



# ***CMR-5995***

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**Digicast Media Router S2 Receiver**  
**CMR-5995**

Installation and Operation Manual

Part Number MN-CMR5995-IOM

Revision 1

August 15, 2008

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# Errata C

## Comtech EF Data Documentation Update

**Subject:** Changes to DVB-S2 Pilot, Chapter 4 and Appendix D

**Date:** October 5, 2009

**Original Manual Part Number:** MNCMR5995.IOM **Rev 1**

**Errata Number / Agile Document ID** ER-CMR5995-EC1 **Agile CO Number** C09574

### Change Specifics:

This information will be incorporated into the next revision:

Added to Chapter 4, 4.2.14.1 Primary and Backup Tuner Configurations, p. 4-25:

#### **Pilot**

Enables or disables the Pilot for DVB-S2 mode of operation only.

**Important: Pilots must be enabled for reliable operation below 6.0 Msps.**

Added to Chapter 4, 4.3.11.1 Tuner Configuration Menu, p. 4-60:

#### **Pilot**

Enables or disables the Pilot for DVB-S2 mode of operation only.

**Important: Pilots must be enabled for reliable operation below 6.0 Msps.**

Added to Appendix D, D.2 Required Information for Setting up a Digicast Satellite Receiver, p. D-3:

#### **8. Pilots**

**Important: Pilots must be enabled for reliable operation below 6.0 Msps.**

Added to Appendix D, D.5 Required Important Terms to Understand, p. D-7:

#### **Pilots**

**Important: Pilots must be enabled for reliable operation below 6.0 Msps.**



# Errata B

## Comtech EF Data Documentation Update

**Subject:** Changes to Appendix F. DVB-S/S2 BER Performance

**Date:** June 26, 2009

**Original Manual Part Number:** MNCMR5995.IOM **Rev 1**

**Errata Number / Agile Document ID** ER-CMR5995-EB1 **Agile CO Number** C08557

### Change Specifics:

This information will be incorporated into the next revision. Appendix F, p. F-1:

**Test Configuration:**

Symbol Rate: 20 Msps  
Frame Size = 64,800 (Normal Frames)  
Pilots: Off  
Roll Off: 35%  
Nominal Input Power: -48 dB  
L-Band Frequency: 1,170 MHz

**Input Range:**

-25 to -61 dBm (2 Msps)  
-25 to -60 dBm (6 Msps)  
-25 to -59 dBm (10 Msps)  
-25 to -57 dBm (20 Msps)  
-25 to -56 dBm (32 Msps)

Receive signal level Monitor Accuracy  $\pm 10$  dB (-25 to -50 dBm)

**Assumptions:**

QEF =  $10^{-7}$  PER  
Es/No = C/N



# Errata A

## Comtech EF Data Documentation Update

**Subject:** Changes to:  
MN-CMR5995-IOM, Rev1, Section 4.3.11, Tuner Menu  
MN-CMR6000-IOM, Rev1, Section 4.4.11, Tuner Menu

**Date:** October 8, 2008

**Errata Numbers:** ER-CMR5995-EA1  
ER-CMR6000-EA1

**Agile Document IDs** ER-CMR5995-EA1      **Agile CO Number** CO5247  
ER-CMR6000-EA1

### Change Specifics:

This information will be incorporated into the next revisions.

MN-CMR5995-IOM, Rev1, Section 4.3.11, Tuner Menu  
MN-CMR6000-IOM, Rev1, Section 4.4.11, Tuner Menu

#### Change From:

#### **Fill Rate:**

Note: It is recommended that this value **NOT** be changed.

#### **Change To:**

#### **Fill Rate:**

This value should not be changed from the factory default setting (1,000,000) unless the receiver is being utilized for low-latency traffic such as VoIP traffic. Comtech EF Data recommends modifying this parameter to improve latency and jitter performance, to a setting greater than 5,000,000. The actual setting will depend upon traffic and may need to be set on a per case basis. The valid value range is 0 to 10,000,000, with the default as 1,000,000. VoIP traffic may require a setting between 5,000,000 to 10,000,000. Setting the Fill Rate to 10,000,000 (the maximum setting) may lower the overall performance (packets per second and bits per second) of the product by as much as 10%, so care must be taken when modifying this parameter.



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# Preface

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## Customer Support

Contact the Comtech EF Data Customer Support Department for:

- Product support or training
- Reporting comments or suggestions concerning manuals
- Information on upgrading or returning a product

A Customer Support representative may be reached at:

Comtech EF Data  
Attention: Customer Support Department  
2114 West 7th Street  
Tempe, Arizona 85281 USA

480.333.2433 or 480.333.4357 (Customer Support Desk)  
480.282.2850 (After Hours Support)  
480.333.2161 FAX

To return a Comtech EF Data product (in-warranty and out-of-warranty) for repair or replacement:

- **Contact** the Comtech EF Data Customer Support Department. Be prepared to supply the Customer Support representative with the model number, serial number, and a description of the problem.
- **Request** a Return Material Authorization (RMA) number from the Comtech EF Data Customer Support representative.
- **Pack** the product in its original shipping carton/packaging to ensure that the product is not damaged during shipping.
- **Ship** the product back to Comtech EF Data. (Shipping charges should be prepaid.)

### For Online Customer Support:

An RMA number request can be requested electronically by contacting the Customer Support Department through the online support page at [www.comtechefdata.com/service.asp](http://www.comtechefdata.com/service.asp):

- **Click** on the “RMA Request Form” hyperlink, then fill out the form completely before sending.
- **Send e-mail** to the Customer Support Department at [cdmipsupport@comtechefdata.com](mailto:cdmipsupport@comtechefdata.com).

For information regarding this product’s warranty policy, refer to the Warranty Policy, p. xi.

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## About this Manual

This manual provides installation and operation information, functional capabilities, and performance specifications for the Comtech EF Data (CEFD) CMR-5995 Digicast Media Router S2 Receivers. The manual additionally provides information on how to connect the CMR-5995 to other data transport equipment.

This is a technical document intended for earth station engineers, technicians, and operators responsible for the operation and maintenance of the CEFD Digicast CMR-5995 Media Router S2 Receiver.

## Reporting Comments or Suggestions Concerning this Manual

Comments and suggestions regarding the content and design of this manual are appreciated. To submit comments, please e-mail the Comtech EF Data Technical Publications Department at [techpub@comtechefdata.com](mailto:techpub@comtechefdata.com).

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## Conventions and References

### Cautions and Warnings



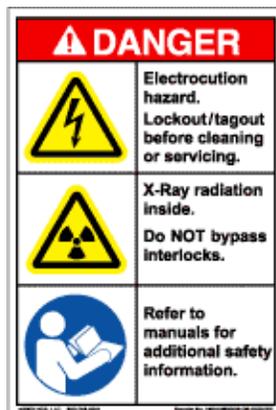
**IMPORTANT** or **NOTE** indicates a statement that is associated with the task being performed or information critical for proper equipment function.



**CAUTION** indicates a hazardous situation that, if not avoided, may result in minor or moderate injury. **CAUTION** may also be used to indicate other unsafe practices or risks of property damage.



**WARNING** indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.



Examples of Multi-Hazard Formats

## **Metric Conversion**

Metric conversion information is located on the inside back cover of this manual. This information is provided to assist the operator in cross-referencing non-Metric to Metric conversions.

## **Recommended Standard Designations**

Recommended Standard (RS) Designations are interchangeable with the designation of the Electronic Industries Association (EIA).

## **Trademarks**

Windows is a trademark of the Microsoft Corporation.

Other product names mentioned in this manual may be trademarks or registered trademarks of their respective companies and are hereby acknowledged. Comtech EF Data neither endorses nor otherwise sponsors any such production or services referred herein.

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## **Electromagnetic Compatibility (EMC) Compliance**

This is a Class B product. In a domestic environment, it may cause radio interference that requires the user to take adequate protection measures.

## **Emissions Compliance**

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the Federal Communications Commission (FCC) rules, and EN55022 Class A requirements.

These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

## **EN61000 Compliance**

This equipment meets the EMC/immunity characteristics for the limits and methods of measurement for information technology equipment as per EN61000-4-2, EN61000-4-3, EN61000-4-4, EN61000-4-5 and EN61000-4-11.

This equipment meets the EMC/immunity characteristics for the limits and methods of measurement of mains harmonics & flicker for information technology equipment as per CE EN61000-3-2 and EN61000-3-3.

## Safety Compliance

### EN60950 Compliance

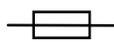
Applicable testing is routinely performed as a condition of manufacturing on all units to ensure compliance with safety requirements of EN60950. This equipment meets the Safety of Information Technology Equipment specification as defined in EN60950.

### Low Voltage Directive (LVD)

The following information is applicable for the European Low Voltage Directive (EN60950):

<HAR>	Type of power cord required for use in the European Community.
	<b>CAUTION:</b> Double-pole/Neutral Fusing <b>ACHTUNG:</b> Zweipolige bzw. Neutraleiter-Sicherung

International Symbols:

Symbol	Definition
	Alternating Current
	Fuse

Symbol	Definition
	Protective Earth / Safety Ground
	Chassis Ground



**For additional symbols, refer to Cautions and Warnings listed earlier in this Preface.**

---

## Warranty Policy

Comtech EF Data products are warranted against defects in material and workmanship for a period of two years from the date of shipment. During the warranty period, Comtech EF Data will, at its option, repair or replace products that prove to be defective.

For equipment under warranty, the owner is responsible for freight to Comtech EF Data and all related customs, taxes, tariffs, insurance, etc. Comtech EF Data is responsible for the freight charges only for return of the equipment from the factory to the owner. Comtech EF Data will return the equipment by the same method (i.e., Air, Express, Surface) as the equipment was sent to Comtech EF Data.

All equipment returned for warranty repair must have a valid RMA number issued prior to return and be marked clearly on the return packaging. Comtech EF Data strongly recommends all equipment be returned in its original packaging.

Comtech EF Data Corporation's obligations under this warranty are limited to repair or replacement of failed parts, and the return shipment to the buyer of the repaired or replaced parts.

## Limitations of Warranty

The warranty does not apply to any part of a product that has been installed, altered, repaired, or misused in any way that, in the opinion of Comtech EF Data Corporation, would affect the reliability or detracts from the performance of any part of the product, or is damaged as the result of use in a way or with equipment that had not been previously approved by Comtech EF Data Corporation.

The warranty does not apply to any product or parts thereof where the serial number or the serial number of any of its parts has been altered, defaced, or removed.

The warranty does not cover damage or loss incurred in transportation of the product.

The warranty does not cover replacement or repair necessitated by loss or damage from any cause beyond the control of Comtech EF Data Corporation, such as lightning or other natural and weather related events or wartime environments.

The warranty does not cover any labor involved in the removal and or reinstallation of warranted equipment or parts on site, or any labor required to diagnose the necessity for repair or replacement.

The warranty excludes any responsibility by Comtech EF Data Corporation for incidental or consequential damages arising from the use of the equipment or products, or for any inability to use them either separate from or in combination with any other equipment or products.

A fixed charge established for each product will be imposed for all equipment returned for warranty repair where Comtech EF Data Corporation cannot identify the cause of the reported failure.

## **Exclusive Remedies**

Comtech EF Data Corporation's warranty, as stated is in lieu of all other warranties, expressed, implied, or statutory, including those of merchantability and fitness for a particular purpose. The buyer shall pass on to any purchaser, lessee, or other user of Comtech EF Data Corporation's products, the aforementioned warranty, and shall indemnify and hold harmless Comtech EF Data Corporation from any claims or liability of such purchaser, lessee, or user based upon allegations that the buyer, its agents, or employees have made additional warranties or representations as to product preference or use.

The remedies provided herein are the buyer's sole and exclusive remedies. Comtech EF Data shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory.

# Chapter 1. INTRODUCTION



Figure 1-1. Digicast Media Router S2 Receiver – Front Panel

---

## 1.1 Introduction

The Comtech EF Data (CEFD) Digicast Media Router S2 Receivers– referred to collectively throughout this manual as the “CMR-5995” – comes in one configuration:

**CEFD Digicast Media Router S2 Receiver – CMR-5995 (CMR-5995) L-Band / Asynchronous Serial Interface (ASI) to IP/ASI Receiver**

The CMR-5995 is an economical, L-Band-to-IP Receiver providing price-versus-performance unparalleled in today’s market. Additionally, the CMR-5995 provides the ability to multiplex the L-band tuner stream to an incoming ASI transport stream.

The CMR-5995 receives Multiprotocol Encapsulated (MPE) data as specified in ETSI EN 301 192 over MPEG-2 packets or raw Transport Streams (TS) carrying audio, video or data over an L-Band input.

The CMR-5995 supports:

- DVB-S (2 to 45 Msps)
  - FEC Rates: 1/2, 2/3, 3/4, 5/6 and 7/8
- DVB-S2 QPSK (2 to 32 Msps)
  - FEC Rates: 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9 and 9/10
- DVB-S2 8PSK (2 to 32 Msps)
  - FEC Rates: 3/5, 2/3, 3/4, 5/6, 8/9 and 9/10



**Figure 1-2. Digicast Media Router S2 Receiver – Rear Panel**

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## 1.2 Standard Features

Based on an embedded architecture, utilizing a FreeScale MPC859 CPU and eCOS Operating System, the CMR-5995 features:

- High Reliability
- DVB-S and DVB-S2 L-Band Input
- ASI Input at rates as high as 213 Mbps
- Ethernet Output rates as high as 83 Mbps (1,500 byte packets)
- ASI Output rates as high as 213 Mbps
- Support for Multicast and Unicast IP datagrams
- Supports the decapsulation of MPE
- MPE Section Packing and Non-Section Packing on a PID-by-PID basis
- Supports encapsulation of transport streams over IP
- Support for all valid PIDs in 8192 range
- Support for the configuration of 64 simultaneous PIDs
- MPEG-2 188/204-byte operation
- Support for 802.1Q VLAN Tags
- IGMP for Multicast Route Announcements
- Redundancy via the CMR-Redundancy Scheme
- Configurable Telnet and HTTP ports for security
- Color LEDs for status monitoring and rapid fault isolation
- Management (monitor, control and configuration):
  - Web Interface
  - TFTP for field software/firmware upgrade
  - Terminal Interface
  - Telnet
  - SNMP V2 (Private and MIB II) Support
  - Vload

### 1.3 Performance

Item	Value
Maximum Bits Per Second (Maximum Packet Size 1,500 Bytes)	83 Mbps
Latency	Less than 10 ms
Minimum Symbol Rate	DVB-S (2 Msps) DVB-S2 (2 Msps)
Maximum Symbol Rate	DVB-S (45 Msps) DVB-S2 (32 Msps)
Minimum Input Level	-50 dBm
Maximum Input Level	-25 dBm
ASI to ASI PCR Jitter	<75nS

### 1.4 Configurations

The CMR-5995, shown in Figure 1-3, is a Satellite-to-Ethernet IP router.

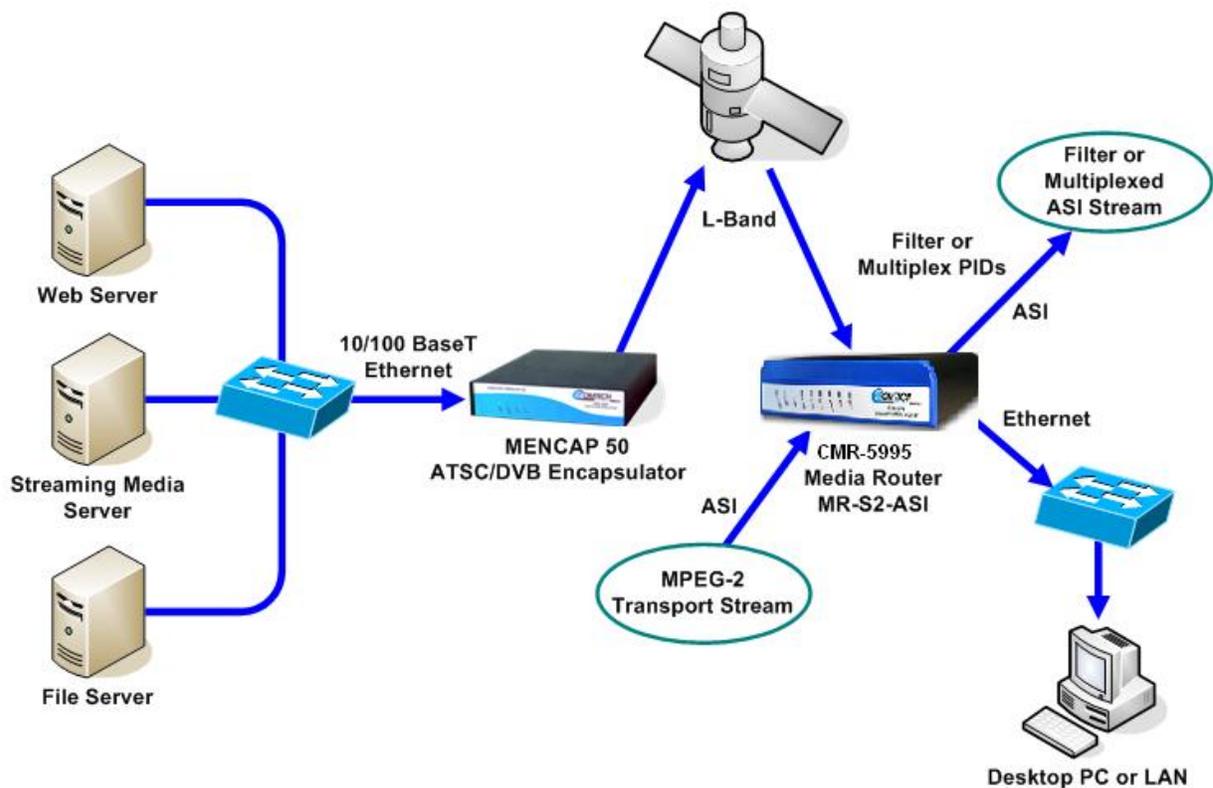


Figure 1-3. CMR-5995 Configured as a Satellite-to-Ethernet IP Router

## 1.5 Specifications

Parameter		Specification		
L-Band Tuner	DVB-S	( 2 to 45 Msps) FEC Rates: 1/2, 2/3, 3/4, 5/6 and 7/8		
	DVB-S2	QPSK	( 2 to 32 Msps) FEC Rates: 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9 and 9/10	
		8PSK	( 2 to 32 Msps) FEC Rates: 3/5, 2/3, 3/4, 5/6, 8/9 and 9/10	
Physical	Dimensions	8.75" L x 7.125" W x 1.625" H (22.225 L x 18.0975 W x 4.1.275 H cm)		
	Weight	1.6 lbs. (0.6 kg)		
	Power	2.5 mm with screw type connector		
	L-Band Input	F-Type (75Ω)		
	ASI Input/Output	BNC-Type (75Ω)		
	Ethernet (10/100BaseT)	RJ-45		
	Terminal	RJ-12		
	Redundancy	RJ-12		
	LEDs	Blue	PWR	Power indicator
		Green	RED	Redundancy indicator
		Red	ALARM	Flashing when the unit is in an alarm state
		Green	LOCK	Steady light indicates that the receiver has obtained a locked signal
		Green	E-SPD	Ethernet speed
Amber		E-COL	Ethernet collision indicator	
Green		E-RX	Ethernet receive indicator	
Green		E-TX	Ethernet transmit indicator	
Electrical	Power Input / Consumption	100 to 240 VAC 47/63 Hz converted to +5VDC @ 5.0A/ <25W		
	L-Band Input	DVB-S ETSI EN 300 421 DVB-S2 ETSI EN 302 307		
	Ethernet (10/100BaseT)	IEEE 802.3u		
	ASI Input/Output	EN-50083-9		
	Console	RS-232		
	Redundancy	RS-232		
Environmental	<b>Temperature</b>			
	Operating	32° to 104° Fahrenheit (0° to 40° Celsius)		
	Storage (Non-operating)	-22° to 150° Fahrenheit (-30° to 65° Celsius)		
	<b>Humidity</b>			
	Operating	10% to 75% Non-condensing		
	Storage (Non-operating)	Relative humidity to 95% with temperature ≤ 95° Fahrenheit (35° Celsius)		
	<b>Altitude</b>			
	Operating	Up to 10,000 feet (3048 m) above sea level		
Storage (Non-operating)	Survival up to 50,000 feet (15240 m) above sea level for up to 15 hours			

## 1.6 Acronym Definitions

<b>ASI</b>	Asynchronous Serial Interface
<b>ARP</b>	Address Resolution Protocol
<b>CEFD</b>	Comtech EF Data
<b>DVB</b>	Digital Video Broadcasting
<b>DVB-S</b>	Digital Video Broadcasting - Satellite
<b>DVB-S2</b>	Digital Video Broadcasting - Satellite (Second Generation)
<b>EBU</b>	European Broadcasting Union
<b>ETS</b>	European Telecommunications Standard
<b>FTP</b>	File Transfer Protocol
<b>HTML</b>	Hypertext Markup Language
<b>HTTP</b>	HyperText Transport Protocol
<b>IANA</b>	Internet Assigned Number Authority
<b>IGMP</b>	Internet Group Management Protocol
<b>IP</b>	Internet Protocol
<b>IRD</b>	Integrated Receiver Decoder
<b>LAN</b>	Local Area Network
<b>MAC</b>	Media Access Control
<b>Mbps</b>	Mega bits per second
<b>MIB</b>	Management Information Base
<b>MPE</b>	Multi-Protocol Encapsulation
<b>MPEG</b>	Moving Pictures Expert Group
<b>MPEGTS</b>	Moving Pictures Expert Group Transport System
<b>MR</b>	Media Router
<b>Msp</b>	Megasymbol per second. A symbol is equivalent to 1 Hz of occupied bandwidth on a satellite (i.e., 34 Msp would be a satellite carrier occupying 34 MHz of bandwidth).
<b>MUX</b>	Multiplexer
<b>PAT</b>	Program Association Table The PAT lists PIDs for all PMTs in the stream.
<b>PID</b>	Program Identifier
<b>PMT</b>	Program Map Table Program Map Tables contain information about programs. The PMTs describe which PIDs contain data relevant to the program. PMTs also provide metadata about the streams in their constituent PIDs.
<b>PSI</b>	Program Specific Information Program Specific Information is comprised of four tables: Program Association (PAT), Program Map (PMT), Conditional Access (CAT), and Network Information (NIT).
<b>RS</b>	Reed Solomon
<b>SNMP</b>	Simple Network Management Protocol
<b>SYSLOG</b>	System Log
<b>TCP</b>	Transmission Control Protocol

<b>TERM</b>	Terminal
<b>TFTP</b>	Trivial File Transfer Protocol
<b>TSD</b>	Transport Stream Demultiplexer
<b>UDP</b>	User Datagram Protocol
<b>VLAN</b>	Virtual Local Area Network

# Chapter 2. INSTALLATION AND INITIAL CONFIGURATION

---

## 2.1 Major Assembly

The CEFD CMR-5995 is available in a standalone configuration. Table 2-1 lists the components provided with a standard configuration. In the event any listed item is missing, please contact Comtech EF Data Customer Support.

**Table 2-1. Digicast Media Router S2 Receiver – Standalone Configuration**

Quantity	Description
1	CMR-5995 [CMR-5995]
1	SPU30-102 Power Supply
1	IEC Power Cable
1	CA-TERMINAL Terminal Cable
1	Quick Start sheet

---

## 2.2 Unpacking

Retain the shipping container and packing materials for possible reshipment. Perform a receiving inspection as follows:

- **Inspect** the shipping container for damage. If there is damage to the shipping container, **notify the carrier**.
- **Check** to determine that all parts, materials and documentation have been shipped with the router.
- **Inspect** the router for possible physical damage.

- **Test** the router for proper operation.
- **Contact** Comtech EF Data Customer Support if the shipment is:
  - Incomplete
  - Physically damaged
  - Inoperable

## 2.3 Installation

The CMR-5995 is designed for ease of installation and configuration. Once the unit has been removed from the packing container, please follow these instructions:

Step	Procedure
1	Place the unit on a flat surface with free airflow, where the LEDs can be clearly observed and with unrestricted access to the rear panel of the unit.
2	Until the unit has been fully configured, the coaxial connection to the Low Noise Block (LNB) should NOT be connected to the unit . If the unit will not be powering the LNB, it is recommended that 'Polarity' (on the 'Tuner' configuration page) be set to 'Off'
3	Connect the DC power connection from the SPU30-102 (external power supply) to the connection labeled PWR on the back of the unit and tighten the restraining nut to ensure secure operation.
4	Connect an RJ-45 Ethernet cable (patch cord) to the port labeled ETHERNET and to an Ethernet concentrator (hub) or switch.
5	Connect a terminal cable P/N CA-TERMINAL (supplied) to the port labeled TERM and to a PC's serial port (DB-9), to initially configure the CMR-5995.
6	Connect the AC power (via the IEC power cord) between a standard wall outlet and the power supply. The Blue LED will illuminate.
7	Upon startup, the LEDs on the front panel may illuminate as follows:

Color	Label	Description
Blue	PWR	Illuminates if power is properly applied
Green	RED	Redundancy indicator
Red	ALARM	May illuminate if the unit is not yet configured
Green	LOCK	Illuminates if the tuner is locked
Green	E-SPD	Ethernet speed indicator
Amber	E-COL	Ethernet collision indicator
Green	E-RX	Flashes if there is Ethernet traffic/activity
Green	E-TX	
Green	E-LINK	Illuminates if the Ethernet connection to the Hub/Switch is operational

---

## 2.4 Initial Configuration

The initial configuration requires setting up the IP parameters using the terminal cable. Once the IP parameters have been configured, the terminal cable can be removed. Store the terminal cable in a known location, because it may be needed in the future.

To configure the IP parameters:

Step	Procedure
1	Using a terminal emulator on a PC such as HyperTerminal™ or TeraTerm™, set up the communication port as follows: 38,400 BAUD 8 Data Bits 1 Stop Bit No Parity No Flow Control
2	Press the <b>&lt;ENTER&gt;</b> key on the PC – the login prompt should be displayed.
3	The default user is “ <i>comtech</i> ” and the default password is “ <i>comtech</i> ”. After logging in, the CMR-5995’s menu should be displayed.
4	Press “ <b>N</b> ” for Network Menu.
5	Press “ <b>I</b> ” for the IP Address, Enter the IP Address and press <b>&lt;ENTER&gt;</b> .
6	Press “ <b>M</b> ” for the Subnet Mask. Enter the Subnet Mask and press <b>&lt;ENTER&gt;</b> .
7	Press “ <b>G</b> ” for the Default Gateway IP Address. Enter the Default Gateway Address and press <b>&lt;ENTER&gt;</b> .
8	Press “ <b>S</b> ” to save the parameters.
9	Press “ <b>Y</b> ” to confirm the saving of parameters.
10	Press “ <b>X</b> ” to exit to the main menu.

After completing Step 10, the unit has been configured for full IP operation and the terminal cable may be removed. (For continued operation, the unit may be managed via the Terminal Interface; however, it is recommended to use the Web Interface for ease of management.)

Additional configuration and management is best performed using the Web interface (refer to [Chapter 4, Device Management Via User Interfaces](#)).

Once fully configured, the coaxial connection to the Low Noise Block (LNB) may be safely attached to the L-Band input port. Read Section 2.5, Connect External Cables, for more information about the LNB connection.

---

## 2.5 Connect External Cables



Exercise caution when connecting the CMR-5995 LNB connection. The L-Band interface receives the L-Band input, but also outputs 13 VDC or 18 VDC @ 600mA.

If the CMR-5995 is not going to power an LNB, then the LNB power should be set to output 0 VDC (no output), or insert a DC-Block inline between the L-Band interface and any external device.

Should there be any question about the LNB, please contact the Comtech EF Data support group.

Descriptions of the interface connector pinouts are provided in [Chapter 3, Interface Pinouts](#).

