mode 2 and the configuration file type is incorrect for the MQAM. The first line of the configuration file contains GqamBootpFileType=2.0.  <p>The MQAM then automatically reboots.</p> 	<ul style="list-style-type: none"> ■ Correct the configuration file. ■ Contact Cisco Services.

Troubleshooting Boot Screen Error Messages

Error Condition	LCD Messages	Check and Correct
RF Module Code Download Failure Screen	<ul style="list-style-type: none"> ■ Unable to TFTP RF Code <p>The following message appears if the MQAM is unable to download the RF module code execution files for boot mode 1 or boot mode 2 from the TFTP server.</p> <div style="border: 1px solid black; padding: 5px; text-align: center;"> Unable to TFTP RF Code Restarting... </div> <p>The MQAM then automatically reboots.</p>	<ul style="list-style-type: none"> ■ Check the configuration file. ■ Check for an incorrect IP address, boot mode, or DNCS address. ■ Reinstall the MQAM package on the DNCS if all MQAMs have this error condition. ■ Check IP connectivity. ■ Contact Cisco Services.
Unable to Boot Successfully	<ul style="list-style-type: none"> ■ Unable to perform BootP (Boot Mode 1) <p>The following message appears if the MQAM is in boot mode 1 while unable to perform a successful boot process (BootP).</p> <div style="border: 1px solid black; padding: 5px; text-align: center;"> Unable to perform BootP Continuing Startup... </div> <p>The MQAM then starts the application program.</p> <ul style="list-style-type: none"> ■ Unable to perform Bootp (Boot Mode 2) <p>The following message appears if the MQAM is in boot mode 2 while unable to obtain a successful BootP.</p> <div style="border: 1px solid black; padding: 5px; text-align: center;"> Unable to perform BootP Restarting... </div> <p>The MQAM then automatically reboots.</p>	<ul style="list-style-type: none"> ■ Verify that the Ethernet port is connected and that the MAC address for the unit matches the MAC address listing on the DNCS. ■ Contact Cisco Services.

Error Condition	LCD Messages	Check and Correct
Unable to Download Configuration File from TFTP Server	<ul style="list-style-type: none"> ■ Unable to TFTP Config File (Boot Mode 1) The following message appears when in boot mode 1 and the MQAM is unable to download the configuration file from the TFTP server. <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-top: 10px;">Problem with Config File Continuing Startup...</div> <p>The MQAM then starts the application program.</p> ■ Unable to TFTP Config File (Boot Mode 2) The following message appears when in boot mode 2 and the MQAM is unable to download the configuration file from the TFTP server. <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-top: 10px;">Problem with Config File Restarting...</div> <p>The MQAM then automatically reboots.</p> 	<ul style="list-style-type: none"> ■ Verify that the configuration file provisioned on the DNCS is present in the DNCS File system. ■ An incorrect DNCS configuration may cause this error condition. ■ Contact Cisco Services.

6

Customer Information

If You Have Questions

If you have technical questions, call Cisco Services for assistance. Follow the menu options to speak with a service engineer.

Access your company's extranet site to view or order additional technical publications. For accessing instructions, contact the representative who handles your account. Check your extranet site often as the information is updated frequently.

A

Technical Specifications

Introduction

This appendix lists the power, rack, and environmental requirements for installing the MQAM and provides technical specifications.

In This Appendix

■ Installation and Operation Requirements	86
■ RF Specifications	88
■ ASI Input Specifications.....	89
■ Modulation Specifications	90
■ Digital I/O Performance Specifications.....	91
■ Connector Type.....	92
■ Factory Default Settings.....	93
■ Standard Output Frequencies	94

Installation and Operation Requirements

This section contains tables that define specifications specific to installing and operating the MQAM.

Power Requirements Table

The following table describes the power specifications for the modulator.