# Chapter 3. INTERFACE PINOUTS

## 3.1 Pinout Overview

The rear panel interface (Figure 3-1) provides all necessary external connections between the CMR-5995 and other equipment.



Figure 3-1. Digicast Media Router S2 Receiver – Rear Panel

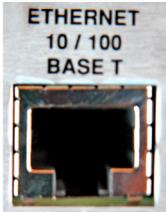
## 3.2 DC Power



Pin	Definition
Center	+5VDC
Outer Ring	GND

---

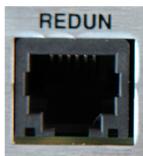
### 3.3 RJ-45 Ethernet



Pin	Definition
1	TXD+
2	TXD-
3	RXD+
4	N/C
5	N/C
6	RXD-
7	N/C
8	N/C

---

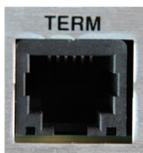
### 3.4 RJ-12 Redundancy



Pin	Definition
1	GND
2	TXD
3	RXD
4	GND
5	N/C
6	N/C

---

### 3.5 RJ-12 Terminal



Pin	Definition
1	GND
2	TXD
3	RXD
4	GND
5	N/C
6	N/C

---

### 3.6 ASI (RX and TX)



Pin	Definition
Center	8B/10B 270 Mbps
Outer Ring	GND

---

### 3.7 F-Type L-Band



Pin	Definition
Center	<b>Input</b> 950-2150 MHz <b>Output</b> +13VDC or + 18VDC 0.6A
Outer Ring	GND



# Chapter 4. DEVICE MANAGEMENT VIA USER INTERFACES

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## 4.1 Introduction

There are a variety of methods to configure and manage the CMR-5995:

- Web Interface via a LAN-based Desktop Browser - Recommended
- Terminal Interface via direct connection to a PC's asynchronous serial port
- Telnet Interface via a LAN
- TFTP for remote terminal upgrades
- Vload (software application allowing configuration changes to remote receivers)

---

## 4.2 Web Interface

The Web Interface, operating under standard HyperText Transport Protocol (HTTP), is used to communicate with and command the CMR-5995 via a HyperText Markup Language (HTML) - based Graphical User Interface (GUI).

To use the Web Interface, a LAN connection must exist between a PC with a browser and the CMR-5995.

The CMR-5995 requires the user to be authenticated via login before the configuration can be viewed or modified. The default user name is “*comtech*” and the default password is “*comtech*”.



**Note:** After a period of inactivity, the user will be logged out automatically. Log in again to re-establish connectivity.

After following the initial configuration procedure (see Chapter 2) to establish a valid IP Address, Subnet Mask and Default Gateway for the CMR-5995, activate a browser on the PC's desktop. Enter the IP address for the CMR-5995 into the URL field as shown in Figure 4-1.



**Note:** If the port number has been modified from the **standard 80** via the Terminal Interface, then the port number must be appended with a colon to the IP address.



**Figure 4-1. Connecting To The CMR-5995**

A successful connection between the PC and the CMR-5995 results in the display of the Login page shown in Figure 4-2.



**Figure 4-2. CMR-5995 Login Page**

The Login page is the entry point to the CMR-5995 menu system via a browser. The default user name is “comtech” and the default password is “comtech”.

The Home page (Figure 4-3) displays after successful login authentication:

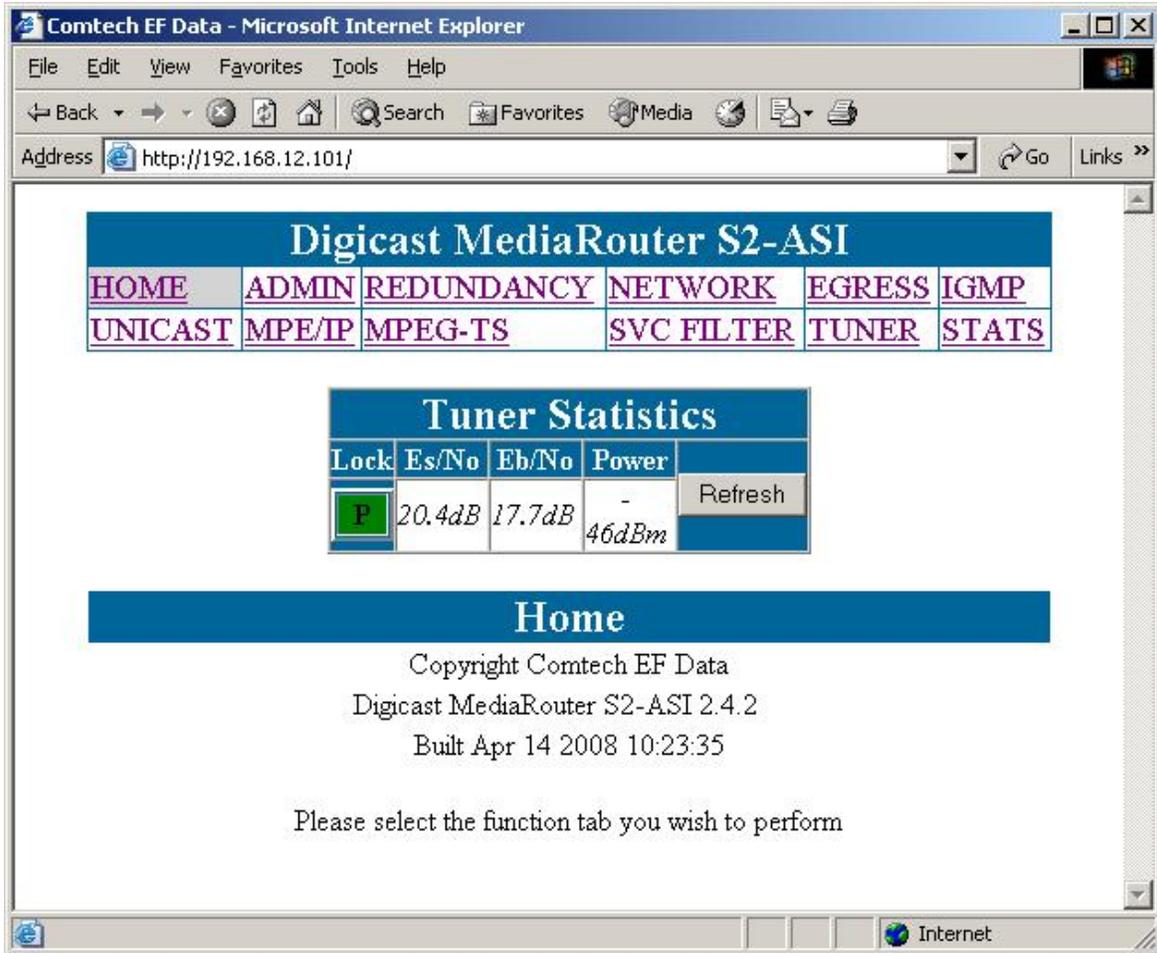


Figure 4-3. CMR-5995 Home Page

## 4.2.1 Administrative Configuration

Select the ADMIN menu item to display the Administrative Configuration page.

The screenshot shows a web browser window titled "Comtech EF Data - Microsoft Internet Explorer" with the address bar showing "http://192.168.12.101/admin.htm". The page content includes a navigation menu with links: HOME, ADMIN, REDUNDANCY, NETWORK, EGRESS, IGMP, UNICAST, MPE/IP, MPEG-TS, SVC FILTER, TUNER, and STATS. Below the menu is a "Tuner Statistics" section with a table showing Lock (green), Es/No (20.3dB), Eb/No (17.6dB), and Power (-46dBm), along with a Refresh button. The main section is "Administrative Configuration" with sub-links for [SNMP], [VLOAD], and [SYSLOG]. It contains several form fields: Unit Name (CMR-5995), OS Version (eCOS 2.0), App Version (2.4.2), FPGA Version (6.0.0.5), User Name (comtech), Password, Confirm Password, System Contact (comtech), System Location (comtech), and Enable Telnet (checked). Buttons for Submit, Cancel, Reset Unit, and Display Config are present. A note says "Press submit to make changes" and "\* Indicates a required field". Below this is the "Update Firmware" section with fields for Unit TFTP Server IP Address and Image Type (Application), a note "Enter server IP and select type, then press submit to make changes", and an Update button.

The CMR-5995 Administrative Configuration page contains the following **configurable**, **required** parameters:

### User Name

The CMR-5995's User Name is user configurable and is used for connecting to the unit via IP management services and terminal services.

The default user name is "comtech".

### **Password**

The Password is used for authenticating a user when connecting via IP management services.

The default password is “*comtech*”.

The password is case sensitive and must be entered carefully.

When the password is changed, enter the password **twice** for verification.

### **System Contact**

Enter the contact information of the system administrator for support.

### **System Location**

Enter the physical location where the unit has been installed.

### **Enable Telnet**

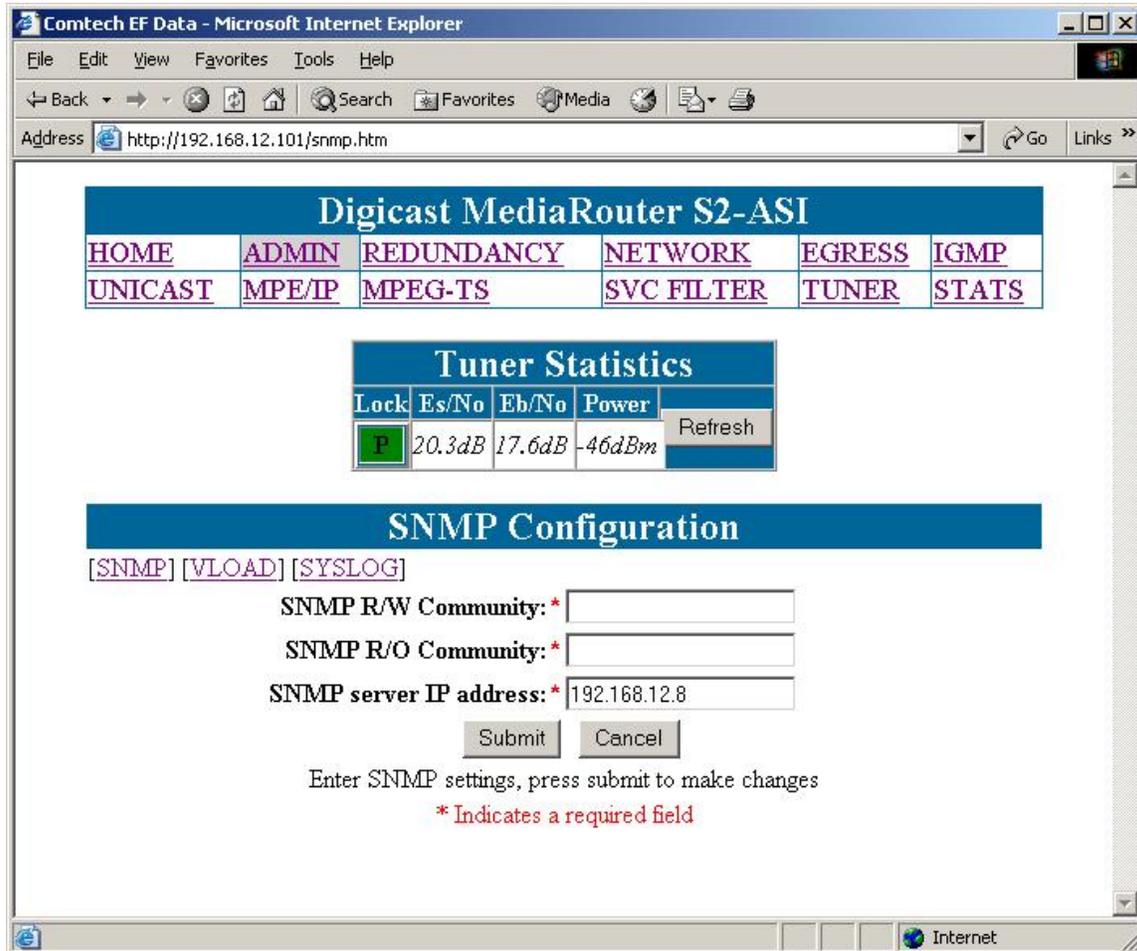
Use the checkbox to Enable or Disable Telnet application on the CMR-5995.

### **Update Firmware**

These fields are provided to allow for software/firmware changes.

## 4.2.2 SNMP Configuration

Select the [SNMP] option to display the SNMP Configuration page.



### SNMP R/W Community

The community name for authentication for read/write access to the private MIB.

### SNMP R/O Community

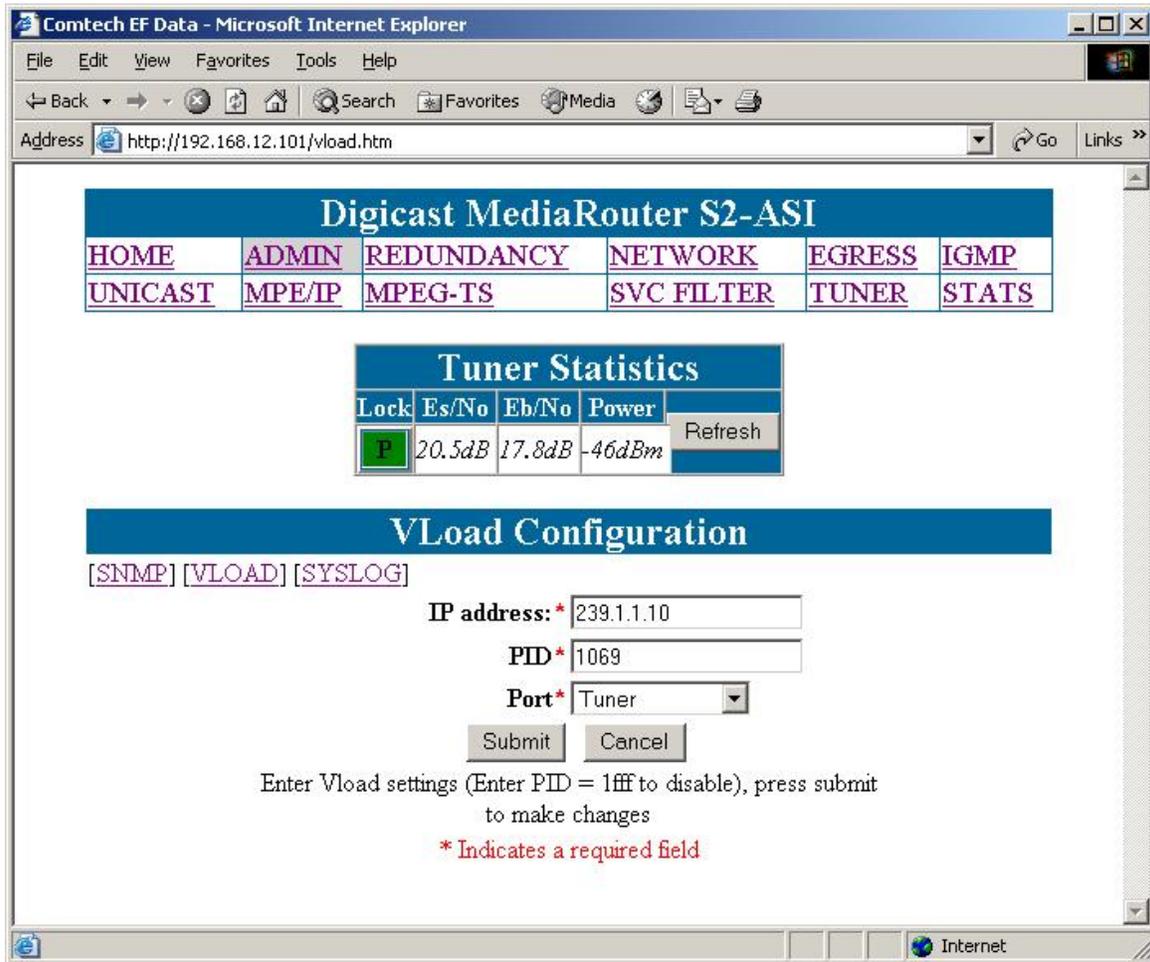
The community name for authentication for read only access to the private MIB.

### SNMP Server IP Address

The IP address of the SNMP server for sending SNMP traps.

### 4.2.3 Vload Configuration

Vload is a system used to remotely update the CMR-5995 receiver via multicast transmission. Please refer to the Digicast section of the Vload manual for information on how to use the head-end software component of Vload.



#### IP Address

The multicast address to be used for Vload.

Please note that the multicast address used here should **not be used in any other route settings**.

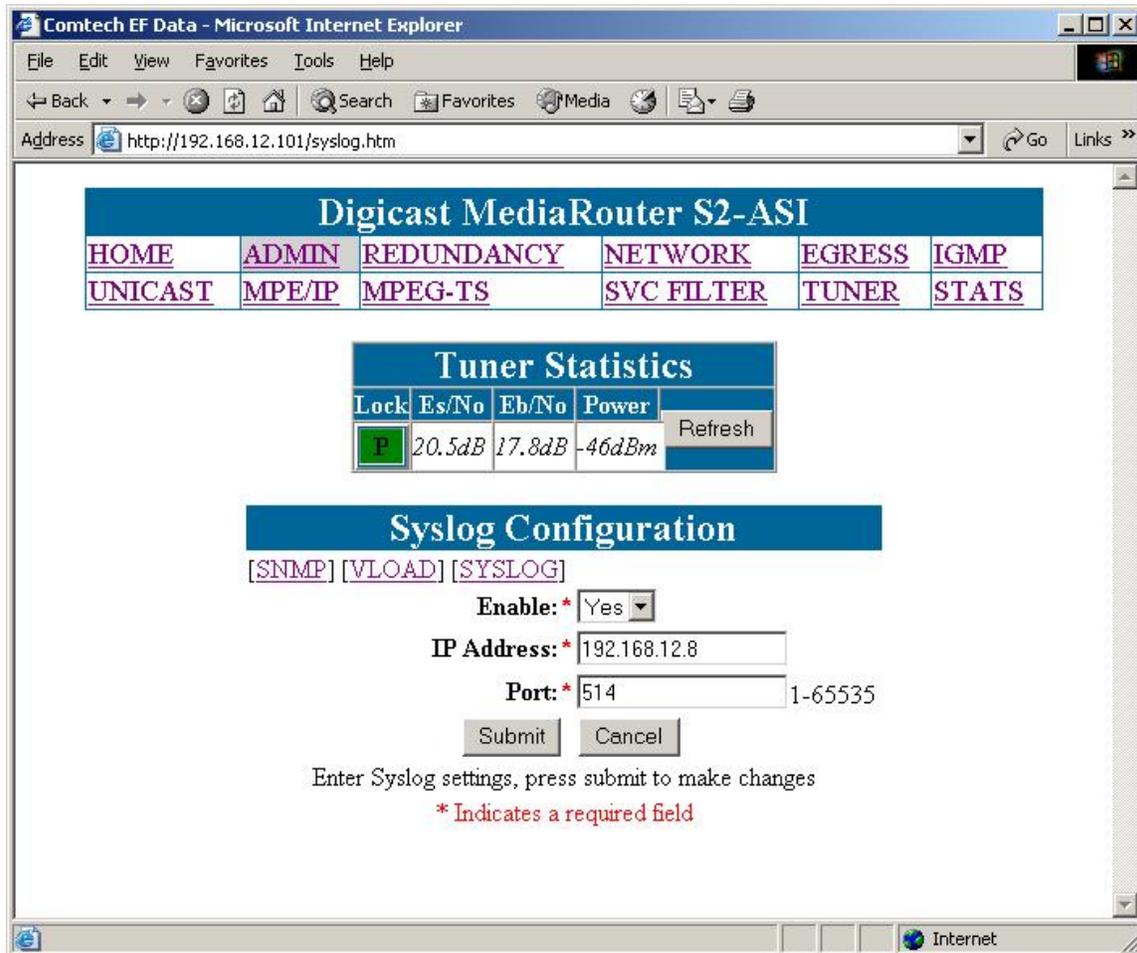
#### PID

Define the PID value (in hexadecimal format) to use for Vload.

**Note:** This PID value cannot be used or defined elsewhere on this receiver for carrying user data traffic.

## 4.2.4 Syslog Configuration

Select the [SYSLOG] option to display the Syslog Configuration page.



Syslog is a common feature of the Linux operating system. Syslog allows the events that occur on the CMR-5995 to be sent to a server where they can be logged. The events are delivered to a configured server over Ethernet IP.

### Enable

Enables or disables the Syslog feature.

### IP Address

The IP address of the Syslog server.

### Port

The port of the Syslog server. The default port number is **514**.

## 4.2.5 Redundancy Configuration

Redundancy is available when two units are used to ensure reliable service in the event of failure of a unit. The units are configured in Primary/Backup roles and communicate between each other using a serial cable (Part Number CA-0000011) connected to each unit's redundant port and via Ethernet.

The screenshot shows a web browser window titled "Comtech EF Data - Microsoft Internet Explorer" displaying the "Digicast MediaRouter S2-ASI" interface. The address bar shows "http://192.168.12.101/redundancy.htm".

The interface features a navigation menu with links: HOME, ADMIN, REDUNDANCY (selected), NETWORK, EGRESS, IGMP, UNICAST, MPE/IP, MPEG-TS, SVC FILTER, TUNER, and STATS.

Below the menu is a "Tuner Statistics" section with a table:

Lock	Es/No	Eb/No	Power	
P	20.3dB	17.6dB	-	Refresh
			46dBm	

The "Redundancy Configuration" section includes:

- Mode:** \* Primary (dropdown menu)
- Current State:** Primary
- Other Unit's IP Address:** \* 192.168.12.100 (text input field)
- Submit and Cancel buttons
- Text: "Enter Redundancy settings, press submit to make changes"
- Text: "\* Indicates a required field"

The "Other Unit Status" section shows:

Serial	Ethernet
OK, Mode Backup, State Backup	Unknown 00

### Other Unit's IP Address

Enter the IP address of the unit to be used in conjunction with this unit for redundant functionality.

### Mode

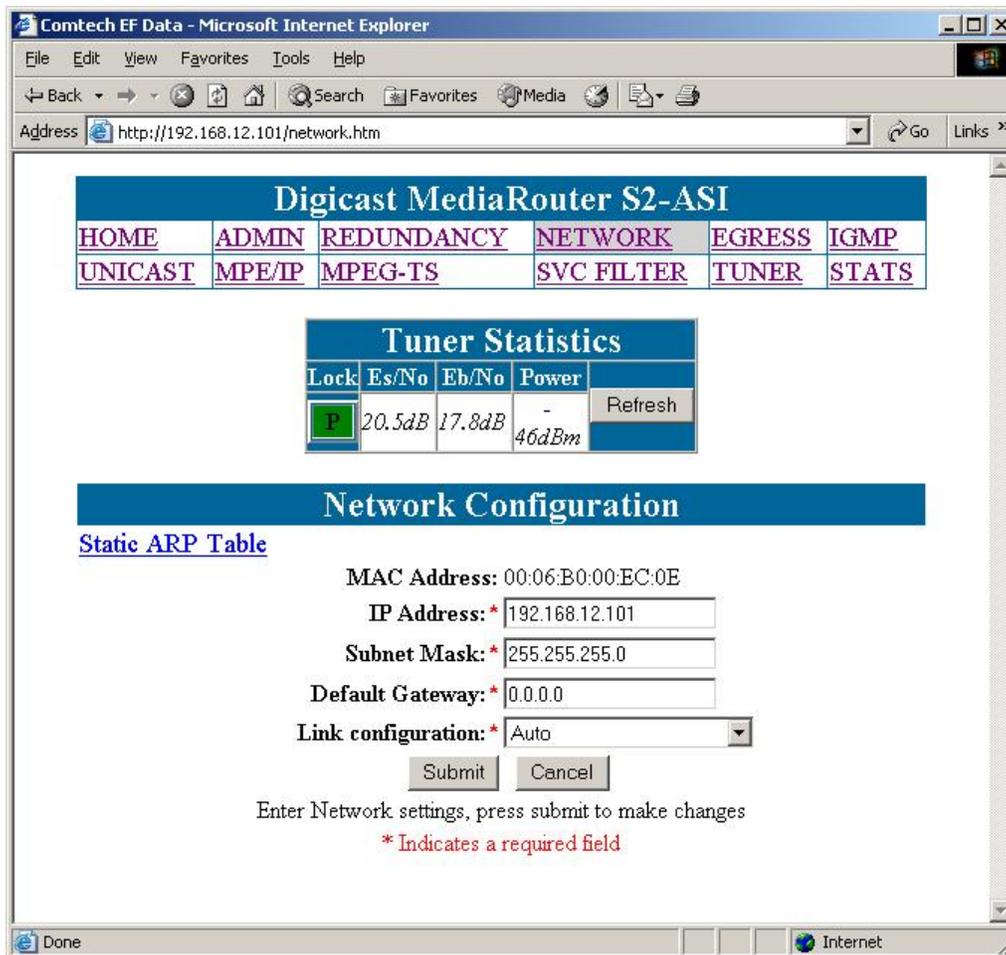
Select the mode of this receiver (Primary, Backup, Disabled). If two units are to be configured as a redundant system, then one unit must be "Primary" and the other must be "Backup". Please note that both units must be configured correctly (one as primary, the other as backup) in order for redundancy to function correctly.



**Note:** CMR Redundancy does not automatically configure the backup unit when changing the primary, or vice versa. Each unit must be independently configured when changes are required.

## 4.2.6 Network Configuration

Select the NETWORK menu item to display the Network Configuration page.



### IP Address

The IP Address assigned to the CMR-5995's LAN interface. The IP Address is entered in dotted decimal format.

### Subnet Mask

The Subnet Mask assigned to the CMR-5995's LAN interface. The Subnet Mask is entered in dotted decimal format and is typically 255.255.255.0 for a C-Class mask, 255.255.0.0 for a B-Class mask or 255.0.0.0 for an A-Class mask.

### Default Gateway

The Default Gateway assigned to the CMR-5995's LAN interface. The Default Gateway is entered in dotted decimal format and must be within the subnet of the IP Address assigned to the LAN interface. The Default Gateway is the address of a local router to which all non-local subnet traffic will be directed.