Item	Specification
Supply Voltage	<ul style="list-style-type: none">■ 90 to 130V AC @ 47 Hz to 63 Hz (AC unit)■ 180 to 264V AC @ 47 Hz to 63 Hz (AC unit)■ -42V to -57V DC (DC unit)
Fuses	<ul style="list-style-type: none">■ 4.0 A SLO BLO 250V (AC unit)■ 6.3 A SLO BLO 250V (DC unit)
Line Frequency	<ul style="list-style-type: none">■ 47 to 63 Hz (AC unit only)
Power Required	<ul style="list-style-type: none">■ 75 VA (typical)
Power Dissipated	<ul style="list-style-type: none">■ 55 Watts (typical)
In Rush Current	<ul style="list-style-type: none">■ 30 amps maximum (AC unit)■ 40 amps maximum (DC unit)

Rack Requirements Table

Item	Specification
Rack Mount Type	EIA RS-310
Height	1.75 in./4.45 cm
Width	19 in./48.26 cm
Depth	21 in./53.34 cm
Weight	12 lb./5.44 kg

Environmental Requirements Table

Item	Specification
Operating Temperature	0° to 50°C (32° to 122°F)  CAUTION: Avoid damage to this product! Your warranty is void if you operate this product above the maximum specified operating temperature. Use caution when installing wiring and racks to avoid obstruction of air flow into the side air vents of the MQAM, or out of the vent fans at the MQAM side panel.
Storage Temperature Range	-10° to 70°C (14° to 158°F)
Operating Humidity	5 to 95%, non-condensing
Vibration Susceptibility	No data errors with a chassis vibration of 0.5 Gs. No data errors with a vibration frequency of 10 to 400 Hz
Electrostatic Shock Susceptibility	No damage sustained from five discharges of 15 KV IEC electrostatic discharge model (150pF + 150 Ω) to all exposed connections

RF Specifications

Specification	Range	
Frequency Range (center frequency)	91 to 867 MHz	
Minimum Tuning Step Size	250 kHz	
RF Output Power Level	+45 to +55 dBmV (0.1 dB steps) minimum range	
RF Output Impedance	75 Ω	
RF Output Return Loss (unsquelched)	> 12 dB (within output channel)	
Spurious Outputs (DC - 1.1 GHz) single frequency modulated output related	< -60 dB < -57 dB	
Noise Floor (out of band)	< -136 dBc/Hz > 40 MHz from Fc	
Phase Noise	-60 dBc/Hz -84 dBc/Hz -102 dBc/Hz -108 dBc/Hz	1 kHz from carrier 10 kHz from carrier 50 kHz from carrier 100 kHz from carrier
Output Noise (broadband) Floor with Carrier Squelched	< -93 dBmV/Hz	
Output Power level with Carrier Squelched	< -10 dBmV	
Output Power Level Stability over temperature	± 2.0 dB	
Output Power Level Change Over Tuning Range	± 2.0 dB	
Output Frequency Error (over temperature)	< 5 ppm	

ASI Input Specifications

Specification	Value
Minimum Sensitivity	200 mV (p-p)
Maximum Input Voltage	880 mV (p-p)
Input Impedance	75 Ω
Input Return Loss	> 17 dB (27 to 270 MHz)

Modulation Specifications

Modulation Specifications Table

The following table provides modulation specifications for the MQAM.

Modulation Type	Alpha	Default Interleaver	Symbol Rate (MHz)	Data Rate including MPEG Header	Data Rate excluding MPEG Header
ITU-B 256	12%	I=128 J=1	5.360537	38.811 MB	37.985MB
ITU-B 64	18%	I=128 J=1	5.056944	26.971 MB	26.397 MB
DAVIC 256	12%	I=204 J=1	5.304	39.104 MB	38.272 MB
DAVIC 64	12%	I=12 J=17	5.304	29.328 MB	28.704 MB
DAVIC 16	12%	I=12 J=17	5.304	19.552 MB	19.136 MB

Digital I/O Performance Specifications

Digital I/O Performance Specifications Table

The following table provides digital input and output performance specifications for the MQAM.