### **Link Configuration**

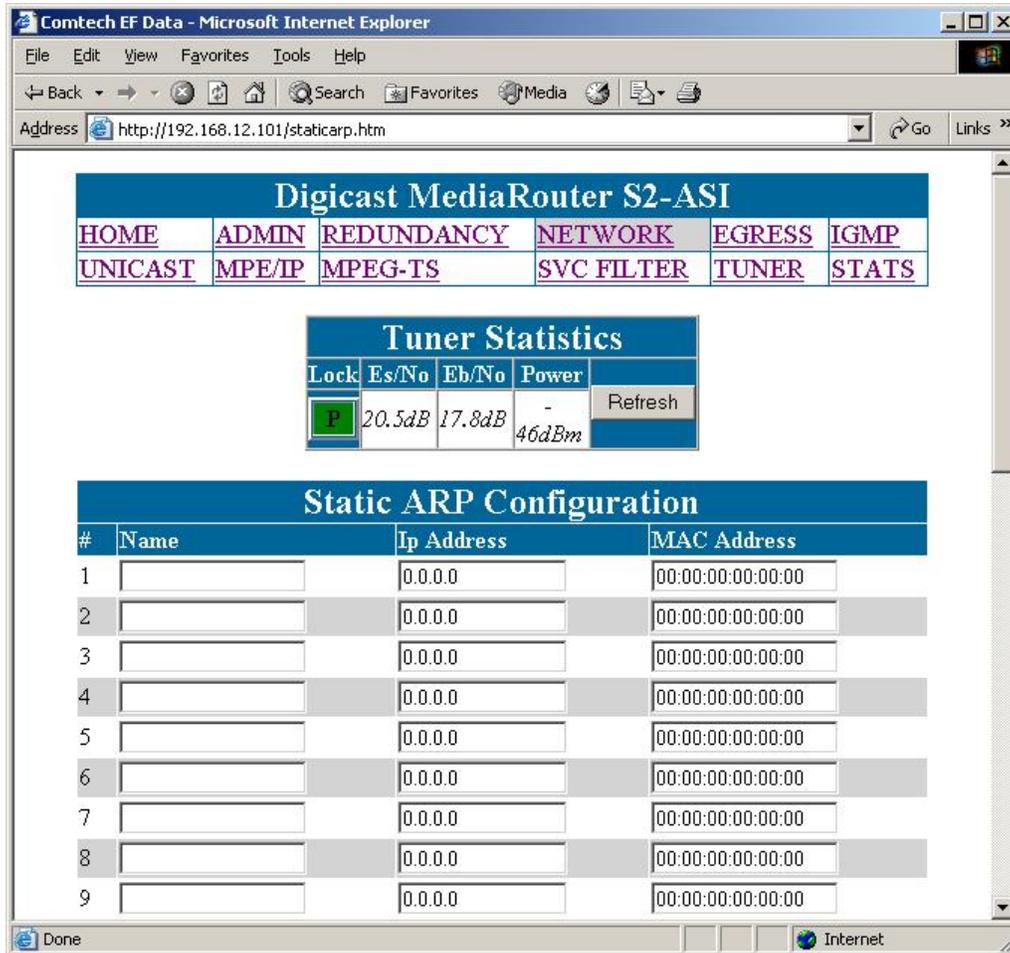
Select the line speed and duplex setting on the CMR-5995's LAN interface. The available options are:

- Auto – the port will auto-negotiate the configuration of the port
- 10 Mb / half duplex
- 10 Mb / full duplex
- 100 Mb / half duplex
- 100 Mb / full duplex

If the configuration of the port is unknown, then “Auto” is the recommended configuration.

## 4.2.7 Network ARP

The CMR-5995 allows the user to define a static ARP for a defined IP address. This mode should only be used when an IP flow is required to be directed to a particular MAC address.



Name

The name of the table entry.

### IP Address

A valid IP address of a device on the network.

### MAC Address

The MAC address associated with the IP address.

## 4.2.8 Egress

The Egress Configuration page addresses the CMR-5995's configuration for the ASI egress interface.

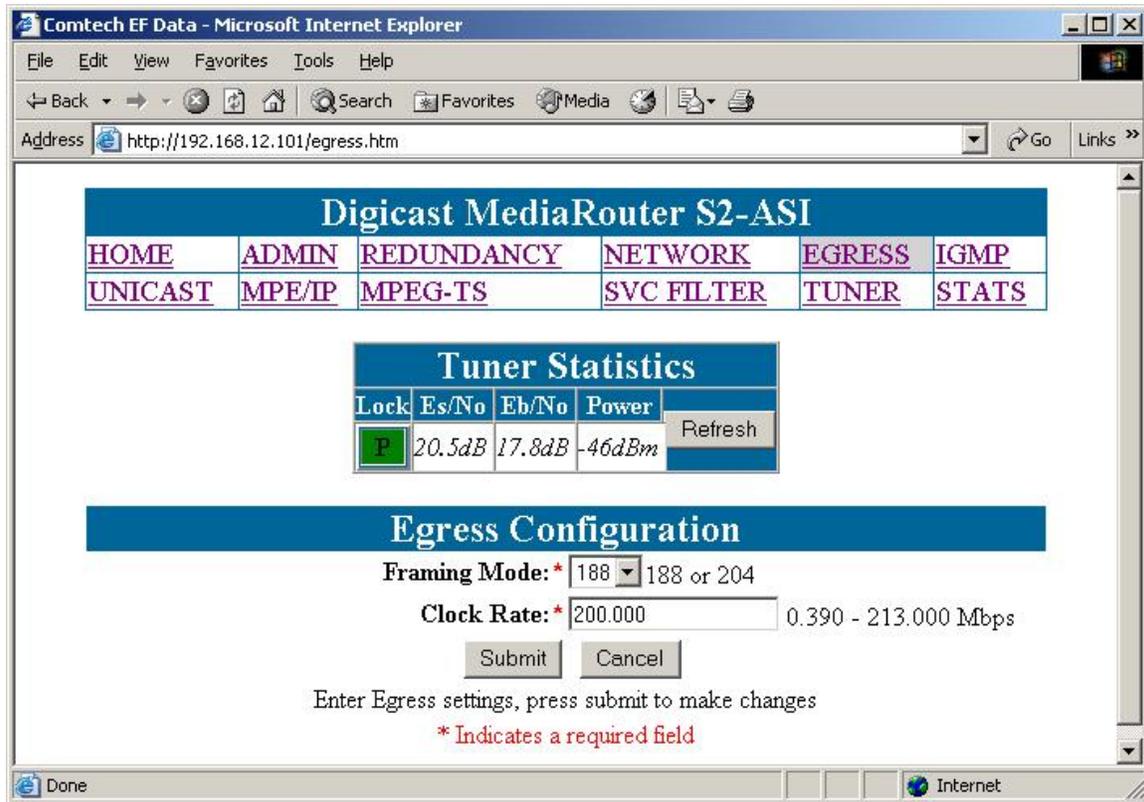


Figure 4-4. Egress Page

### Framing Mode

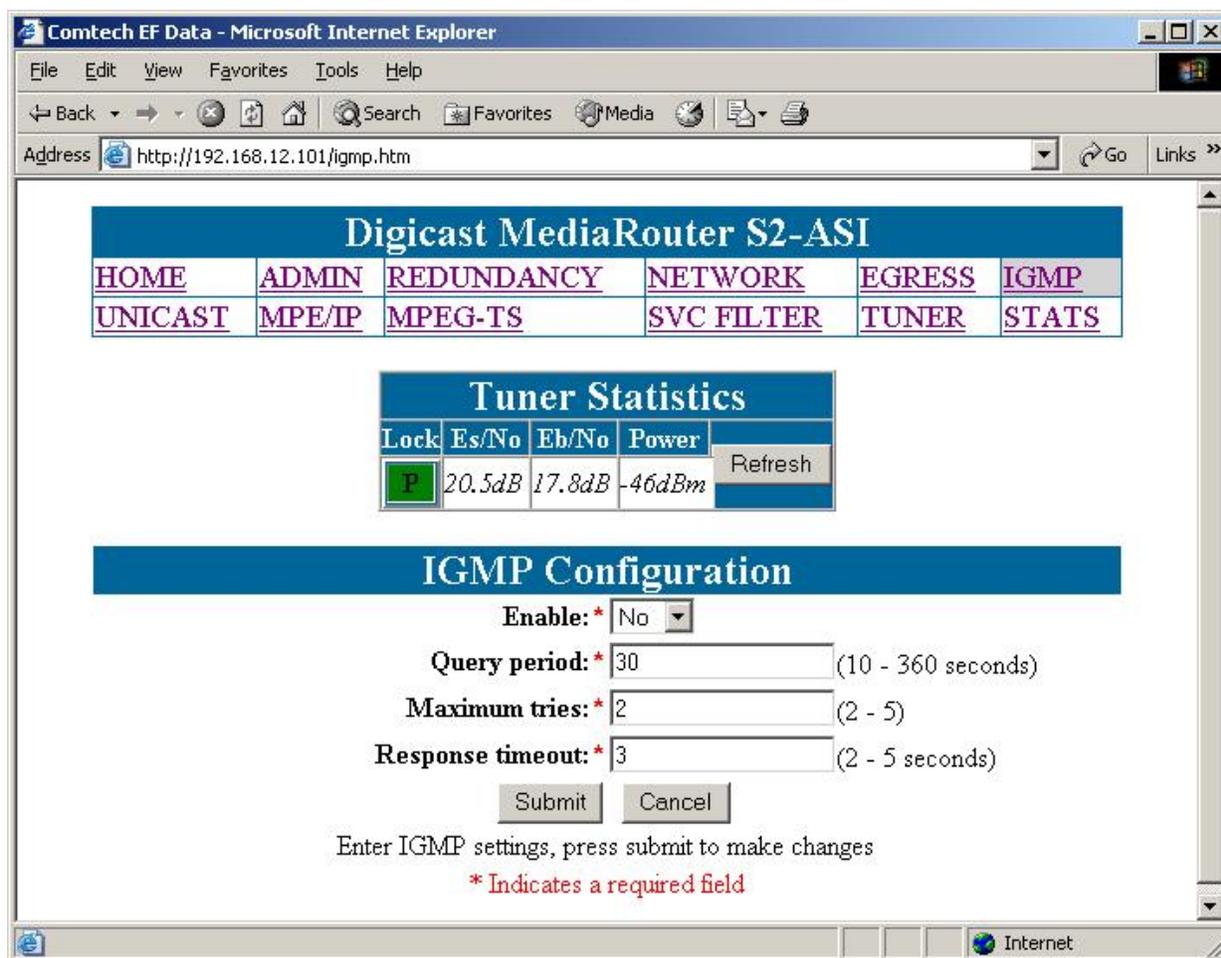
Selects whether the ASI operates with either 188-byte or 204-byte MPEG-2 Frames.

### Clock Rate

Sets the egress bit rate of the ASI Output interface in Mbps.

## 4.2.9 IGMP Configuration

Select the IGMP menu item to access the IGMP Configuration parameters.



### Enable

Select the Boolean if IGMP is to be supported. If the Boolean is not selected, all received Multicast IP is forwarded to the Ethernet, but if support is enabled, no Multicast IP will be forwarded to the Ethernet, until a subscriber has joined the Multicast group.

### Query Period

How often a solicitation is made for Multicast subscribers.

### Maximum Tries

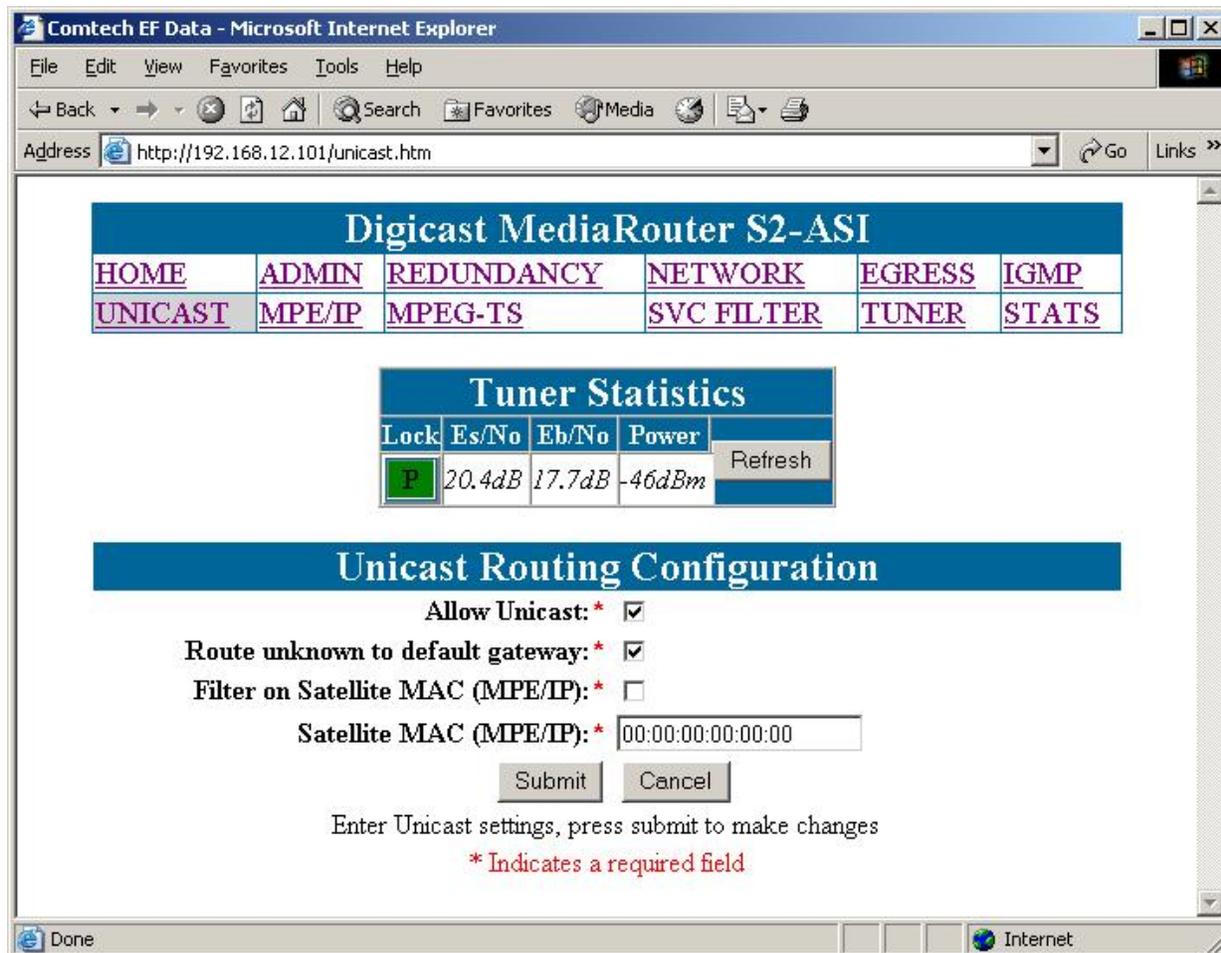
The maximum number of attempts the CMR-5995 will make for soliciting for Multicast subscribers before the Multicast stream is pruned off.

### Response Timeout

The maximum amount of time the CMR-5995 will wait for a Multicast Subscribers before the Multicast stream is pruned off.

## 4.2.10 Unicast Routing Configuration

The Unicast Routing Configuration page addresses the CMR-5995's configuration for handling Unicast traffic over the transport stream. This feature is only used in the MPE/IP configuration.



### Allow Unicast

Selects whether the CMR-5995 will support the routing of Unicast traffic.

### Route unknown to default gateway

When selected, all incoming Unicast that is not destined for the CMR-5995 local network subnet will be directed to the configured default gateway.

### Filter on Satellite MAC (MPE/IP)

The hardware Media Access Control (MAC) address assigned for Unicast operation. When the satellite MAC is defined, the CMR-5995 will only route Unicast traffic that is specifically addressed to the satellite MAC. This value does not affect the characteristics of multicast data flow.

Digicast receivers do not need to filter on MAC. Some third party encapsulators/receivers may need to filter on MAC, and if the MAC is configured on the Encapsulator for a Unicast Route.

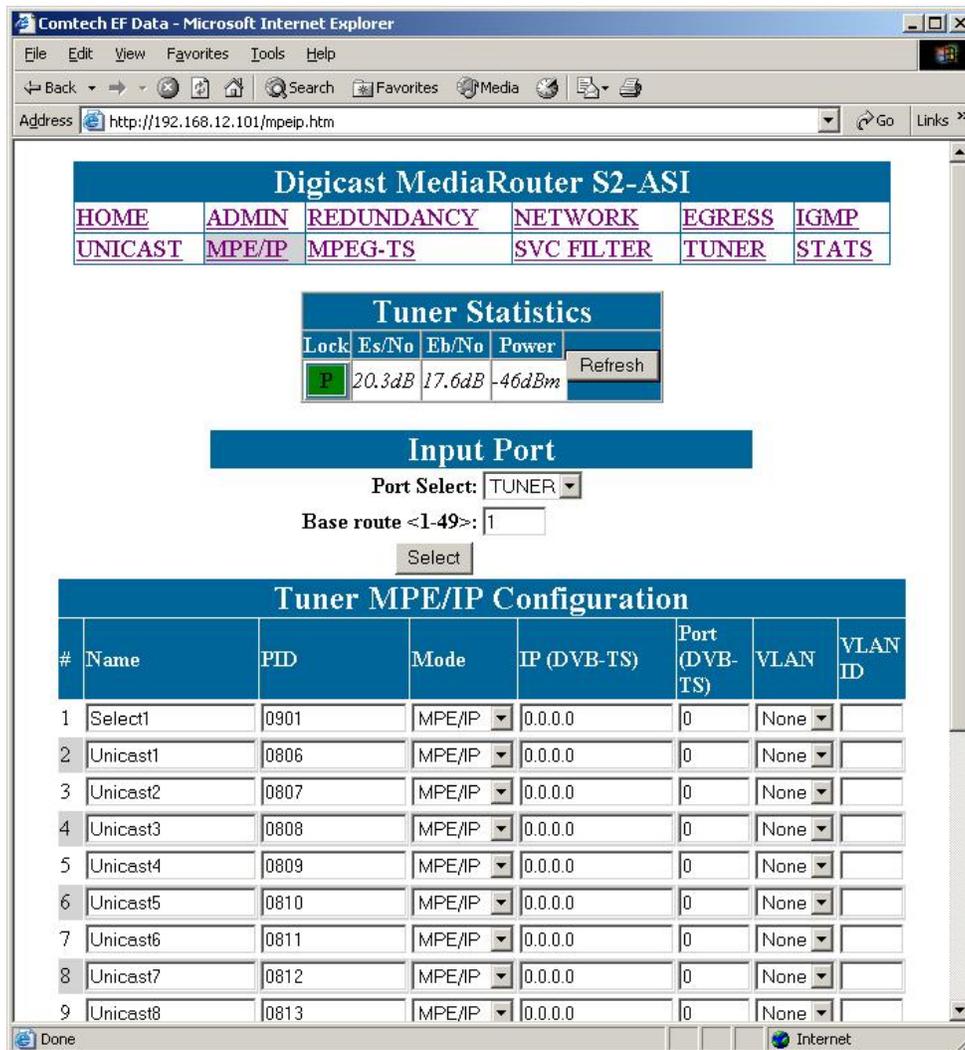
### **Satellite MAC (MPE/IP)**

The hardware Media Access Control (MAC) address assigned for Unicast operation. When the satellite MAC is defined, the CMR-5995 will only route Unicast traffic that is specifically addressed to the satellite MAC. This value does not affect the characteristics of multicast data flow. Do not use the CMR-5995 Ethernet MAC – this address should be the MAC assigned by the route defined in the Encapsulator at the uplink (headend).

## 4.2.11 MPE/IP Configuration

A configured PID value, in hexadecimal, is required for MPE/IP data to be extracted from the transport stream and sent to the CPU. Once a valid PID value is configured, and data is found on a transport stream, the data is decapsulated and delivered to the Ethernet port.

From the pull-down list, select an input interface for which the PIDs will be configured for MPE/IP (Tuner or ASI). A value of 0x1FFF is shown if disabled.



### Name

User defined name (cannot contain spaces)

### PID

A valid PID in hexadecimal format, ranging from 0x10 to 0x1FFE (0x1FFF disables the entry). The PID value cannot be in use elsewhere on the receiver.

**Mode**

MPE/IP or DVB-TS

**IP (DVB-TS)**

If DVB-TS Mode is selected, then a valid IP address is required. This is the destination IP address, and can be either multicast or unicast.

**Port (DVB-TS)**

If DVB-TS Mode is selected, then a valid destination port is required.

**VLAN**

Options are All, ID, or None

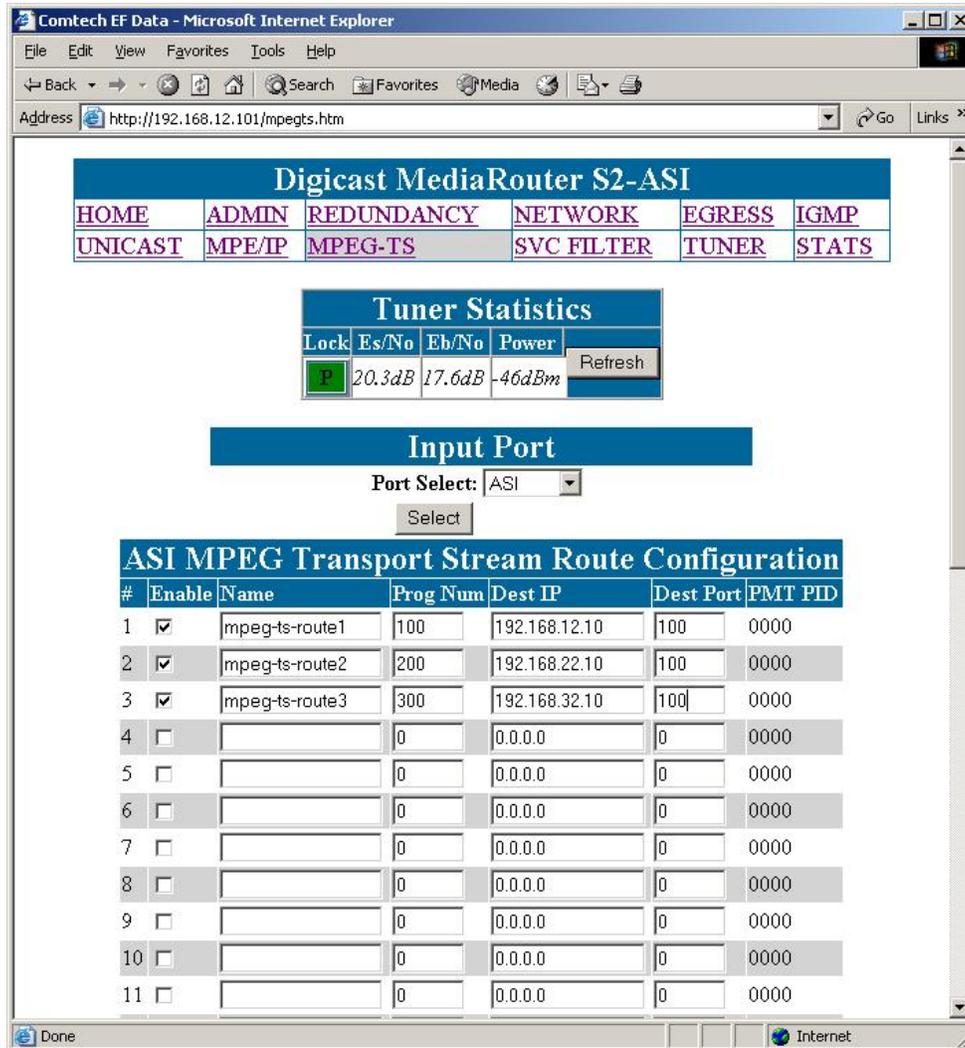
**VLAN ID**

VLAN ID tag from the originating point

## 4.2.12 Tuner MPEG TS Route Configuration

From the pull down, select which interface (Tuner or ASI) to configure.

Select the “Service List” button at the bottom of the page to see all services on the particular input. This is achieved by looking at the Program Stream Information (PSI) that is contained in the Program Association Table (PAT) and Program Mapping Table (PMT) – all detected programs will be displayed for either input port selected.



### Enable

Enables or disables the route.

### Name

The name of the incoming program that is extracted from the Program Service Information (PSI) and the Service Descriptor Table (SDT).

### Program Number

The program number, as defined in the service list, to be routed to the Ethernet as Transport Stream over IP.

### PMT PID Number

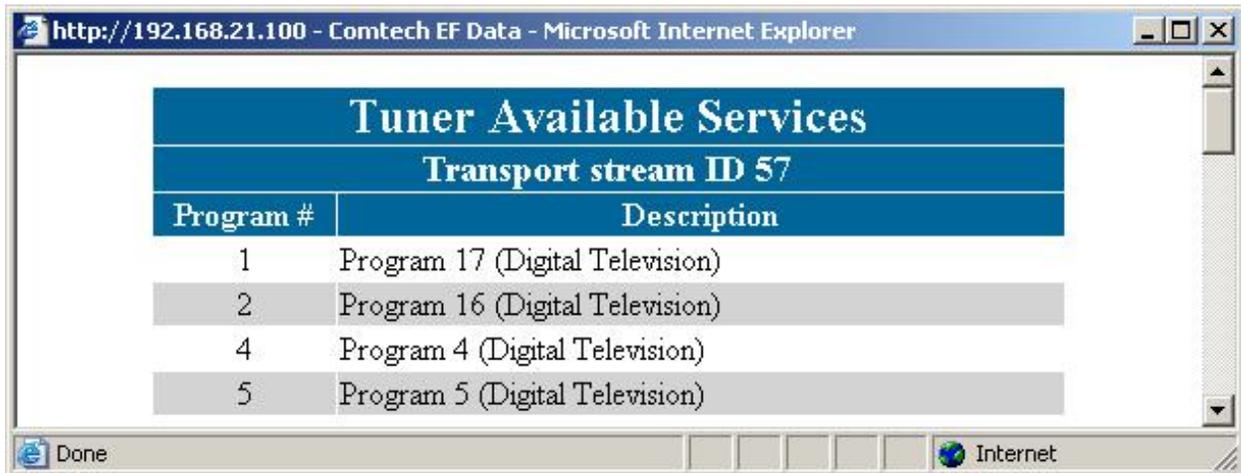
The PMT PID to be routed to the Ethernet as Transport Stream over IP.

### Destination IP

The IP address to be used when routing the Transport Stream over Ethernet IP.

### Port Number

The Port Number to be used when routing the Transport Stream over Ethernet IP.

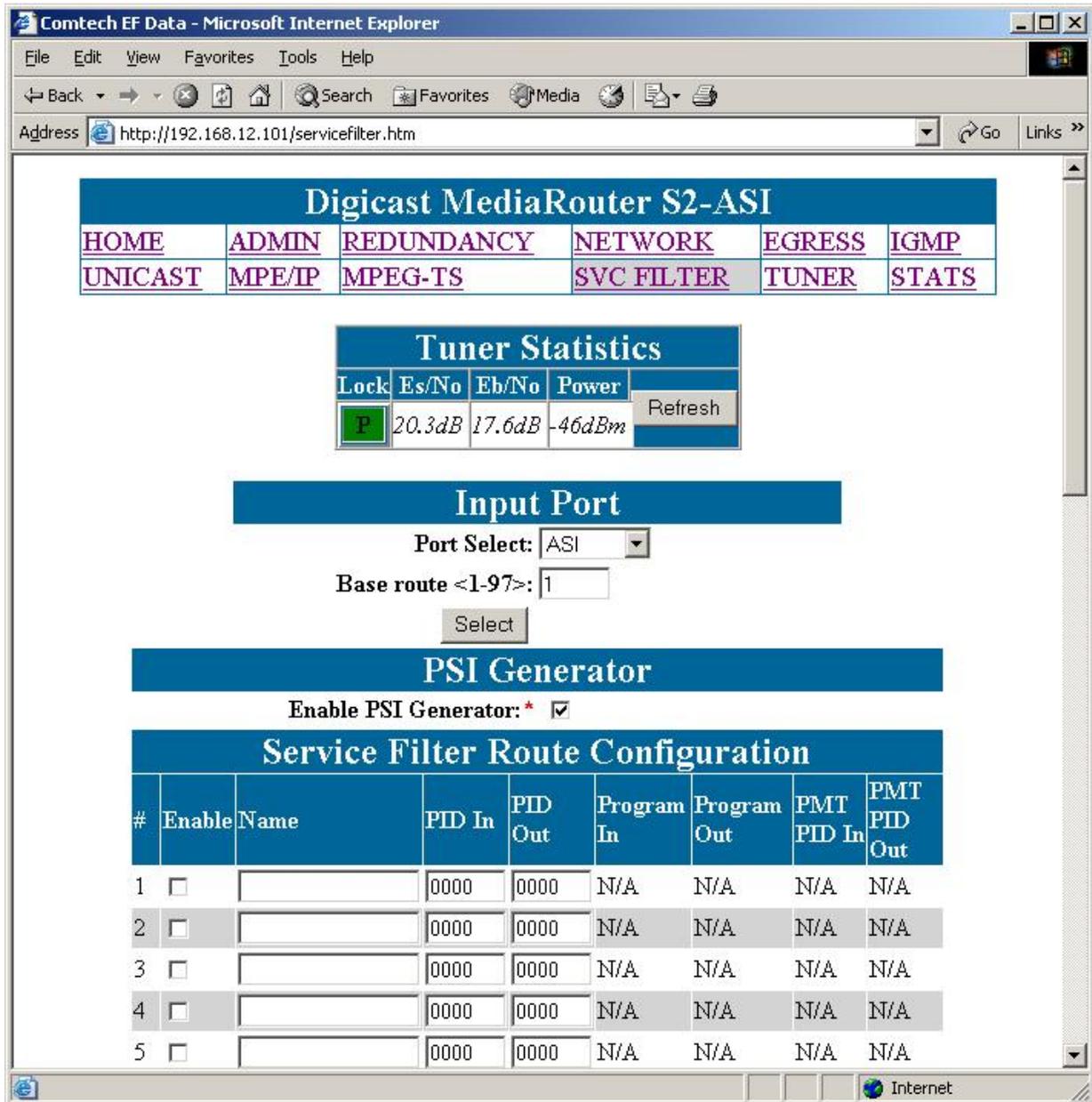


The screenshot shows a web browser window with the address bar displaying 'http://192.168.21.100 - Comtech EF Data - Microsoft Internet Explorer'. The main content area features a blue header with the text 'Tuner Available Services' and 'Transport stream ID 57'. Below this is a table with two columns: 'Program #' and 'Description'. The table contains four rows of data, each representing a different program available for streaming.

Program #	Description
1	Program 17 (Digital Television)
2	Program 16 (Digital Television)
4	Program 4 (Digital Television)
5	Program 5 (Digital Television)

### 4.2.13 Service Filter Route Configuration

This menu allows the CMR-5995 to filter incoming transport streams and route the content from either the ASI or Tuner inputs to the ASI output.



**Enable**  
 Enables or disables a program.

**Name**  
 Name configured for a program.

**PID In**

The hexadecimal value of an input PID contained within a transport stream to the CMR-5995.

**PID Out**

The hexadecimal value of an output PID contained within a transport stream from the CMR-5995. This feature allows the operator to set up and remap incoming and outgoing PID values for a transport stream.

**PMT PID In**

The hexadecimal value of the input PMT PID to the CMR-5995.

**PID Out**

The hexadecimal value of the output PMT PID from the CMR-5995.

## 4.2.14 Tuner Configuration

The CMR-5995 can be configured to have a backup (secondary) configuration. The backup tuner configuration allows the user to configure a backup configuration in the event the main carrier is taken down. The CMR-5995 will only attempt to use the **backup configuration** in the event the primary carrier is not available, and if a switch time of greater than 0 (zero) is set. If the **unit is unable to lock to the** backup tuner settings, the unit will continue to switch between backup and primary frequencies based on the switch time until lock is achieved.

### 4.2.14.1 Primary and Backup Tuner Configurations

Note the primary and backup can be completely different configurations, e.g.: the primary may be a DVB-S2 service, but the backup may be a DVB-S service, or vice versa. Any valid configurations supported by the CMR-5995 can be setup as primary and backup configurations.

**Digicast MediaRouter S2-ASI**

<a href="#">HOME</a>	<a href="#">ADMIN</a>	<a href="#">REDUNDANCY</a>	<a href="#">NETWORK</a>	<a href="#">EGRESS</a>	<a href="#">IGMP</a>
<a href="#">UNICAST</a>	<a href="#">MPE/IP</a>	<a href="#">MPEG-TS</a>	<a href="#">SVC FILTER</a>	<a href="#">TUNER</a>	<a href="#">STATS</a>

**Tuner Statistics**

Lock	Es/No	Eb/No	Power	Refresh
P	20.3dB	17.6dB	-46dBm	Refresh

**Tuner Configuration**

Config	LNB	Downlink	Modulation	Symbol Rate (Msp/s)	Polarity	Spectral Inversion	22KHz Tone	Pilot (S2)	Roll Off	DiSeqC
Primary	10750	11915	DVB-S2 8PSK 9/10	32.000	Off	Both Off	Off	Off	20%	Off
Backup	10750	12700	DVB-S2 8PSK 9/10	30.000	Off	Both Off	Off	On	35%	Off

Switch time in seconds:  (0=Disable, minimum=5)

Enable EbNo Monitoring: \*

EbNo error threshold:  (min=0.0, max=40.0)

Enter Tuner settings, press submit to make changes

\* Indicates a required field

### LNB Frequency

The frequency of the Local Oscillator (LO) that resides in the Low Noise Block (LNB) amplifier located at the antenna. For Ku-Band operation, the LO is typically 10,750 MHz for Ku-Band operation North America and other common frequencies are 9,750 MHz and 10,600 MHz. For C-Band operation, 5,150 MHz is a common LO frequency. Please consult your LNB manufacturer for the LO in the LNB.

### Downlink Frequency

The actual receive frequency being down linked from the satellite to the Low Noise Block (LNB) amplifier located at the antenna. For Ku-Band operation, this frequency ranges from 10,700 MHz to 12,750 MHz. For C-Band operation, this frequency ranges from 3,400 MHz to 4,200 MHz.

The combination of the LO and the downlink frequency produce the L-Band frequency expected by the CMR-5995. Some examples are as follows:

#### Example 1:

LO = 10,750 MHz  
Ku-Band Receive Frequency = 11,895 MHz  
L-Band Frequency = 11,895 MHz – 10,750 MHz  
L-Band Frequency = 1,145 MHz

#### Example 2:

LO = 10,600 MHz  
Ku-Band Receive Frequency = 12,010 MHz  
L-Band Frequency = 12,010 MHz – 10,600 MHz  
L-Band Frequency = 1,410 MHz

#### Example 3:

LO = 5,150 MHz  
C-Band Receive Frequency = 3,920 MHz  
L-Band Frequency = 5,150 MHz – 3,920 MHz  
L-Band Frequency = 1,230 MHz

#### Example 4 (Direct L-Band entry):

This would be used if the user desired to not enter in the LO and RX frequencies. For this example assume the same values as example 1:

LO = 10,750 MHz  
Ku-Band Receive Frequency = 11,895 MHz  
L-Band Frequency = 11,895 MHz – 10,750 MHz  
The user would simply enter:  
LO = 0 MHz (this allows the direct entry of the L-Band frequency)  
L-Band Frequency = 1,170 MHz as the RX frequency

### Modulation

The CMR-5995 supports the following modes of operation:

- DVB-S – QPSK
- DVB-S2 – QPSK
- DVB-S2 – 8PSK

Each mode of operation provides a range of FEC rates that are supported based on the mode and modulation.

### Symbol Rate

Depending on the configured mode of operation, the following symbol rates are supported:

- DVB-S – QPSK 2 to 45 Msps
- DVB-S2 – QPSK 2 to 32 Msps
- DVB-S2 – 8PSK 2 to 32 Msps

### Polarity

The configured polarity provides the voltage supplied to the LNB or switch. The valid selections for the CMR-5995 are:

- 13 VDC for vertical polarization
- 18 VDC for horizontal polarization
- Off if LNB voltage is not required

The CMR-5995 is capable of providing up to 600mA of current in either mode of operation. It is recommended, that if the LNB voltage is not required, either polarity be set to 'Off' or that a DC block be installed.

### Spectral Inversion

There are four supported modes of spectral inversion:

- **On** – forces the tuner to stay with spectral inversion. The tuner will not check for spectral inversion automatically
- **Off** – forces the tuner to stay without spectral inversion. The tuner will not check for spectral inversion automatically
- **On Both** – tries spectral inversion first and then attempts to automatically check spectral inversion periodically – **recommended default configuration**
- **Off Both** – tries non-spectral inversion first and then attempts to automatically check spectral inversion periodically

### LNB 22 KHz Tone

Enables or disables the LNB 22 KHz tone to the LNB for remote LNB and switch control.

### Pilot

Enables or disables the Pilot for DVB-S2 mode of operation only.

### Roll Off

The expected filter roll off of the carrier the receiver should be looking at. This parameter only works for DVB-S2 mode, since DVB-S mode uses a fixed roll off of 35%.

The valid roll offs in DVB-S2 mode are:

- 20%
- 25%
- 35%

### DiSEqC

Enables sending and receiving DiSEqC commands as are supported in DiSEqC mode 1.2. The valid configuration settings for DiSEqC mode are:

- Off
- Mode A
- Mode B

- Mode C
- Mode D

### **Switch Time**

The number of seconds the unit should wait before attempting to locate the backup carrier. If set to disabled (by setting to a value of 0 (zero)), the CMR-5995 will not attempt to switch to a backup carrier.

## 4.2.15 Route Statistics

**Digicast MediaRouter S2-ASI**

<a href="#">HOME</a>	<a href="#">ADMIN</a>	<a href="#">REDUNDANCY</a>	<a href="#">NETWORK</a>	<a href="#">EGRESS</a>	<a href="#">IGMP</a>
<a href="#">UNICAST</a>	<a href="#">MPE/IP</a>	<a href="#">MPEG-TS</a>	<a href="#">SVC FILTER</a>	<a href="#">TUNER</a>	<a href="#">STATS</a>

**Tuner Statistics**

Lock	Es/No	Eb/No	Power	
P	20.5dB	17.8dB	-46dBm	Refresh

**Port select and statistics to view**

Port Select:

Statistics to View:

Auto refresh:

[Ethernet Stats](#)

**Tuner MPE/IP Route Statistics**

Link Status	Ingress Total Rate	Ingress Filtered Rate
Locked 188	85,740,032	4,466,880

Received	Dropped	Min (Mbps)	Max (Mbps)	Average	Current
28,428,215	87	0.001	34.447	2.099	3.676

#	Multicast Received	Multicast Dropped	Unicast Received	Unicast Dropped	PID	Min (Mbps)	Max (Mbps)	Average (Mbps)
1	0	0	0	0	0901	0.000	0.000	0.000
2	0	0	0	0	0806	0.000	0.000	0.000
3	0	0	0	0	0807	0.000	0.000	0.000
4	0	0	0	0	0808	0.000	0.000	0.000

## 4.2.16 Tuner Statistics

Statistical reports are available from the CMR-5995 using this menu. These detailed tuner statistics can be used to troubleshoot problems with a satellite link. The available report options are:

- MPE/IP
- MPEG TS
- Tuner

**Digicast MediaRouter S2**

<a href="#">HOME</a>	<a href="#">ADMIN</a>	<a href="#">REDUNDANCY</a>	<a href="#">NETWORK</a>	<a href="#">IGMP</a>
<a href="#">UNICAST</a>	<a href="#">MPE/IP</a>	<a href="#">MPEG-TS</a>	<a href="#">TUNER</a>	<a href="#">STATS</a>

**Tuner Statistics**

Lock	Es/No	Eb/No	Power	
P	18.0dB	20.7dB	-56dBm	Refresh

**Statistics to View**

Statistics to View:

Auto refresh:

[Ethernet Stats](#)

**Tuner Statistics**

Active configuration: Primary  
 Initialized: Initialized, address = 05  
 Acquisition State: Locked and tracking  
 Lock Status: pll=Y demod=Y ldpc=Y viterbi=Y bch=Y rs=Y  
 bchlp=N  
 Symbol rate: 32000KHz  
 Spectrum Inversion: No  
 Btl: 59KHz  
 Saturated: No  
 Bits per symbol: 0  
 esno estimate: 18.0dB  
 ebno estimate: 20.7dB

### **Active Configuration**

Displays whether the tuner is running with the Primary or Backup configuration.

### **Initialized**

Displays whether the tuner is initialized or not. The I2C address where the processor found the tuner is displayed.

### **Acquisition State**

Displays whether the tuner is locked and tracking or whether the tuner is unlocked.

### **Lock Status**

Displays the lock status of various components in the tuner:

- PLL – Phase Lock Loop
- Demodulator
- LDPC Decoder
- Viterbi Decoder
- BCH Decoder
- Reed Solomon Decoder
- BCHLP Decoder

### **Symbol Rate**

Displays the configured symbol rate.

### **Spectrum Inversion**

Displays the state of the spectrum which the tuner locked to either **inverted** or **non-inverted**.

### **BTL**

Displays the status of the BTL.

### **Es/No**

Displays the Es/No (Symbol Energy over the Noise Density).

### **Eb/No**

Displays the Eb/No (Energy per Bit to Noise Power Spectral Density Ratio).

### **Power Estimate**

Displays the received port input level. This level must be between -50 dBm to -25 dBm for proper operation.

### **Bits per Symbol**

Displays the number of bits per symbol.

### **Corrected Bit Error Rate**

Displays the corrected bit error rate coming from the tuner. Corrected data does not result in any lost user data.

### **Uncorrected Bit Error Rate**

Displays the uncorrected bit error rate coming from the tuner. These are bit errors that could not be corrected and result in lost user data.

### **Window Adjustment**

Displays the adjustment the tuner used to capture the incoming carrier.

### **CRC Error Rate**

Displays the Cyclic Redundancy Check (CRC) error rate received over the satellite.

---

## **4.3 Terminal Interface**

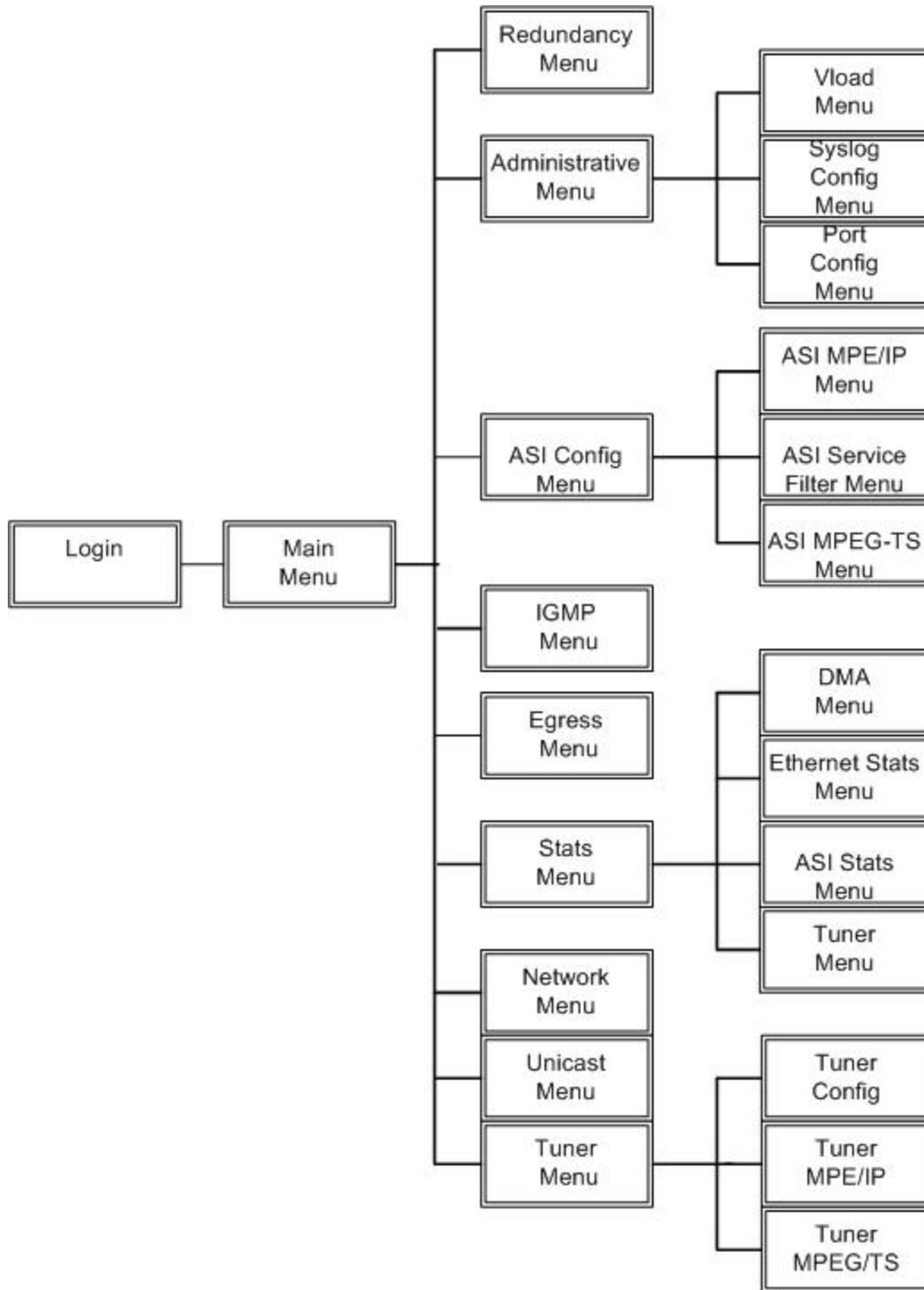
The Terminal Interface provides the user with a textual configuration dialog for configuring the CMR-5995. This method of configuration should be used for initial configuration of the unit; i.e., configuring the network parameters for the unit but *not* for normal operation. The Web (HTTP) Interface is recommended for operational management.

The Terminal Interface allows the entire unit to be configured and managed, but this interface can only be used while a serial connection is present between the CMR-5995 and a PC. The screens shown in this section are displayed via a Telnet connection.

The user must authenticate (login) before being able to access the application. After a period of inactivity, the user's session will time out, and must log in again to resume.

The same menu information is displayed via the serial interface with some specific features only available via this access method – these 'serial interface only' features are noted in this section. Detailed information is provided about the menu features in **Chapter 4.2 Web Interface**.

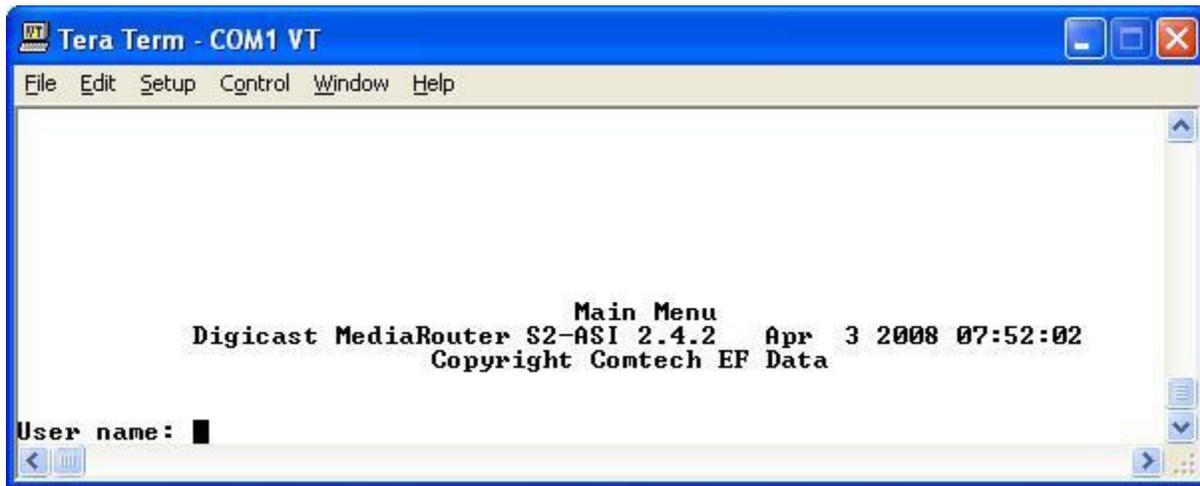
Figure 4-5 shows the hierarchal structure of the Terminal Interface-based menus and the sections in this chapter which provide figures of these submenu pages.



**Figure 4-5. Menu Hierarchy (Via Terminal Interface)**

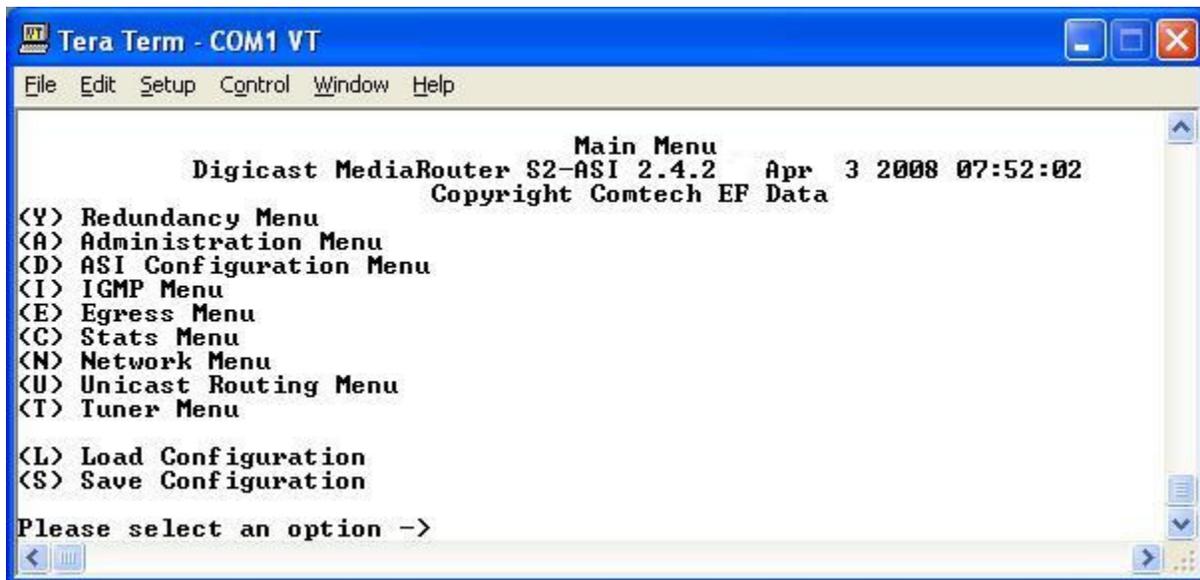
Once the terminal interface is connected, as described in **Chapter 2.4 Initial Configuration**, press the <ENTER> key. Observe the Login screen, and after a successful login, the Main Menu as shown in Section 4.3.2.

### 4.3.1 Login



The login prompt is displayed upon entry via Telnet or a serial connection. The default user name is "comtech", and the default password is "comtech" (case sensitive).

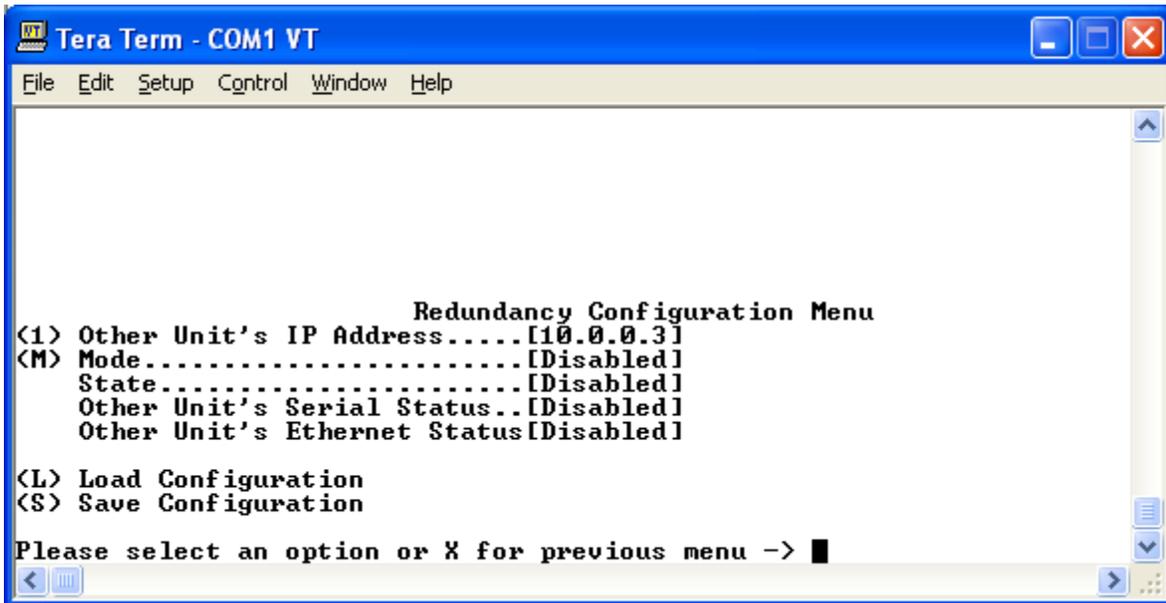
### 4.3.2 Main Menu



The Main Menu uses different menus for the command line interface to access the various configuration settings and statistics on the MRS-2 receiver.

### 4.3.3 Redundancy Menu

Redundancy is available when two units are used to ensure reliable service in the event of a failure or loss of signal. The units are configured in Primary/Backup roles and communicate between each other via cable connected to each unit's redundant port.



#### Other Unit's IP Address

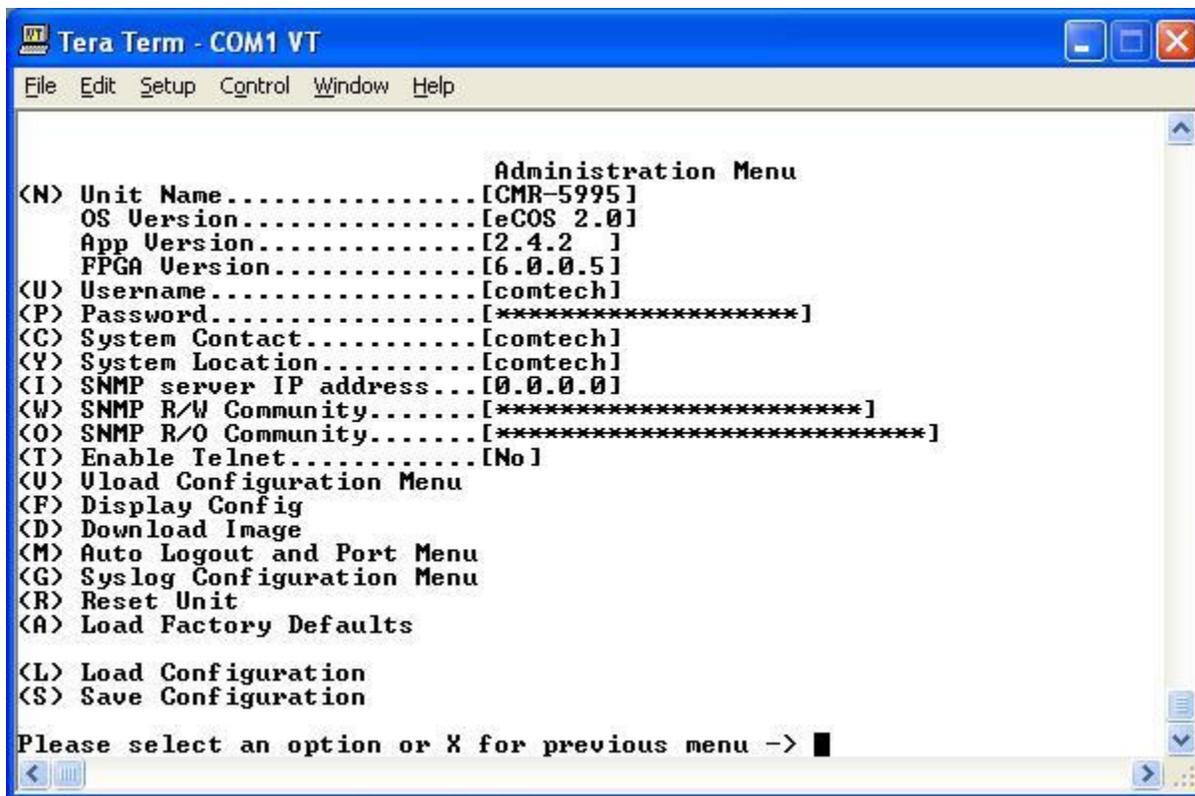
Enter the IP address of the unit to be used in conjunction with this unit for redundant functionality.

#### Mode

Select the mode of this receiver (Primary, Backup, Disabled).

Note CMR Redundancy does not automatically configure the backup unit when changing the primary or vice versa. Each unit must be independently configured when changes are required.

### 4.3.4 Administration Menu



#### Unit Name

The name of this receiver.