Specification	Value
Maximum Input Rate	216 Mbps for each of the two ASI input ports, 432 Mbps total, including overhead
Maximum Aggregate Output Rate	38.8 Mbps for each of the RF output ports, 155.2 Mbps total, including overhead
Maximum Number of Sessions per MQAM	234 sessions per channel
Maximum Number of Content PIDs	1000, total for all sessions
Maximum Multicast Bandwidth	38.8 Mbps

Connector Type

Connector Type Table

The following table lists the various types of connectors for the MQAM.

Item	Connector
10 Base-T Ethernet	RJ-45
AC Power	IEC 320-conductor grounded outlet
DC Power	2 Termi-Blok 90 degree header
ASI Inputs (2)	BNC, 75 Ω
Craft (serial port) I/O	DB-9 male
RF Output (4)	Type F connectors, 75 Ω

Factory Default Settings

Factory Default Settings Table

The following table lists default settings for the modulator.

Value	Factory Setting
Boot Mode	2
Carrier Mode	Modulated
Encryption	PowerKEY
ITUB Interleave	128, 4
LCD Contrast	80%
Modulation Type	ITUB 256
RF Freq	Highest Center Frequency Setting (867 MHz)
RF Mute	Off (the output is <u>not</u> muted)
RF Output Level	Midrange setting (50 dBmV)

Standard Output Frequencies

The following table provides an example of channel center frequency settings listed in 6 MHz increments between 93 and 867 MHz.

Important: This modulator also supports all Standard, Harmonically Related Carrier (HRC), and Incremental Related Carrier (IRC) frequency lineups. This table is for reference purposes only.

93	99	105	111	117	123	129	135	141	147
153	159	165	171	177	183	189	195	201	207
213	219	225	231	237	243	249	255	261	267
273	279	285	291	297	303	309	315	321	327
333	339	345	351	357	363	369	375	381	387
393	399	405	411	417	423	429	435	441	447
453	459	465	471	477	483	489	495	501	507
513	519	525	531	537	543	549	555	561	567
573	579	585	591	597	603	609	615	621	627
633	639	645	651	657	663	669	675	681	687
693	699	705	711	717	723	729	735	741	747
753	759	765	771	777	783	789	795	801	807
813	819	825	831	837	843	849	855	861	867

Index

A

Adjust the Frequencies of a Selected Carrier • 49
Adjust the RF Output Level of a Selected RF Module • 13, 49
Adjusting the Output Frequency • 49
Advanced Parameters Tab • 38

B

Basic Parameters Tab • 38

C

Change the Boot Mode • 42
Change the Carrier Mode of a Selected RF Module • 49
Code Download Messages • 42
Connect Power Sources • 12, 13, 18, 46
Connect the 10/100BaseT Ethernet Port • 13
Connect the CA SYNC Port • 13, 45
Connect the DVB ASI Input Ports • 13
Connect the RF OUT Ports • 13
Connectivity Tab • 39
Customer Support • 72

F

File Selection Dialog Window • 38
Front Panel Overview • 48, 49

I

Initial Boot Screens • 42
Install the Modulator Into a Rack • 12
Installation and Operation Requirements • 12, 15

M

Monitor Setup Options • 13, 49
Mute the RF Output of a Selected RF Module • 49

P

Provision the MQAM • 13
Provisioning the MQAM on the DNCS • 20, 21

R

Read the Default Status Screen • 18
Record the MAC Address • 13

T

Troubleshooting Alarm Messages • 13, 55, 70
Troubleshooting Boot Screen Error Messages • 13, 42, 72

Troubleshooting the MQAM • 62

U

Understand the Boot Process • 13, 80
Unpack and Inspect the MQAM • 12

V

Viewing the Program Count • 13



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