#### User Name

The CMR-5995's User Name is user configurable and is used for connecting to the unit via IP management services.

The default user name is “*comtech*”.

#### Password

The CMR-5995's Password is user configurable and is used for authenticating a user when connecting via IP management services.

The default password is “*comtech*”. The password is case sensitive and must be entered carefully.

When the password is changed, the user will be prompted to enter the password **twice** to verify it is correct.

#### System Contact

Contact information of the system administrator for support.

### **System Location**

The physical location where the unit has been installed.

### **SNMP IP Address**

Defines the SNMP server where traps are sent.

### **SNMP R/W Community**

The community name for authentication for read/write access to the private MIB.

### **SNMP R/O Community**

The community name for authentication for read only access to the private MIB.

### **Enable Telnet**

Enables Telnet application on the CMR-5995.

### **Display Config**

Outputs the overall configuration of the receiver (verbose).

### **Download Image**

Allows software/firmware changes to be made. User name and password is required for security.

### **Reset Unit**

Reboots the receiver.

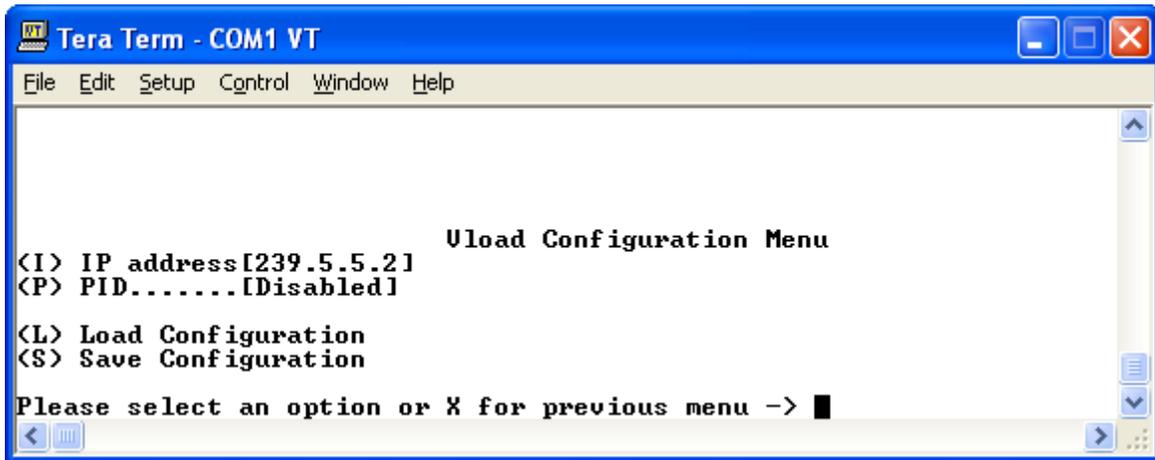
### **Load Factory Defaults**

Resets all settings (except network) to factory default settings.

---

### 4.3.4.1 Vload Configuration Menu

Vload is a system used to remotely update the MRS-2 receiver via multicast transmission. Please refer to the Digicast section of the Vload manual for information on how to use the head-end software component of Vload.



#### IP Address

The multicast address to be used for Vload. Please note that the multicast address used here should **not be used in any other route settings**.

#### PID

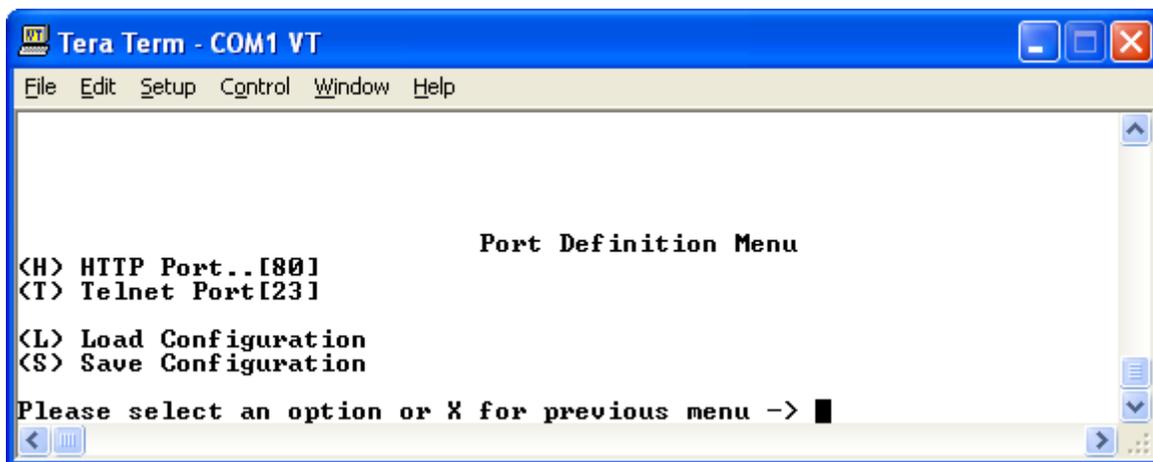
Define the PID value (in hexadecimal format) to use for Vload.

**Note:** This PID value cannot be used or defined elsewhere on this receiver.

---

### 4.3.4.2 Port Number Configuration

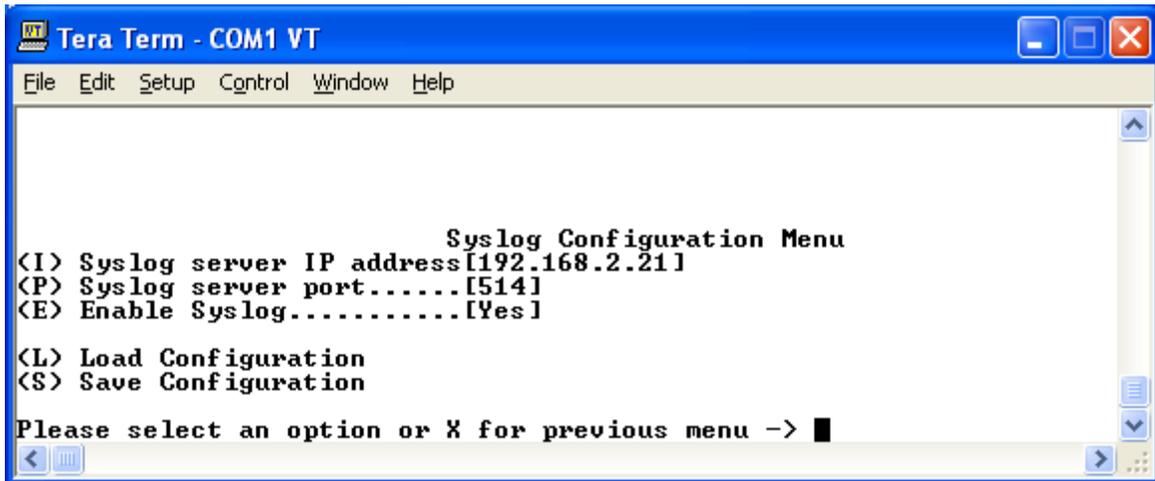
In addition to the features illustrated, one additional feature is available, for security reasons, via the serial interface only. Modifying the port numbers prevents attacks on “well known” ports by devices known as port scanners. This feature is configuration of the TCP Port number for Telnet and HTTP protocols. Option <M> allows the operator to modify the standard port numbers for Telnet (23) and HTTP (80) to prevent unauthorized access to the device. Care should be taken not to use a reserved standard port number.



---

### 4.3.4.3 Syslog Configuration Menu

**Syslog** is a common feature of the Linux operating system. Syslog allows the events that occur on the CMR-5995 to be sent to a server where they can be logged. The events are delivered to a configured server over Ethernet IP.



#### **IP Address**

The IP address of the Syslog server.

#### **Port**

The port of the Syslog server. The default port number is **514**.

#### **Enable**

Enables or disables the Syslog feature.

---

#### 4.3.4.4 Load Factory Defaults

The **Load Factory Defaults** feature allows the user to restore the unit to the original configuration as it was set up before leaving the factory.



*This feature should be used with caution, because all configured settings, including usernames and passwords, will be removed.*

The only parameters that remain persistent after execution of a Load Factory Defaults are the network interface settings. The LAN attributes, such as IP Address, Subnet Mask and Default Gateway, are retained after the unit is restarted.

#### 4.3.5 ASI Configuration Menu

```
Tera Term Web 3.1 - COM1 VT
File Edit Setup Web Control Window Help

                               ASI Configuration Menu
<M> ASI MPEIP
<F> ASI Service Filter Menu
<T> ASI MPEGTS

<L> Load Configuration
<S> Save Configuration

Please select an option or X for previous menu ->
```

---

##### 4.3.5.1 ASI MPE/IP Configuration Menu

```
Tera Term Web 3.1 - COM1 VT
File Edit Setup Web Control Window Help

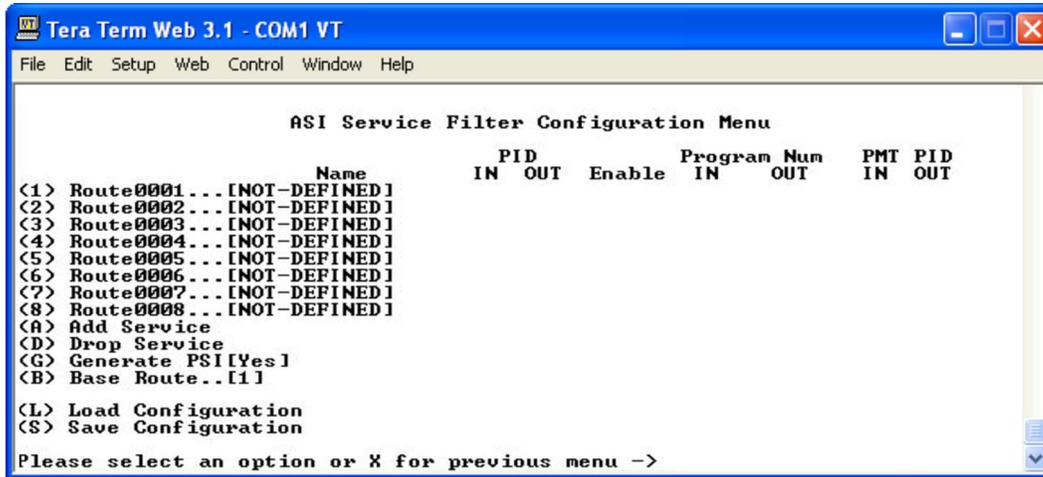
                               ASI MPE/IP Configuration Menu
<1> PID01.....[NOT-DEFINED]
<2> PID02.....[NOT-DEFINED]
<3> PID03.....[NOT-DEFINED]
<4> PID04.....[NOT-DEFINED]
<5> PID05.....[NOT-DEFINED]
<6> PID06.....[NOT-DEFINED]
<7> PID07.....[NOT-DEFINED]
<8> PID08.....[NOT-DEFINED]
<B> Base Route.[1]
<F> Fill rate.[100000]

<L> Load Configuration
<S> Save Configuration

Please select an option or X for previous menu ->
```

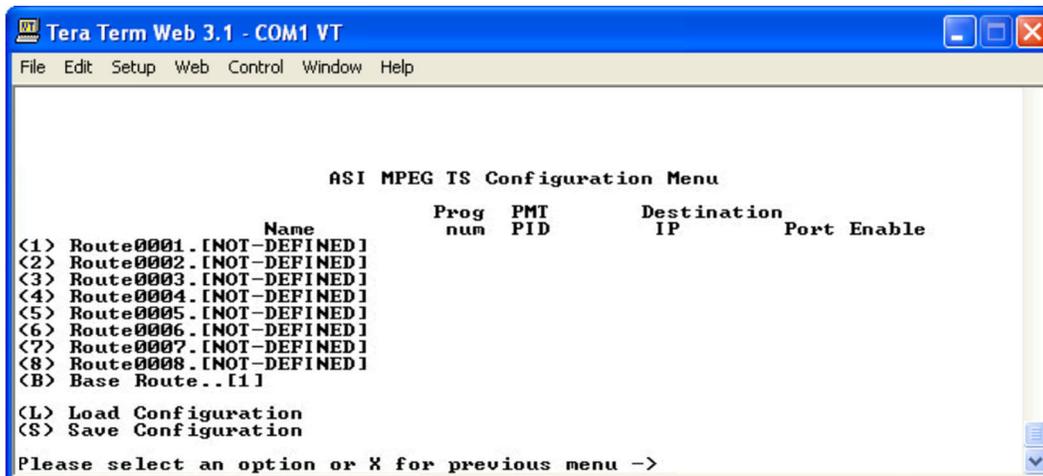
---

### 4.3.5.2 ASI Service Filter Configuration Menu

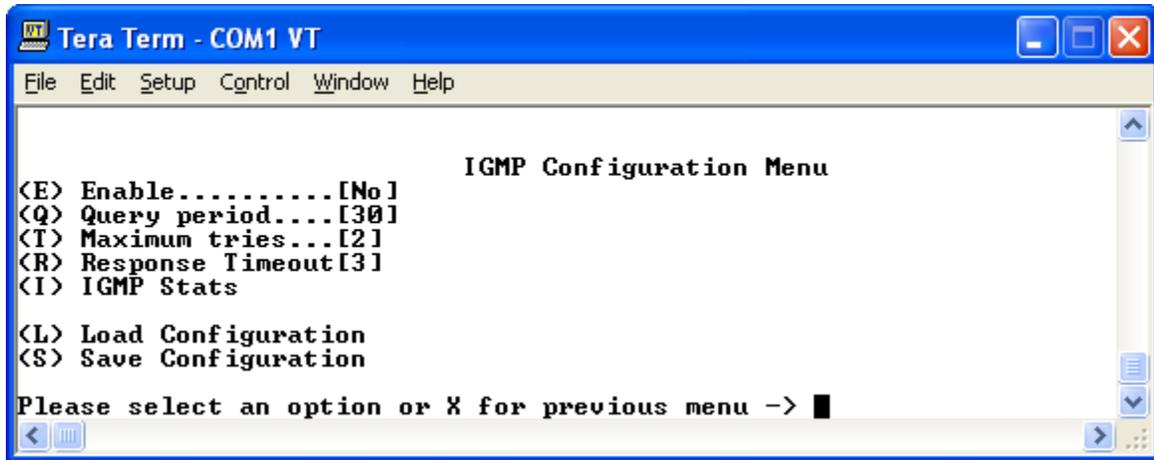


---

### 4.3.5.3 ASI MPEG TS Configuration Menu



### 4.3.6 IGMP Configuration Menu



#### Enable

Select the Boolean if IGMP is to be supported. If the Boolean is not selected, all received Multicast IP is forwarded to the Ethernet, but if support is enabled, no Multicast IP will be forwarded to the Ethernet, until a subscriber has joined the Multicast group.

#### Query Period

How often a solicitation is made for Multicast subscribers.

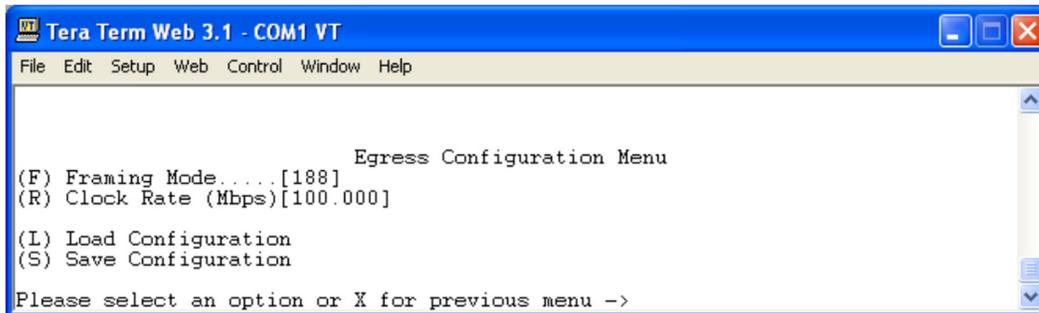
#### Maximum Tries

The maximum number of attempts the CMR-5995 will make for soliciting for Multicast subscribers before the Multicast stream is pruned off.

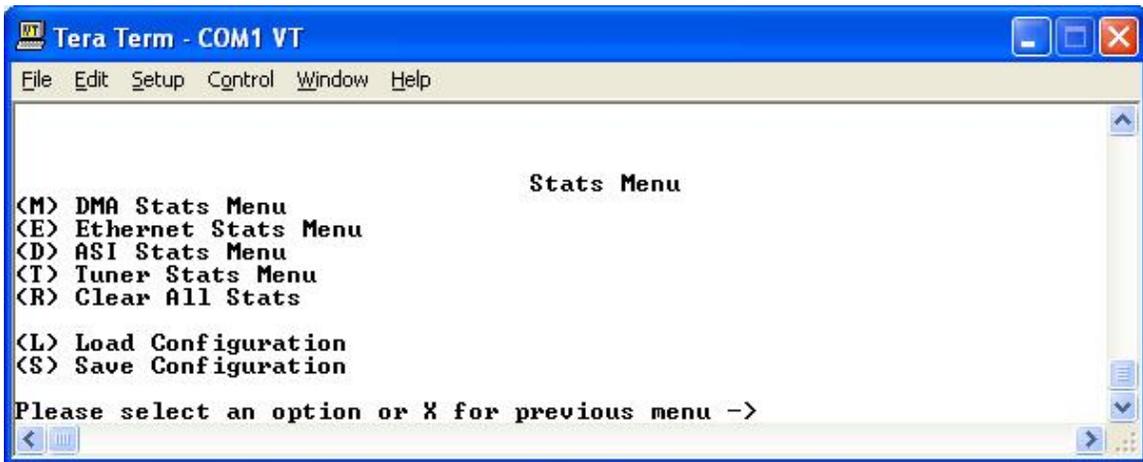
#### Response Timeout

The maximum amount of time the CMR-5995 will wait for a Multicast Subscribers before the Multicast stream is pruned off.

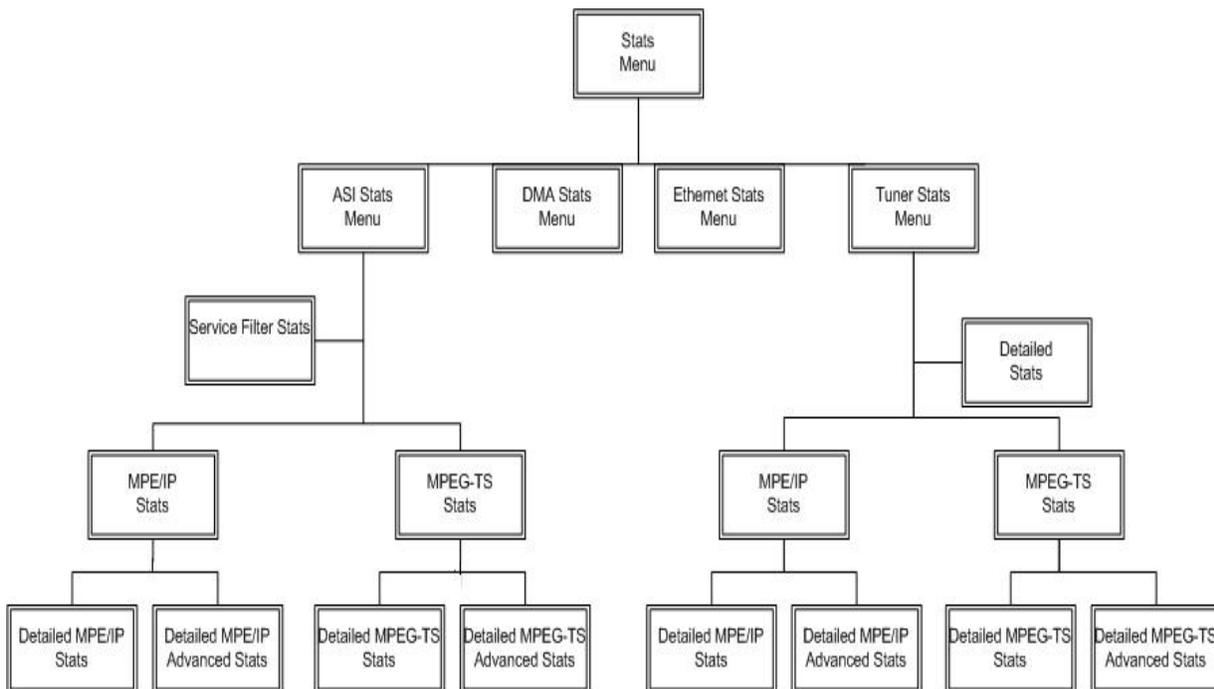
### 4.3.7 Egress Configuration Menu



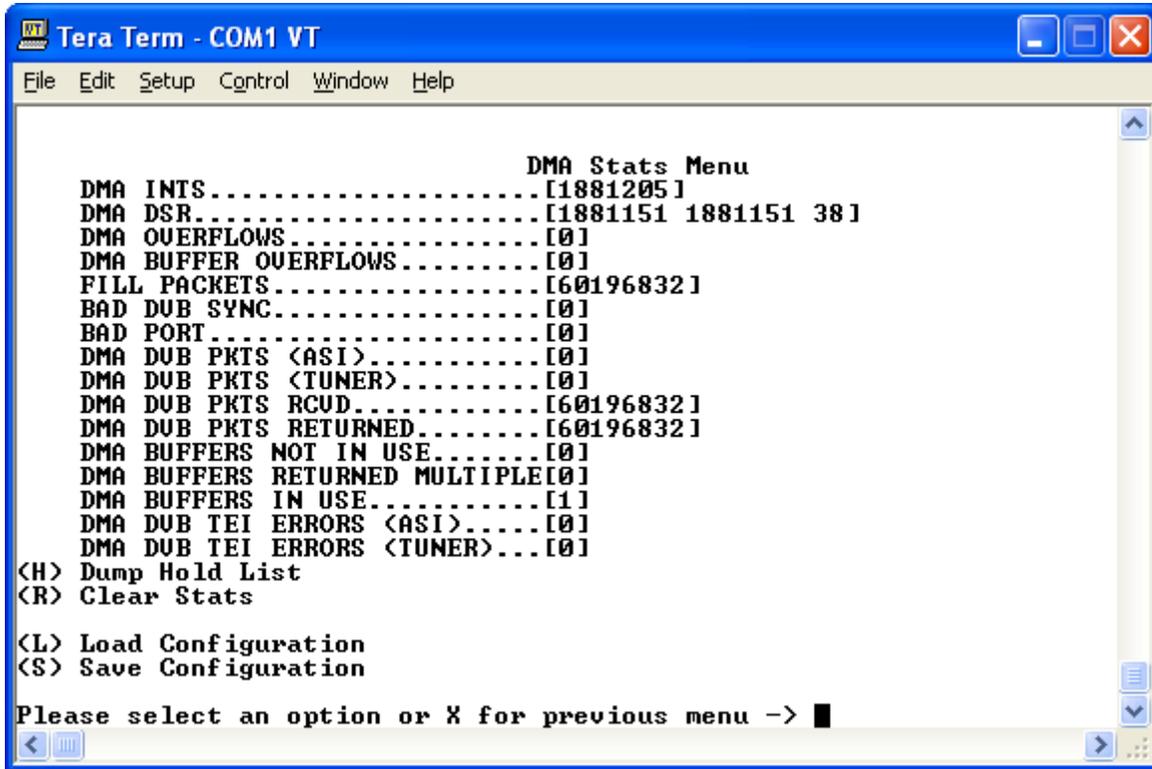
### 4.3.8 Stats Menu



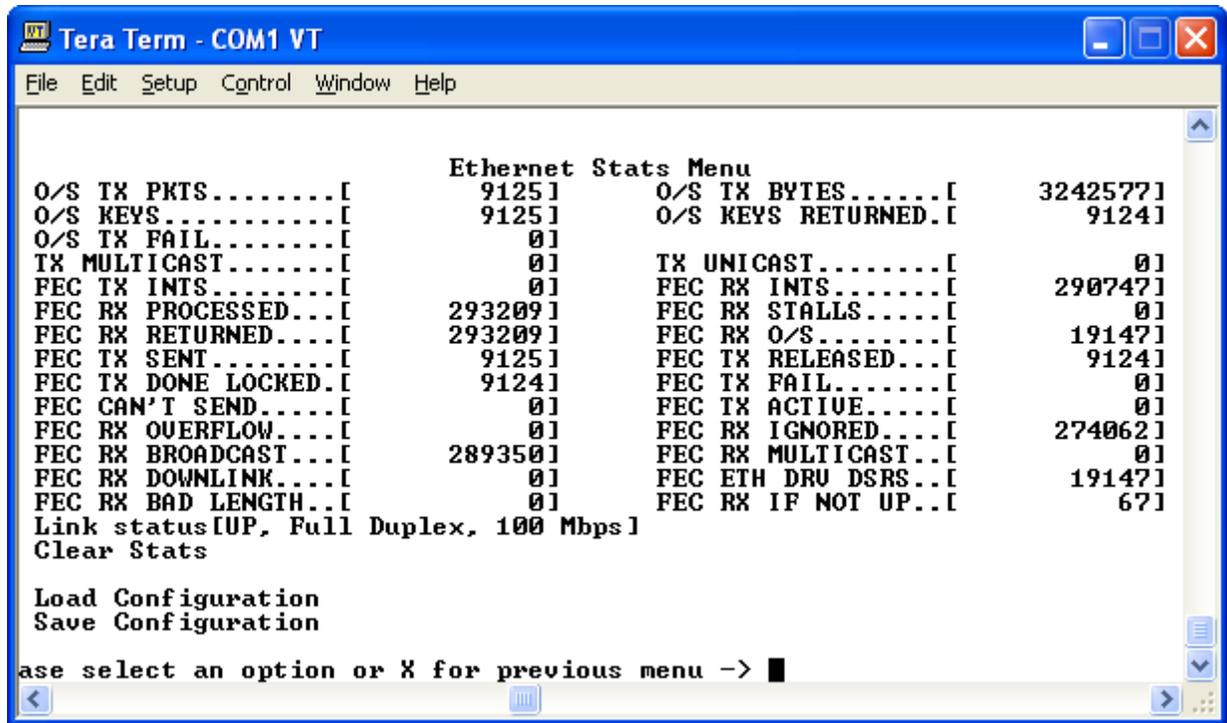
The following diagram shows the hierarchal structure of the Terminal Interface-based Stats menus and the sections in this chapter which illustrate the menu pages within this hierarchy.



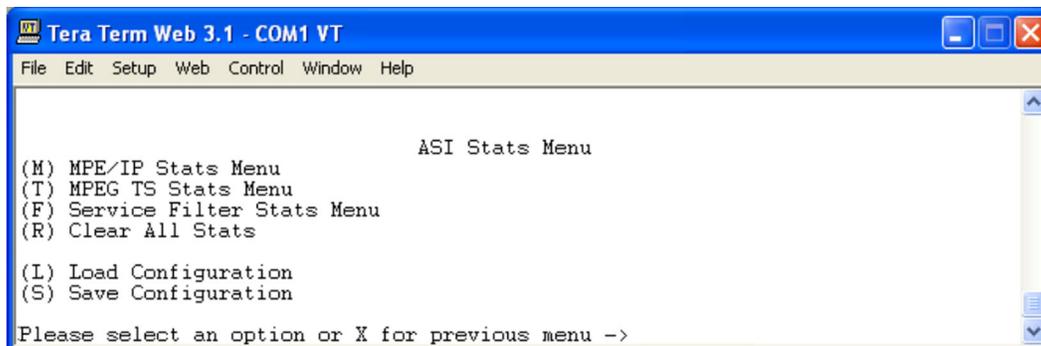
### 4.3.8.1 DMA Stats Menu



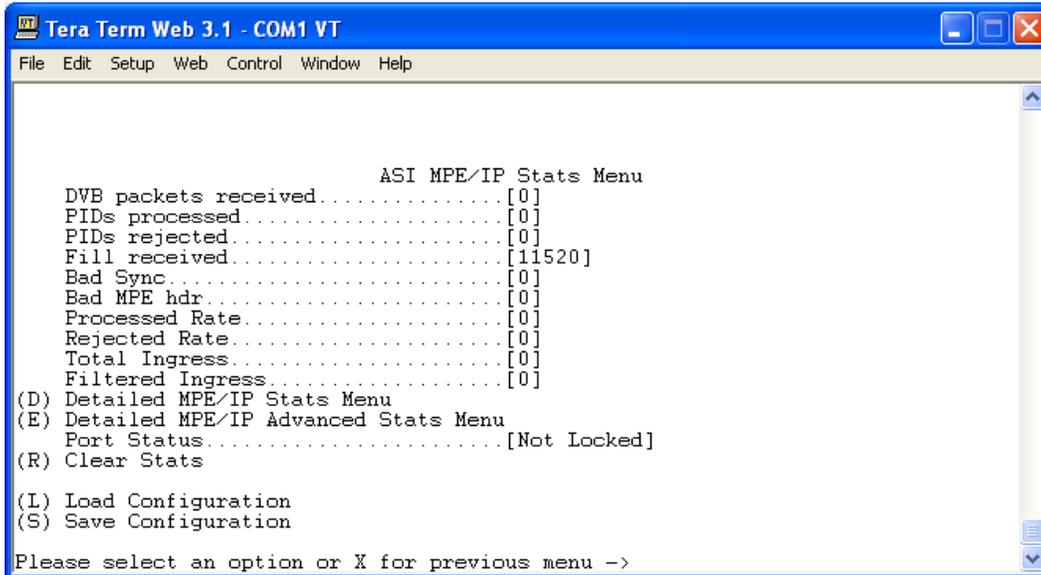
### 4.3.8.2 Ethernet Stats Menus



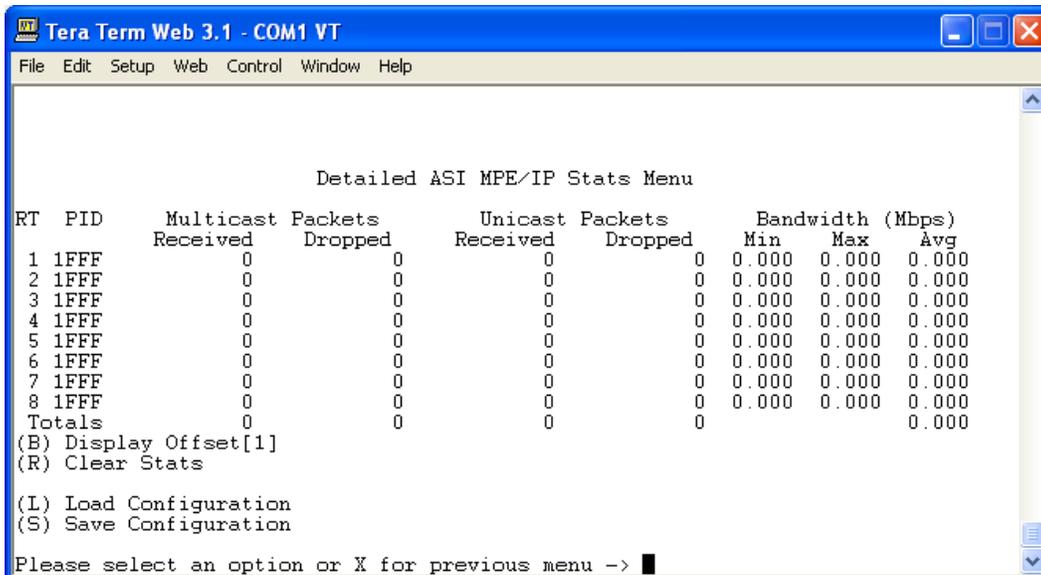
### 4.3.8.3 ASI Stats menu



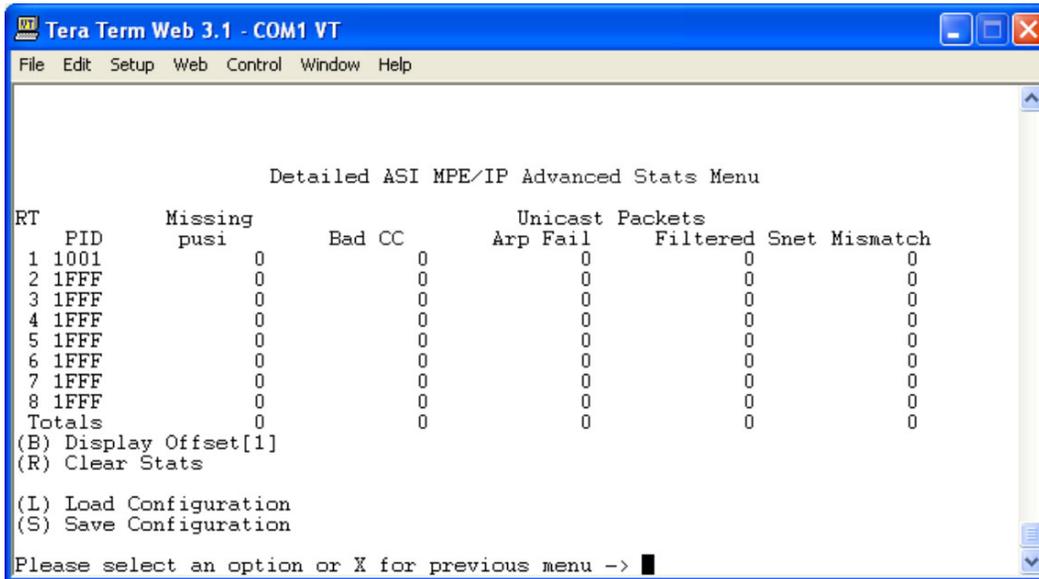
### 4.3.8.3.1 ASI MPE/IP Stats Menu



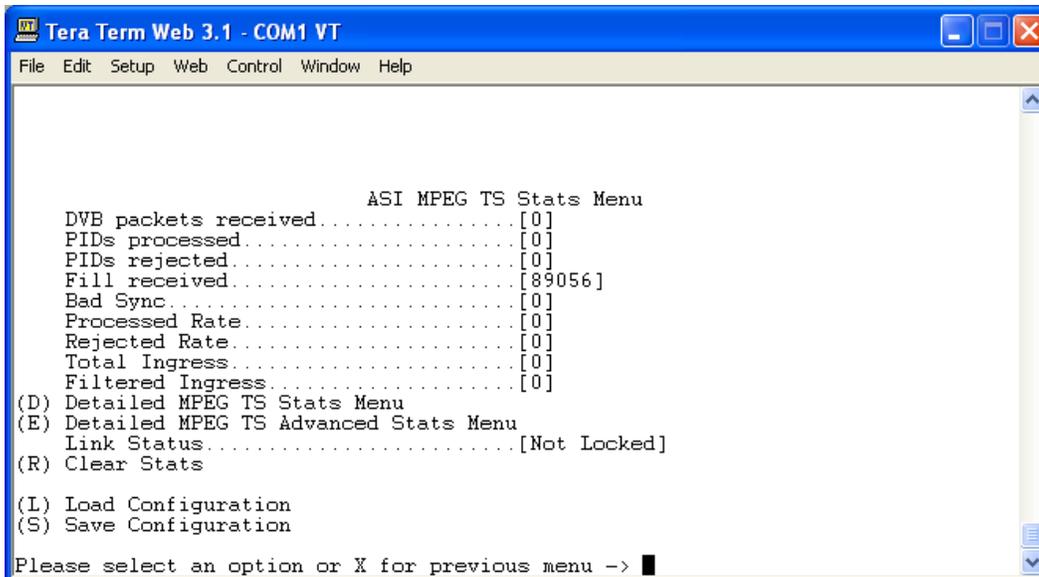
#### 4.3.8.3.1.1 ASI Detailed MPE/IP Stats Menu



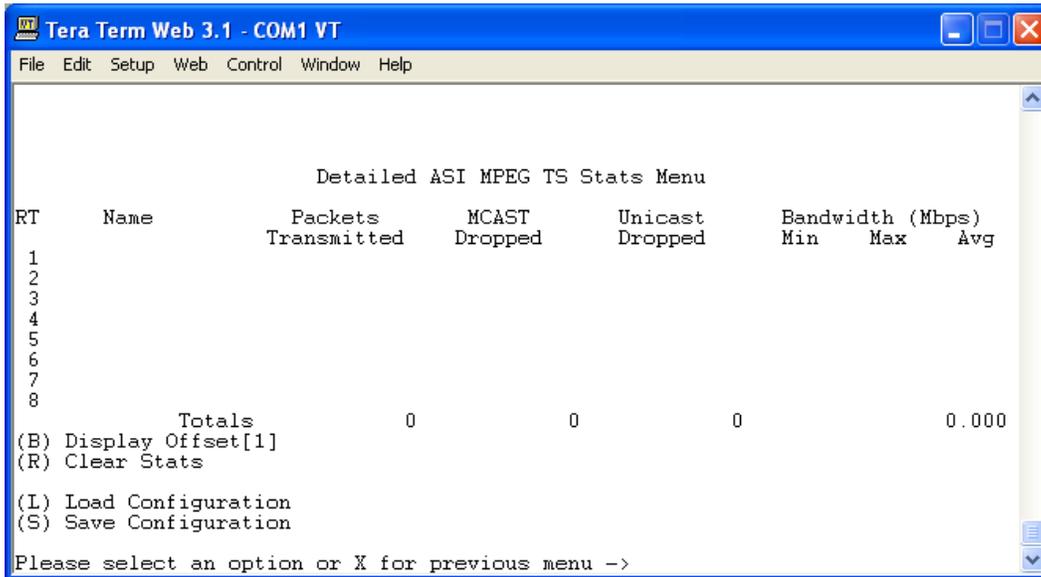
### 4.3.8.3.1.2 ASI Detailed MPE/IP Advanced Stats Menu



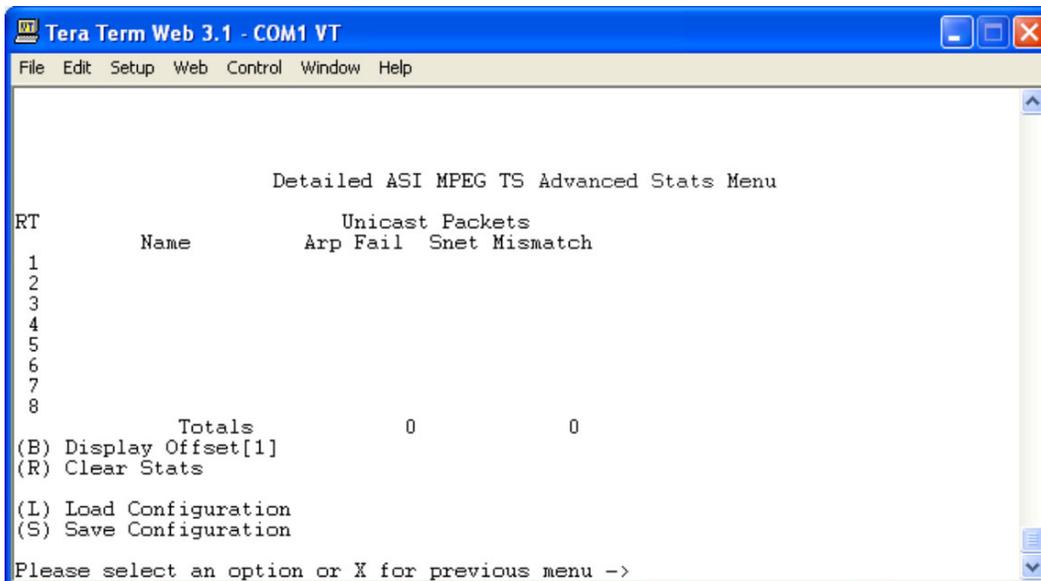
### 4.3.8.3.2 ASI MPEG TS Stats Menu



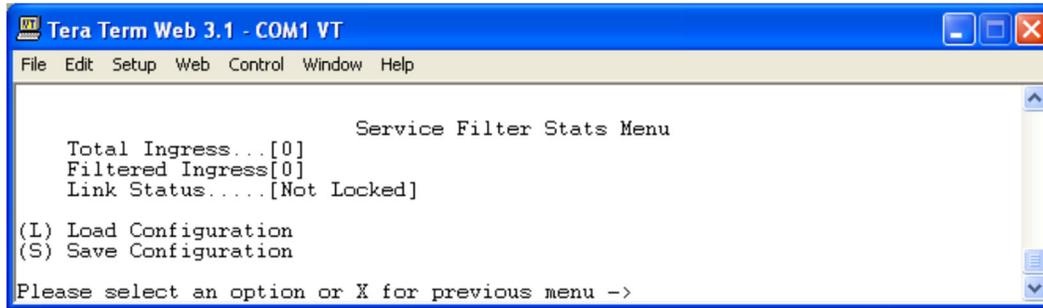
### 4.3.8.3.2.1 Detailed ASI MPEG TS Stats Menu



### 4.3.8.3.2.2 Detailed ASI MPEG TS Advanced Stats Menu



### 4.3.8.3.3 ASI Service Filter Stats Menu



---

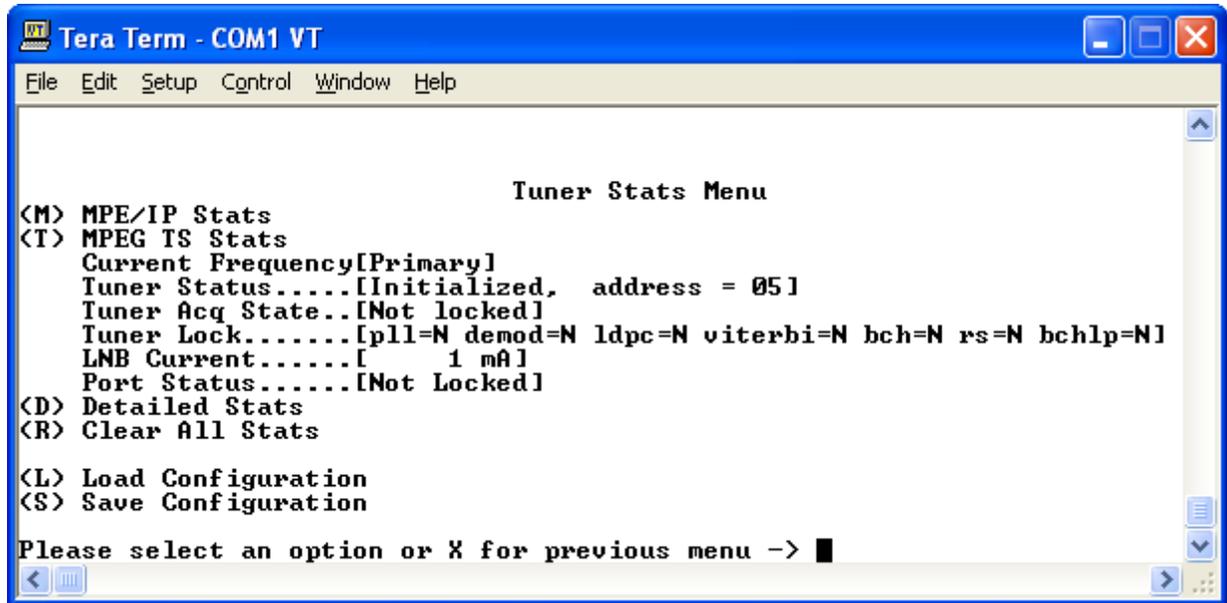
### 4.3.8.4 Tuner Stats Menu

Statistical reports are available from the CMR-5995 using this menu.

The available report options are:

- MPE/IP
- MPEG TS
- Tuner

These detailed tuner statistics can be used to troubleshoot problems with a satellite link.



```
Tera Term - COM1 VT
File Edit Setup Control Window Help

                                Tuner Stats Menu
(M) MPE/IP Stats
(T) MPEG TS Stats
    Current Frequency[Primary]
    Tuner Status.....[Initialized,  address = 05]
    Tuner Acq State..[Not locked]
    Tuner Lock.....[pll=N demod=N ldpc=N viterbi=N bch=N rs=N bchlp=N]
    LNB Current.....[    1 mA]
    Port Status.....[Not Locked]
(D) Detailed Stats
(R) Clear All Stats

(L) Load Configuration
(S) Save Configuration

Please select an option or X for previous menu -> █
```

#### Acquisition State

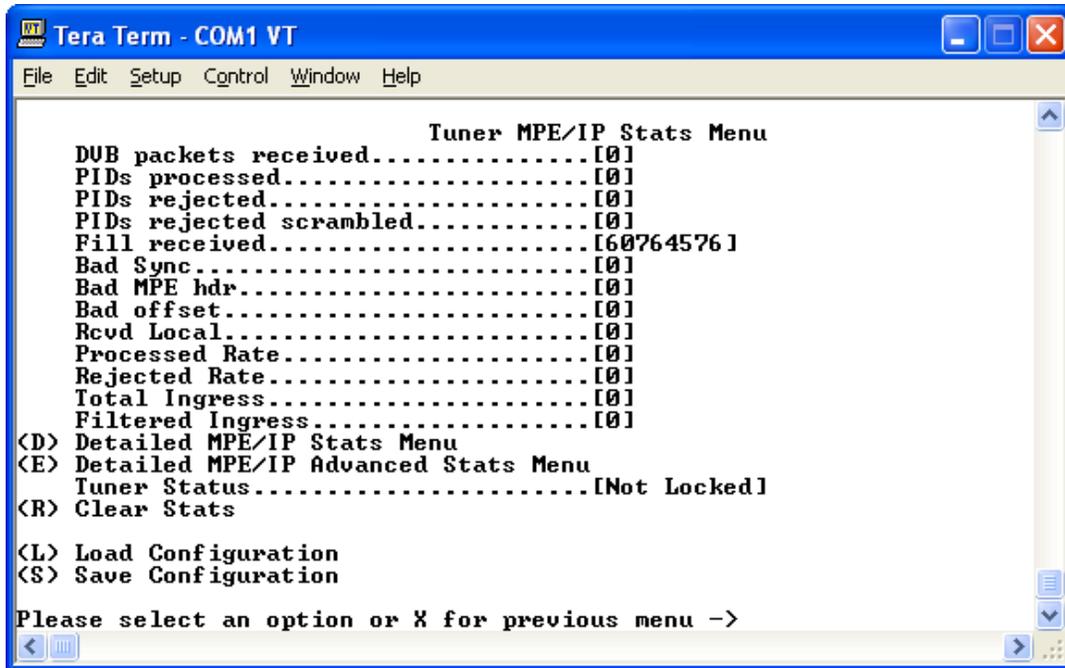
Displays whether the tuner is locked and tracking or whether the tuner is unlocked.

#### Lock Status

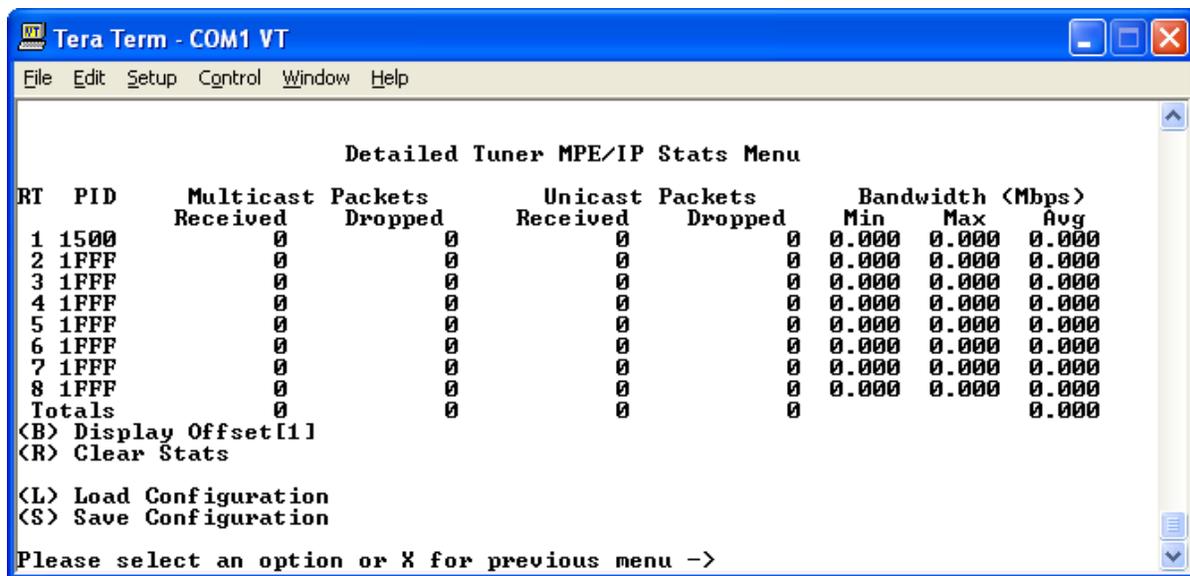
Displays the lock status of various components in the tuner:

- PLL – Phase Lock Loop
- Demodulator
- LDPC Decoder
- Viterbi Decoder
- BCH Decoder
- Reed Solomon Decoder
- BCHLP Decoder

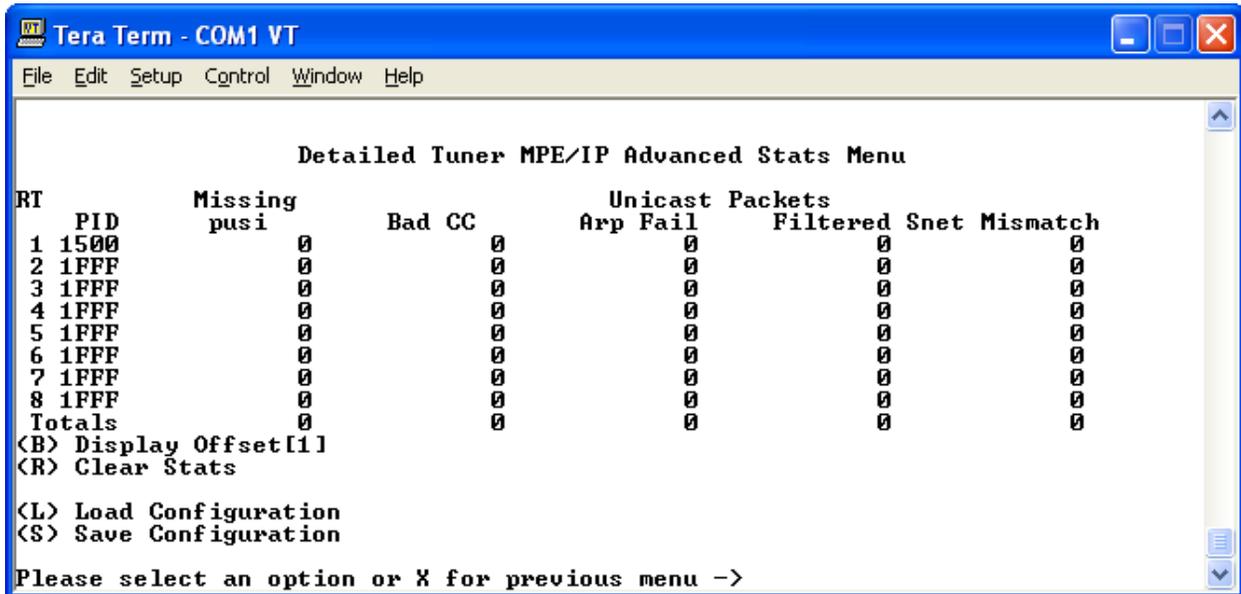
### 4.3.8.4.1 Tuner MPE/IP Stats Menu



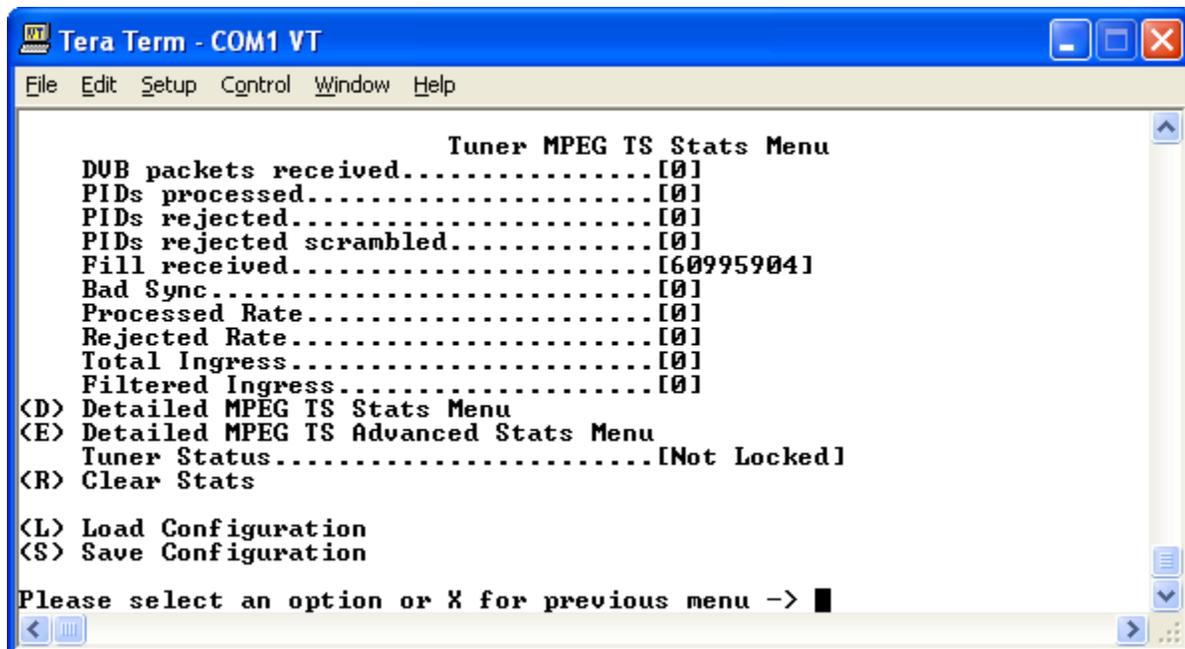
#### 4.3.8.4.1.1 Detailed Tuner MPE/IP Stats Menu



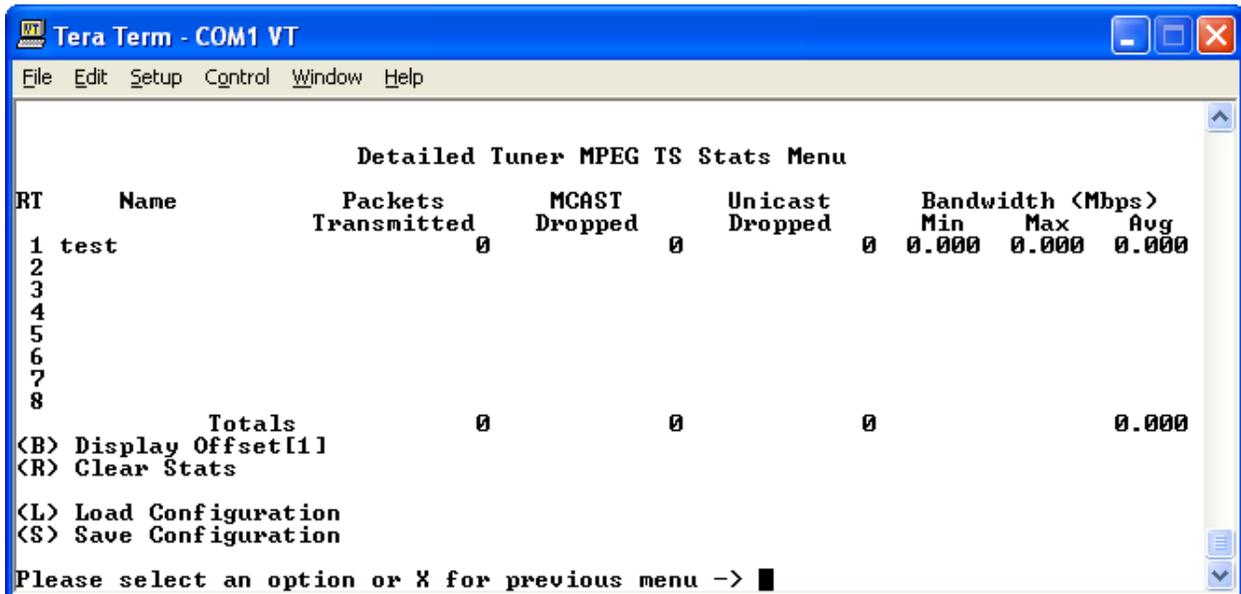
### 4.3.8.4.1.2 Detailed Tuner MPE/IP Advanced Stats Menu



### 4.3.8.4.2 Tuner MPEG TS Stats Menu



#### 4.3.8.4.2.1 Detailed Tuner MPEG TS Stats



```
Tera Term - COM1 VT
File Edit Setup Control Window Help

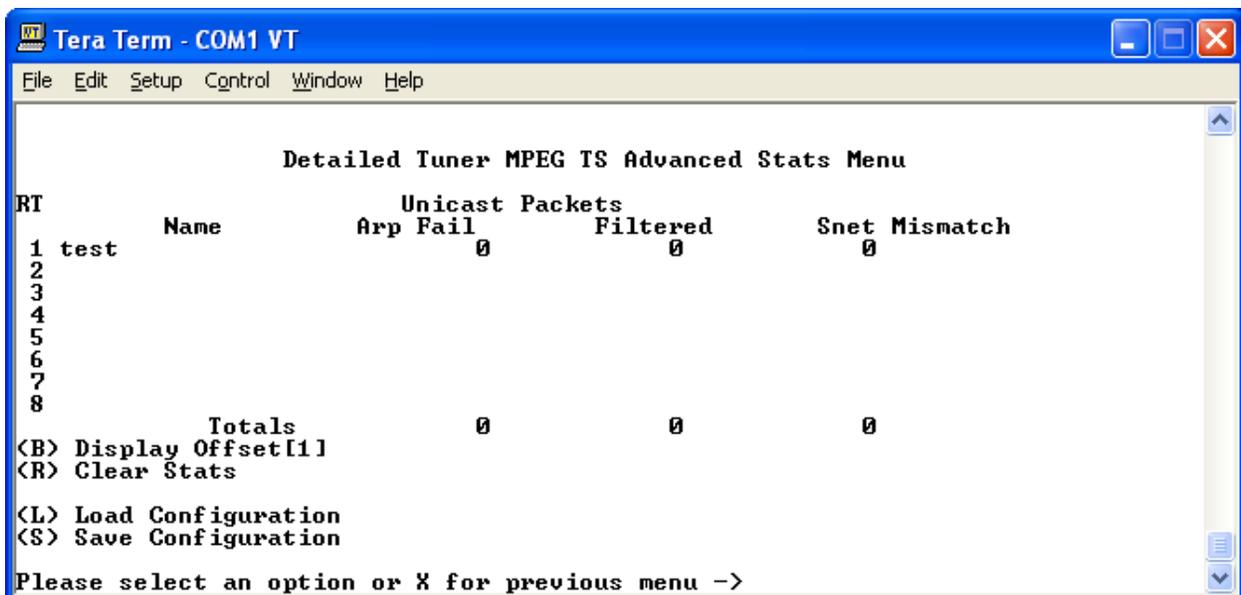
Detailed Tuner MPEG TS Stats Menu

RT      Name      Packets      MCAST      Unicast      Bandwidth (Mbps)
      Transmitted  Dropped      Dropped      Min      Max      Avg
1 test          0           0           0      0.000  0.000  0.000
2
3
4
5
6
7
8
      Totals          0           0           0      0.000
<B> Display Offset[1]
<R> Clear Stats

<L> Load Configuration
<S> Save Configuration

Please select an option or X for previous menu ->
```

#### 4.3.8.4.2.2 Detailed Tuner MPEG TS Advanced Stats Menu



```
Tera Term - COM1 VT
File Edit Setup Control Window Help

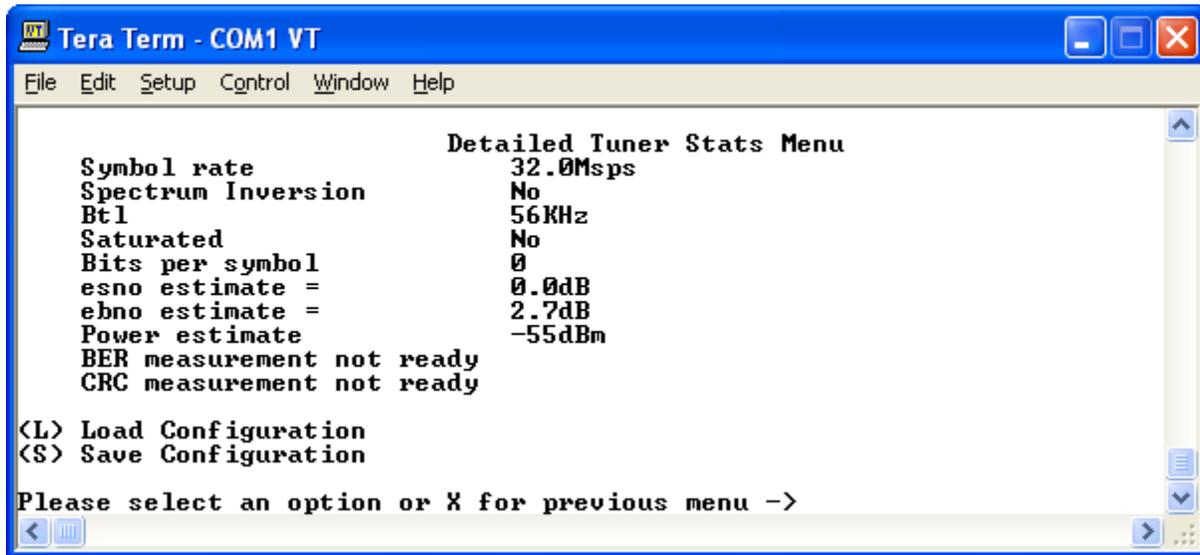
Detailed Tuner MPEG TS Advanced Stats Menu

RT      Name      Unicast      Packets      Snet
      Arp Fail  Filtered      Mismatch
1 test          0           0           0
2
3
4
5
6
7
8
      Totals          0           0           0
<B> Display Offset[1]
<R> Clear Stats

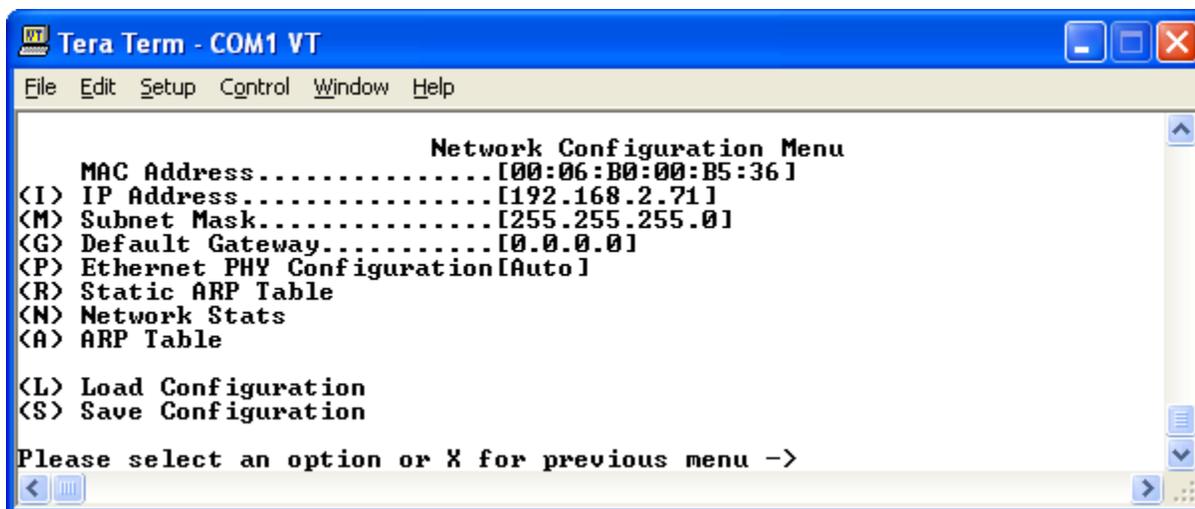
<L> Load Configuration
<S> Save Configuration

Please select an option or X for previous menu ->
```

### 4.3.8.4.3 Detailed Tuner Stats Menu



### 4.3.9 Network Configuration Menu



#### IP Address

The IP Address assigned to the CMR-5995's LAN interface. The IP Address is entered in dotted decimal format.

#### Subnet Mask

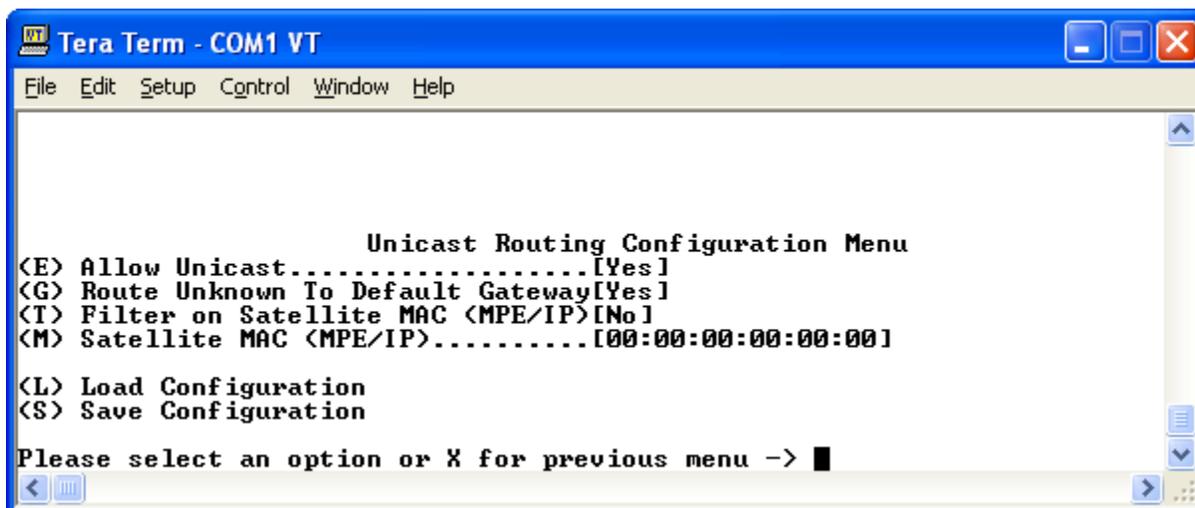
The Subnet Mask assigned to the CMR-5995's LAN interface. The Subnet Mask is entered in dotted decimal format and is typically 255.255.255.0 for a C-Class mask, 255.255.0.0 for a B-Class mask or 255.0.0.0 for an A-Class mask.

#### Default Gateway

The Default Gateway assigned to the CMR-5995's LAN interface. The Default Gateway is entered in dotted decimal format and must be within the subnet of the IP Address assigned to the LAN interface. The Default Gateway is the address of a local router to which all non-local subnet traffic will be directed.

### 4.3.10 Unicast Routing Configuration Menu

The Unicast Routing Configuration page addresses the CMR-5995's configuration for handling Unicast traffic over the transport stream. This feature is only used in the MPE/IP configuration.



#### **Allow Unicast**

Selects whether the CMR-5995 will support the routing of Unicast traffic.

#### **Route unknown to default gateway**

If an Address Resolution Protocol (ARP) cannot be achieved, then incoming Unicast is directed to the configured default gateway.

#### **Filter on Satellite MAC (MPE/IP)**

The hardware Media Access Control (MAC) address assigned for Unicast operation. When the satellite MAC is defined, the CMR-5995 will only route Unicast traffic that is specifically addressed to the satellite MAC. This value does not affect the characteristics of multicast data flow.

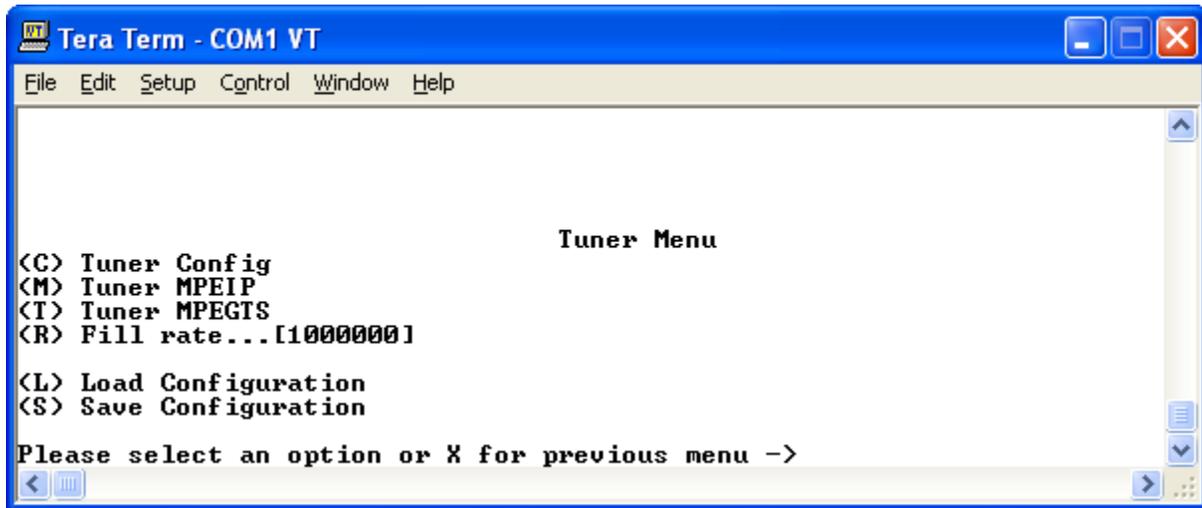
Digicast receivers do not need to filter on MAC. Some third party encapsulators/receivers may need to filter on MAC, and if the MAC is configured on the Encapsulator for a Unicast Route.

#### **Satellite MAC (MPE/IP)**

The hardware Media Access Control (MAC) address assigned for Unicast operation. When the satellite MAC is defined, the CMR-5995 will only route Unicast traffic that is specifically addressed to the satellite MAC. This value does not affect the characteristics of multicast data flow. Do not use the CMR-5995 Ethernet MAC – this address should be the MAC assigned by the route defined in the Encapsulator at the uplink (headend).

### 4.3.11 Tuner Menu

This menu enables the user to configure the tuner for operation. The terminal configuration of the tuner is simple to perform and can be done at installation time.



```
Tera Term - COM1 VT
File Edit Setup Control Window Help

                                Tuner Menu
<C> Tuner Config
<M> Tuner MPEIP
<T> Tuner MPEGTS
<R> Fill rate...[1000000]

<L> Load Configuration
<S> Save Configuration

Please select an option or X for previous menu ->
```

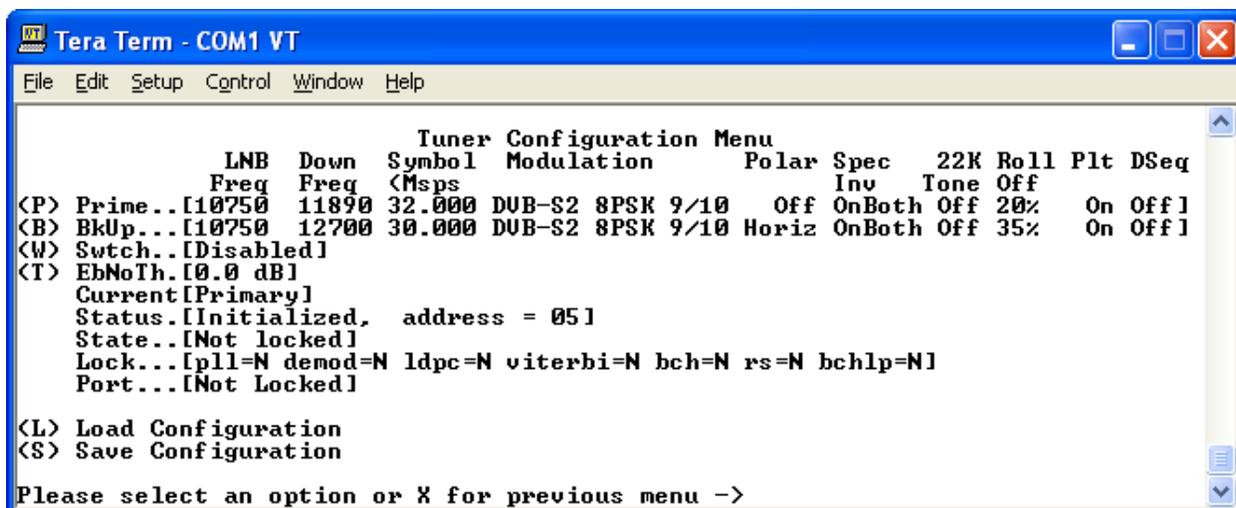
Menu items <C>, <M> and <T> are described in detail on the following pages.

#### Fill Rate



**It is recommended that the Fill Rate value NOT be changed.**

### 4.3.11.1 Tuner Configuration Menu



#### Primary and Backup Tuner Configuration

The CMR-5995 can be configured to have a backup (secondary) configuration. The backup tuner configuration allows the user to configure a backup configuration in the event the main carrier is taken down. The CMR-5995 will only attempt to use the backup configuration in the event the primary carrier is not available.

#### LNB Frequency

The frequency of the Local Oscillator (LO) that resides in the Low Noise Block (LNB) amplifier located at the antenna. For Ku-Band operation, the LO is typically 10,750 MHz for Ku-Band operation North America and other common frequencies are 9,750 MHz and 10,600 MHz. For C-Band operation, 5,150 MHz is a common LO frequency. Please consult your LNB manufacturer for the LO in the LNB.

#### Downlink Frequency

The actual receive frequency being down linked from the satellite to the Low Noise Block (LNB) amplifier located at the antenna. For Ku-Band operation, this frequency ranges from 10,700 MHz to 12,750 MHz. For C-Band operation, this frequency ranges from 3,400 MHz to 4,200 MHz.

The combination of the LO and the downlink frequency produce the L-Band frequency expected by the CMR-5995. Some examples are as follows:

#### Example 1:

LO = 10,750 MHz  
 Ku-Band Receive Frequency = 11,895 MHz  
 L-Band Frequency = 11,895 MHz – 10,750 MHz  
 L-Band Frequency = 1,145 MHz

#### Example 2:

LO = 10,600 MHz  
 Ku-Band Receive Frequency = 12,010 MHz

L-Band Frequency = 12,010 MHz – 10,600 MHz  
L-Band Frequency = 1,410 MHz

**Example 3:**

LO = 5,150 MHz  
C-Band Receive Frequency = 3,920 MHz  
L-Band Frequency = 5,150 MHz – 3,920 MHz  
L-Band Frequency = 1,230 MHz

**Example 4 (Direct L-Band entry):**

This would be used if the user desired to not enter in the LO and RX frequencies. For this example assume the same values as example 1:  
LO = 10,750 MHz  
Ku-Band Receive Frequency = 11,895 MHz  
L-Band Frequency = 11,895 MHz – 10,750 MHz  
The user would simply enter:  
LO = 0 MHz (this allows the direct entry of the L-Band frequency)  
L-Band Frequency = 1,170 MHz as the RX frequency

**Modulation**

The CMR-5995 supports the following modes of operation:

- DVB-S – QPSK
- DVB-S2 – QPSK
- DVB-S2 – 8PSK

Each mode of operation provides a range of FEC rates that are supported based on the mode and modulation.

**Symbol Rate**

Depending on the configured mode of operation, the following symbol rates are supported:

- DVB-S – QPSK 2 to 45 Msps
- DVB-S2 – QPSK 2 to 32 Msps
- DVB-S2 – 8PSK 2 to 32 Msps

**Polarity**

The configured polarity provides the voltage supplied to the LNB or switch. The valid selections for the CMR-5995 are:

- 13 VDC for vertical polarization
- 18 VDC for horizontal polarization
- Off if LNB voltage is not required

The CMR-5995 is capable of providing up to 600mA of current in either mode of operation. It is recommended, that if the LNB voltage is not required, either polarity be set to ‘Off’ or that a DC block be installed.

### **Spectral Inversion**

There are four supported modes of spectral inversion:

- **On** – forces the tuner to stay with spectral inversion. The tuner will not check for spectral inversion automatically
- **Off** – forces the tuner to stay without spectral inversion. The tuner will not check for spectral inversion automatically
- **On Both** – tries spectral inversion first and then attempts to automatically check spectral inversion periodically – **Recommended Default Configuration**
- **Off Both** – tries non-spectral inversion first and then attempts to automatically check spectral inversion periodically

### **LNB 22 KHz Tone**

Enables or disables the LNB 22 KHz tone to the LNB for remote LNB and switch control.

### **Pilot**

Enables or disables the Pilot for DVB-S2 mode of operation only.

### **Roll Off**

The expected filter roll off of the carrier the receiver should be looking at. This parameter only works for DVB-S2 mode, since DVB-S mode uses a fixed roll off of 35%.

The valid roll offs in DVB-S2 modes are:

- 20%
- 25%
- 35%

### **DiSEqC**

Enables sending and receiving DiSEqC commands as are supported in DiSEqC mode 1.2. The valid configuration settings for DiSEqC mode are:

- Off
- Mode A
- Mode B
- Mode C
- Mode D

### **Switch**

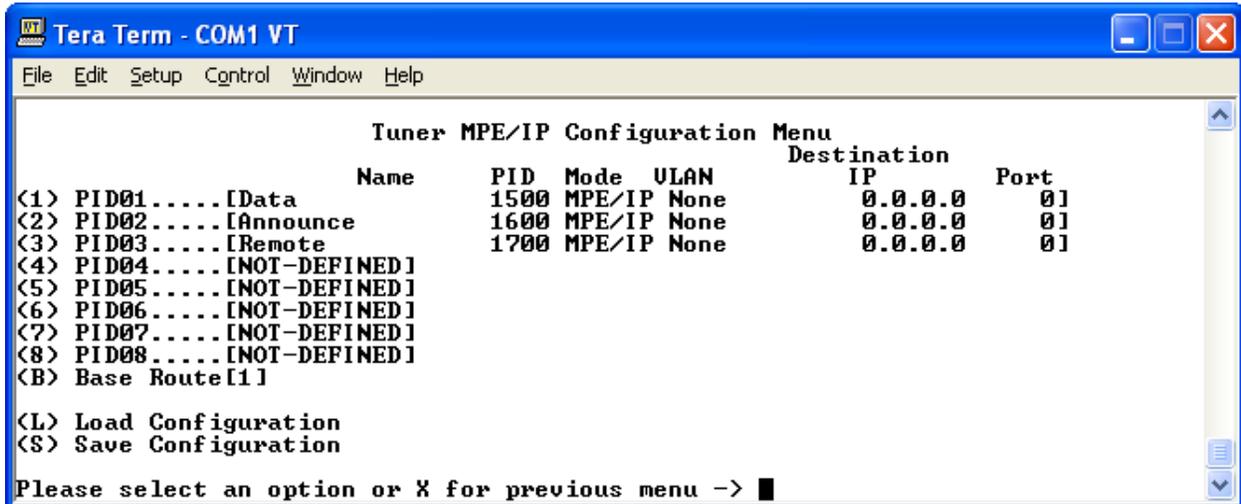
Enables or disables the ability to switch to a backup carrier. If set to disabled, the CMR-5995 will not attempt to switch to a backup carrier.

### **Switch Time**

The number of seconds the unit should wait before attempting to locate the backup carrier. Setting the switch time to a setting of 0 (zero) causes the backup frequency to be disabled.

### 4.3.11.2 Tuner MPE/IP Configuration Menu

A configured PID value in hexadecimal is required for MPE/IP data to be extracted from the transport stream and sent to the CPU. Once a valid PID value is configured, and data is found on a transport stream, the data is decapsulated and delivered to the Ethernet port. A value of 0x1FFF is disabled.



**Name**

The name of the route.

**PID**

The PID value in hexadecimal format.

**Mode**

MPE/IP or DVB-TS.

**VLAN**

Options are None, All, or 1 to 4094.

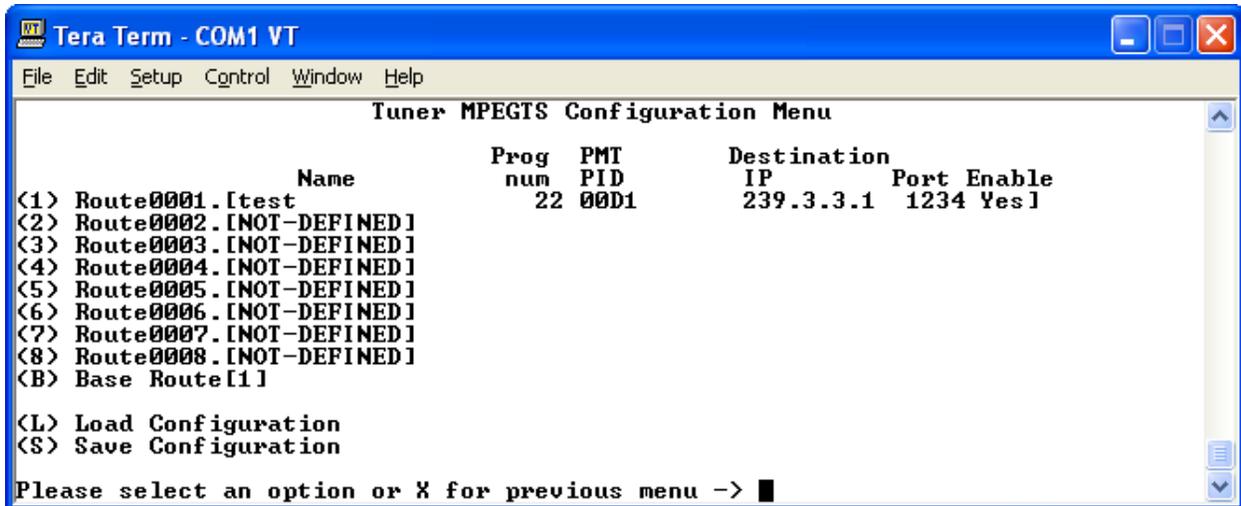
**Destination IP**

A valid destination IP address if mode is DVB-TS.

**Port**

A valid port if mode is DVB-TS.

### 4.3.11.3 Tuner MPEG TS Configuration Menu



#### **Name**

The name of the incoming program that is extracted from the Program Service Information.

#### **Program Number**

The program number to be routed to the Ethernet as Transport Stream over IP.

#### **PMT PID Number**

The PMT PID to be routed to the Ethernet as Transport Stream over IP.

#### **Destination IP**

The IP address to be used when routing the Transport Stream over Ethernet IP.

#### **Port Number**

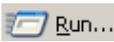
The Port Number to be used when routing the Transport Stream over Ethernet IP.

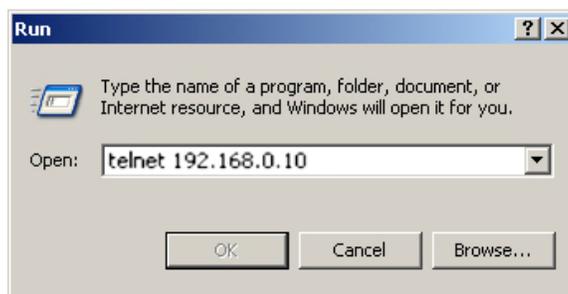
#### **Enable**

Enables or disables the route.

## 4.4 Telnet Interface

Telnet provides a textual interface over a LAN. Most PCs have the capability to use Telnet. Navigate the menus in the same manner as when using the Terminal Interface. With specific exceptions as noted in the Terminal Interface section, the menus available via Telnet and Serial interfaces are identical.

To use Telnet on a Microsoft Windows® product, click , then . The Run dialog box opens:



In the **Open:** text window, enter “**telnet xxx.xxx.xxx.xxx,**” where **xxx.xxx.xxx.xxx** is the IP address of the CMR-5995. If the port number has been modified from the **standard 23** via the Terminal Interface, then the port number must be appended with a colon to the IP address.

Click **OK** to continue to the login prompt. At the login prompt, enter the user name and password to gain access to the telnet interface.



**The default username is “comtech” and the default password is “comtech”, both of which are case sensitive.**

Press <ENTER> and the Main Menu will display.



## 4.5 Trivial File Transfer Protocol (TFTP)

The CMR-5995 supports changes to the resident software and firmware by means of the Trivial File Transfer Protocol (TFTP). This enables changes to be made remotely via the LAN interface. It is recommended to use Solarwinds TFTP server application (available at <http://support.solarwinds.net/updates/SelectProgramFree.cfm>).

To modify the software and/or firmware, use the following procedures:

### Configure the server as follows:

- a) **File** → **Configuration** → Select the '**TFTP Root Directory**'. Set up the location of the CMR-5995 files.
- b) **File** → **Configuration** → Select the '**Security**' tab and make sure '**Transmit and Receive**' are selected.
- c) Save configuration.

The server is now configured for the file transfer process.



IMPORTANT

***Because the CMR-5995 stops processing data traffic during the download process, it is recommended that this upgrade procedure be performed during scheduled network down time.***

***Do NOT remove power from the unit during the download process.***

### To modify code via Telnet:

Step	Procedure
1	Start up Solarwinds TFTP server – Ensure configuration as described previously.
2	Ensure that the code provided by CEFD is located in the TFTP Root directory.
3	Start up a Telnet client and initiate a session with the CMR-5995, as described in the Telnet Interface section
4	Select ' <b>A</b> ' for Administration
5	Select ' <b>D</b> ' for Download
6	Enter ' <b>1</b> ' for Application code or ' <b>2</b> ' for FPGA code (the user will be directed to select Application or FPGA code in the download instructions provided by CEFD when new code is provided)
7	Enter the IP address of the TFTP server and wait for the message " <b>Upgrade complete. Press any key to continue</b> "

This code modification process can also be conducted via the Web Interface, under the Administration page, or the Terminal Interface under the Main Menu.



IMPORTANT

***Under heavy traffic conditions, the TFTP transfer may take several minutes. The transfer process reported by Solarwinds may show greater than 100% transferred, but this is a normal condition. Be patient and allow the transfer to take place.***

---

## 4.6 Simple Network Management Protocol (SNMP)

Simple Network Management Protocol (SNMP) allows an SNMP Manager such as OpenView or Castle Rock to be used to remotely manage the CMR-5995 in an automated fashion.

The CMR-5995 supports SNMP versions 1 and 2 (SNMPv1 and SNMPv2). Two types of Management Information Bases (MIBs) are supported: **MIB II** and **private MIB**.

**MIB II** is the default MIB that is used to gather generic information about the unit, such as system ‘up’ time, packets sent or received on an interface, etc. **MIB II** is designed for only read access, not write access. To read and write configuration parameters over SNMP requires a **private MIB**. The **private MIB** allows parameters to be set on the Web, Terminal, or Telnet interfaces.

The elements Object Identifiers (OIDs) of the MIB will be listed in the appendix of a revised version of this manual. CEFD has been assigned an SNMP designator by the IEEE, which will be found in all elements of the CMR-5995’s MIB.



***The assigned designator for CEFD (enterprise OID) is 1.3.6.4.1.18723.***

NOTE

The CMR-5995 supports configurable community strings for added security. **As a security precaution, passwords cannot be remotely queried over SNMP.**

For SNMP access from a remote network via the public Internet, a VPN connection to the CMR-5995 will need to be established using third-party VPN client/server access.

The default community strings for the SNMP R/W community is “*private*” and the R/O community is “*public*”.

## 4.6.1 SNMP Traps

The CMR-5995 supports SNMP Traps for providing unsolicited SNMP events to a pre-configured SNMP Manager. The SNMP Trap may be used as a tool to automatically notify an SNMP manager of a change that has taken place on the unit. Traps typically define a state change such as an interface that goes from active to inactive (or up to down). SNMP Traps provide unsolicited reporting to a central SNMP manager, so events can be reported as they happen.

The Traps supported on the CMR-5995 are as follows:

### Generic Traps (SNMPv1)

- **Cold Start** - Unit has booted from a cold start (hardware startup)
- **Warm Start** - Unit has re-booted from a power on start (warm startup)
- **Link Down** - An interface has gone from up to down (such as a tuner has lost lock)
- **Link Up** - An interface has gone from down to up (such as a tuner regaining lock)
- **Authentication Failure** - An SNMP message received could not be authenticated

### Specific Traps (SNMPv1)

- **dniEbNoThresholdOK** - EbNo value is now set above the defined limit
- **dniEbNoThresholdFail** - EbNo value has fallen below the defined limit
- **dniRedundancyBackup** - Redundant backup unit is now active
- **dniRedundancyPrimary** - Redundant primary unit is now active
- **dniRedundancyModeConflict** - A conflict in redundancy mode has been detected
- **dniMPEGPIDConflict** - MPEG-TS PID Conflict has occurred
- **dniDMAOverflow** - DMA Overflow
- **dniDMAOverflowCleared** - DMA Overflow Cleared

# Appendix A. SOFTWARE UPGRADE

---

## A.1 Introduction

The CMR-5995 is enabled to receive an upgrade via TFTP transmission. Comtech EF Data recommends using the Solarwinds TFTP server application (available at <http://support.solarwinds.net/updates/SelectProgramFree.cfm>) for upgrading the product.



***CEFD provides download instructions for the software upgrade. The instructions indicate whether to download Application or FPGA or Redboot code.***

Once the TFTP server is enabled and the new file (**Application** or **FPGA** or **Redboot**) has been copied to the TFTP server, use the procedures described in sections A.2 and A.3 to upgrade the unit.

## A.2 Web Interface

Access the **Administrative Configuration** menu:

The screenshot shows the web interface of a Digicast Media Router S2-ASI. The browser window is titled "Comtech EF Data - Microsoft Internet Explorer" and the address bar shows "http://192.168.12.101/admin.htm".

The main navigation menu includes: HOME, ADMIN, REDUNDANCY, NETWORK, EGRESS, IGMP, UNICAST, MPE/IP, MPEG-TS, SVC FILTER, TUNER, and STATS.

The "Tuner Statistics" section displays a table with columns: Lock, Es/No, Eb/No, Power, and a Refresh button. The data row shows: P, 20.3dB, 17.6dB, -46dBm.

The "Administrative Configuration" section includes links for [SNMP], [VLOAD], and [SYSLOG]. It contains the following fields and values:

- Unit Name: \* CMR-5995
- OS Version: eCOS 2.0
- App Version: 2.4.2
- FPGA Version: 6.0.0.5
- User Name: \* comtech
- Password: \*
- Confirm Password: \*
- System Contact: \* comtech
- System Location: \* comtech
- Enable Telnet: \*

Buttons at the bottom of this section are: Submit, Cancel, Reset Unit, and Display Config. A note below the buttons says: "Press submit to make changes" and "\* Indicates a required field".

The "Update Firmware" section includes:

- Unit TFTP Server IP Address: \*
- Image Type: \* Application

A note below the fields says: "Enter server IP and select type, then press submit to make changes" and "\* Indicates a required field". An "Update" button is located at the bottom of this section.

Callouts from external boxes point to specific elements:

- Step 4, Reset** points to the "Reset Unit" button.
- Step 1, Unit TFTP Server IP Address** points to the "Unit TFTP Server IP Address" field.
- Step 2, Select Image Type** points to the "Image Type" dropdown menu.
- Step 3, Update** points to the "Update" button.

Step	Procedure
1	In the <b>Update Firmware</b> section, enter the <b>Unit TFTP Server IP Address</b> .
2	Select <b>Application</b> or <b>FPGA</b> or <b>Redboot</b> for the <b>Image Type</b> to be upgraded.
3	Select <b>Update</b> . The software update will begin to download.
 IMPORTANT	<b><i>Do NOT power down the unit during the upgrade process.</i></b>
4	Once the unit is upgraded, select <b>Reset Unit</b> .

### A.3 Telnet or Terminal Interface

Access the **Administration Menu**.

```

Tera Term - COM1 VT
File Edit Setup Control Window Help

                                Administration Menu
(N) Unit Name.....[cmr5975]
   OS Version.....[eCOS 2.0]
   App Version.....[2.4.1 ]
   FPGA Version....[4.0.0.12]
(U) Username.....[comtech]
(P) Password.....[*****]
(C) System Contact.....[comtechefdata]
(Y) System Location.....[comtechefdata]
(I) SNMP server IP address.....[0.0.0.0]
(W) SNMP R/W Community.....[*****]
(O) SNMP R/O Community.....[*****]
(T) Enable Telnet.....[Yes]
(U) Uload Configuration Menu
(F) Display Config
(D) Download Image
(M) Auto Logout and Port Configuration Menu
(G) Syslog Configuration Menu
(R) Reset Unit
(A) Load Factory Defaults

(L) Load Configuration
(S) Save Configuration

Please select an option or X for previous menu -> d

Press (Esc)ape key to abort changes

Image type <1=Application, 2 = FPGA, 3 = Redboot>: 1
TFTP Server IP Address: 192.168.141.17
Retrieving cmr59x5.bin...
Received 907320 bytes
Erasing and Programming...

Upgrade complete
Press any key to continue
    
```

**Step 1, <D> Download Image**

**Step 2, Image Type**

**Step 3, TFTP IP Server Address**

**Step 4, Press any key to continue**

**Step 5, <R> Reset**

The steps are explained in the following table.

Step	Procedure
1	Select <b>(D)</b> for <b>Download Image</b> .
2	At the “ <b>Image type</b> ” prompt, enter: <b>1</b> for <b>Application</b> or <b>2</b> for <b>FPGA</b> or <b>3</b> for <b>Redboot</b> .
3	Enter the <b>TFTP IP</b> server address. Once the <b>TFTP IP</b> server address is entered, the software update will begin to download.



IMPORTANT

***Do NOT power down the unit during the upgrade process.***

- 4 When the update is complete, the message “**Press any key to continue**” will be displayed at the bottom of the screen.
- 5 After the unit has been upgraded, reset the unit by selecting **(R)** for Reset and ‘**Y**’ to confirm the reset



# Appendix B. IP ROUTING SUPPORT

---

## B.1 Introduction

The CMR-5995 provides state-of-the-art L-Band DVB-S and DVB-S2 IP and transport stream delivery based on the ISO/IEC 13818-1, ISO/IEC 13818-6 and DVB Specification for Data Broadcasting (EN 301 192).

The following configuration features are provided:

- Support for DVB-S reception at rates from 2 to 45 Msps
- Support for DVB-S2 reception at rates:
  - QPSK 2 to 32 Msps
  - 8PSK 2 to 32 Msps
- IP Decapsulation per Multi-Protocol Encapsulation (EN 301 192)
- Unicast Routing
- Multicast Routing
- Section Packing and Non-Section Packing
- IGMP version 2
- Output of MPEG2 Transport Streams over ASI

---

## B.2 IP Configuration

Both Unicast and Multicast IP datagrams are encapsulated per the Multiprotocol Encapsulation MPE specification. Routing of datagrams is accomplished by configuration of PIDs in the CMR-5995, as described in the following sections.

### B.2.1 Unicast Routing

Unicast routing provides point-to-point delivery of IP datagrams. Routes for Unicast IP packets are configured according to the following:

- IP Addresses, which fall into three classes:
  - A (0.0.0.0 to 127.255.255.255)
  - B (128.0.0.0 to 191.255.255.255)
  - C (192.0.0.0 to 223.255.255.255)
- Medium Access Control (MAC) Addresses, which identifies the destination device (next-hop) to which the packets are sent. The least-significant bit of the first byte of the six-byte MAC address is a '0'. For example, 0x00 11 22 33 44 55 is a Unicast address.

Unicast is supported by the CMR-5995 as it would be in any routed network. Packets received by the CMR-5995 are routed to the Ethernet if they meet the subnet criteria or the CMR-5995 is configured to route non-local packets to a default gateway.

The CMR-5995 uses Classless Inter-Domain Routing (CIDR) notation in which a 'slash' followed by a decimal number is used to represent the number of bits for the mask, e.g. /32 is 255.255.255.255 and /24 is 255.255.255.0.

As stated above, part of the route configuration is a MAC address that is assigned for delivery of the packet when it is encapsulated into MPE. The MAC address typically identifies the remote receiver (physical device), e.g. satellite terminal, DTV terminal, or cable receiver.

## B.2.2 Multicast Routing

Multicast routing provides point-to-multipoint delivery of IP datagrams. Routes for multicast IP packets are configured according to the following:

- IP Addresses, which fall into class D (224.0.0.0 to 239.255.255.255)
- Medium Access Control (MAC) Addresses, which identifies the frames as multicast. The least-significant bit of the first byte of the six-byte MAC address is a '1'. For example, 0x01 00 5E 00 00 01 is a multicast address
- Broadcast frames are identified by the MAC Address **0x FF FF FF FF FF FF**.

Multicast IP addresses are related to multicast MAC addresses as follows:

The lower 23 bits of the IP address are mapped into the lower 23 bits of the MAC address as shown in Figure B-1. Examples of the relationship are:

- 1) Received IP: 239.1.1.10 = MAC: 0x01 00 5E 01 01 0A
- 2) Received IP: 224.10.10.10 = MAC: 0x01 00 5E 0A 0A 0A
- 3) Received IP: 228.63.10.10 = MAC: 0x01 00 5E 3F 0A 0A

Note that the upper 5 bits of the multicast IP address are ignored in the MAC so that 32 Multicast group IP addresses map to a single MAC address. This implies further filtering is required at the end device.

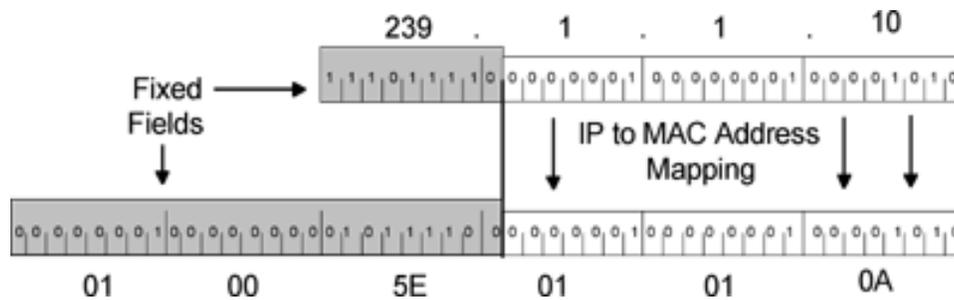


Figure B-1. Multicast Mapping (IP to MAC)

### B.3 Section Packing

Section packing (Figure B-2) is a technique that provides more optimal utilization of the MPEG-2 transport stream (TS) packet structure. When section packing is not used, each TS packet (containing the MPE section) can carry no more than a single section. This often results in wasted payload capacity when the sections are less than 184 bytes.

The section packing feature allows more than a single MPE section to be carried by an MPEG-2 TS packet, thereby minimizing wasted payload capacity.

In the case of a large MPE section that spans multiple MPEG-2 packets, the ending of an MPE section may occur in the middle of an MPEG-2 packet. In this instance, with section packing, a new MPE section begins immediately after the first MPE section has finished without any 'fill' (wasted) bytes having to be inserted before the start of the next MPEG-2 packet.

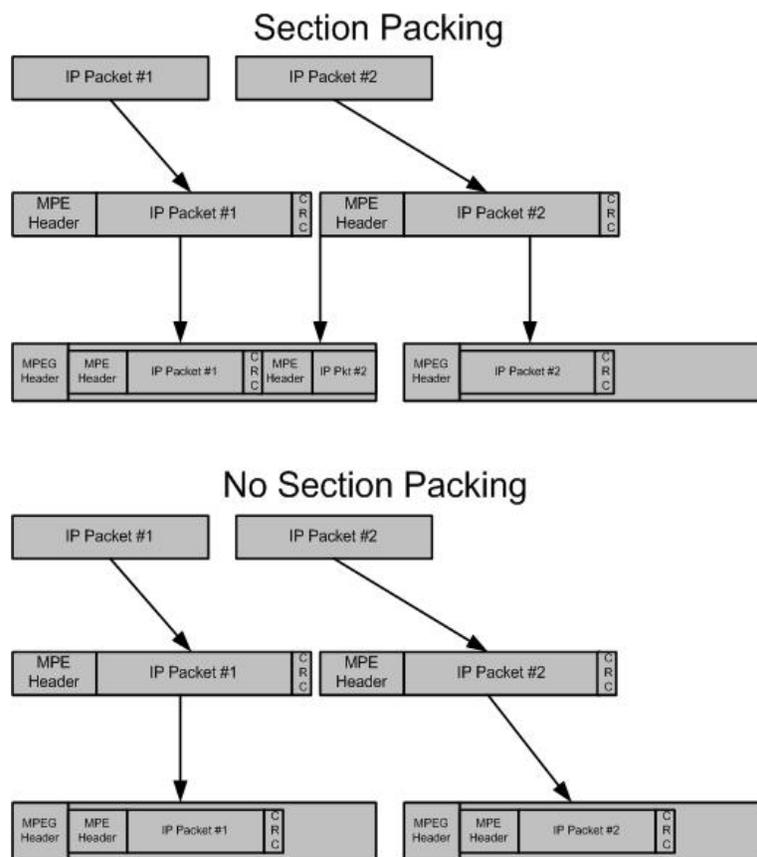


Figure B-2. Section Packing

# Appendix C. SYSTEM LOG CONFIGURATION

---

## C.1 Introduction

The CMR-5995 supports a feature known as **system logging**, more commonly called **Syslog**.

This section illustrates how a **system logger** can be set up on a Linux or Unix system<sup>1</sup>, allowing the CMR-5995 to report system events to a logger attached via an Ethernet connection.

---

## C.2 Enabling a System Logger

To enable system logging, add the following command string to the bottom of the `/etc/syslog.conf` file on the Logging Server:

---

---

```
# log the mux messages to here
*.=info /var/log/mux.log
```

---

---

Where:

**\*.=info** tells the logger to send all messages it receives from the Mux to the Dir/file

---

<sup>1</sup> Note that this is merely a sample configuration. CEFD does not support the setup of a syslog server, since it is assumed that one is already configured and operational for use.

Looking in the top of file `/etc/init.d/syslog`<sup>2</sup>, the following is usually displayed:

```
#!/bin/bash
#
# syslog      Starts syslogd/klogd.
#
#
# chkconfig: 2345 12 88
# description: Syslog is the facility by which many daemons use to log \
# messages to various system log files. It is a good idea to always \
# run syslog.

# Source function library.
. /etc/init.d/functions

[ -f /sbin/syslogd ] || exit 0
[ -f /sbin/klogd ] || exit 0

# Source config
if [ -f /etc/sysconfig/syslog ] ; then
    . /etc/sysconfig/syslog
else
    SYSLOGD_OPTIONS="-m 0"
    KLOGD_OPTIONS="-2"
fi
```

Of specific interest is the following line:

```
SYSLOGD_OPTIONS="-m 0"
```

By adding a `-r` suffix, this allows the server to accept messages from remote machines. The edited line should read as follows:

```
SYSLOGD_OPTIONS="-m 0 -r"
```

Check the services file, normally at `/etc/services`, to ensure that **PORT 514** is defined. By default this should be enabled on most machines.



***After making the changes you must restart `syslogd`.***

On most machines, entering “`service syslog restart`” should complete the configuration.

---

<sup>2</sup> This file may be in a different location.

# Appendix D. SETTING UP A DIGICAST DIGITAL SATELLITE RECEIVER

---

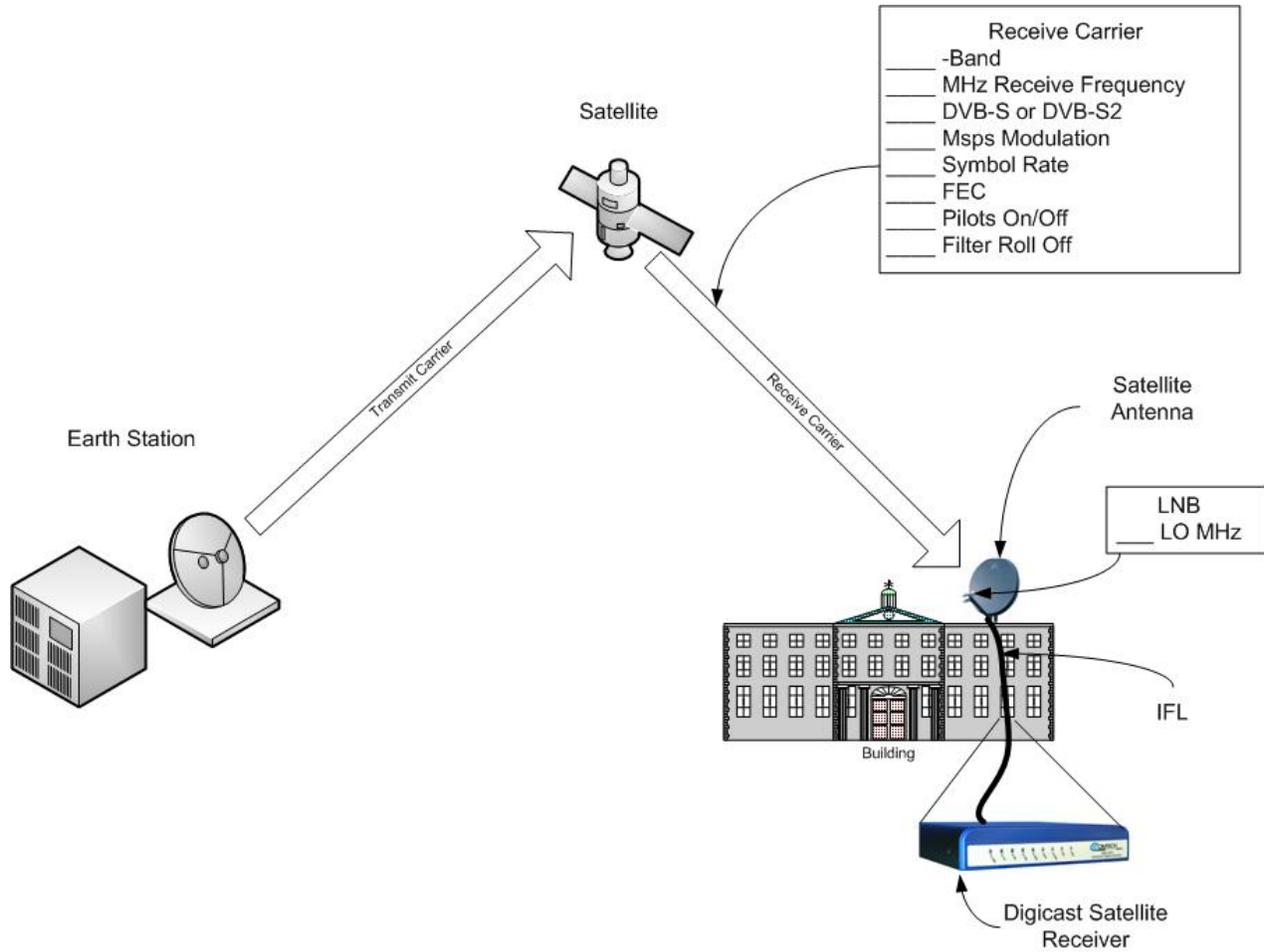
## D.1 Introduction

Setting up a digital satellite receiver for the delivery of IP or transport stream information over an Asynchronous Serial Interface (ASI) involves more than just configuring the data related parameters. The person performing the configuration must have knowledge of both communications concepts and satellite communications. Section D.5, Important Terms to Understand contains information that will help the individual performing the configuration by explaining each parameter and what parameters must be on hand when setting up a Digicast satellite receiver. It is recommended that these terms and concepts be thoroughly understood before proceeding with the setup process.

To complete the setup of a Digicast Satellite Receiver, follow these steps:

1. Understand the significant terms and parameters (Section D.5)
2. Gather the required information (Section D.2)
3. Verify frequency values (Section D.3)
4. Apply the required information to the primary and secondary configurations (Section D.4)

The following image illustrates some of the significant terms and indicates their application:



## D.2 Required Information for Setting Up a Digicast Satellite Receiver

To set up the Digicast receiver for receiving a live satellite feed, gather the following data:

1. Which frequency band is being used? <input checked="" type="checkbox"/>	C-Band
	X-Band
	Ku-Band
	Ka-Band
2. Downlink frequency of the carrier from the satellite?	(MHz)
3. Local Oscillator of the LNB?	(MHz)
4. Which DVB Type? <input checked="" type="checkbox"/>	DVB-S
	DVB-S2
5. Symbol Rate?	(MSPS)
6. Which modulation of the carrier from the satellite? <input checked="" type="checkbox"/>	QPSK
	8-PSK
	16-APSK
7. FEC of the carrier from the satellite? (Range = 1/4 to 9/10 FEC)	
8. Pilots: <input checked="" type="checkbox"/>	On
	Off
9. Which Filter Roll Off (for DVB-S2 Only)? <input checked="" type="checkbox"/>	20%
	25%
	35%
10. Secondary (backup) Carrier? <input checked="" type="checkbox"/>	Enabled
	Disabled
11. Which LNB Power Requirement? <input checked="" type="checkbox"/>	None
	13 VDC
	18 VDC
12. Which Spectral Inversion mode? <input checked="" type="checkbox"/>	On
	Off
	On/Both
	Off/Both

---

## D.3 Verify Frequency Values

The information gathered in the previous section will become the proper parameters entered into the Digicast receiver. However, before this can be done successfully, several values must be verified:

1. Verify the downlink frequency provided falls into the proper band:
  - a. C-Band – 3,700 to 4,200 MHz
  - b. X-Band – 7,000 to 12,500 MHz
  - c. Ku-Band – 11,000 to 18,000 MHz
  - d. Ka-Band – 18,000 to 40,000 MHz

If the downlink frequency does not fall within proper band, contact the space-link provider for clarification.

2. Determine the values to set for the LO and downlink frequency on the Digicast satellite receiver. There are two ways the frequencies can be loaded into the Digicast satellite receiver: 1) Directly entering the downlink and LO frequencies, or 2) by entering the values as L-Band frequencies.
  - 1) Entering the values directly provides the most convenience, since the user simply enters the downlink frequency and LO directly into the Digicast satellite receiver.
  - 2) Entering the values as an L-Band frequency requires some math to be performed, but allows those who are more comfortable with L-Band values to use those familiar frequencies.

To use L-Band frequencies in the configuration, the LO frequency must be set to 0 MHz. The downlink frequency is determined by taking the absolute difference of the actual downlink frequency at (C-, X-, Ku- or Ka-Band) and subtracting the two and using the absolute result (a non-negative number). Once this number has been found, the difference will be the L-Band frequency that can be entered into the downlink frequency on the Digicast satellite receiver. The following examples are given:

<p><b>Example 1:</b> Ku-Band LO = 10,750 MHz Downlink Frequency = 11,895 MHz L-Band Frequency =   11,895 MHz – 10,750 MHz   L-Band Frequency = 1,145 MHz</p>
<p><b>Example 2:</b> Ku-Band LO = 10,600 MHz Downlink Frequency = 12,010 MHz L-Band Frequency =   12,010 MHz – 10,600 MHz   L-Band Frequency = 1,410 MHz</p>
<p><b>Example 3:</b> C-Band LO = 5,150 MHz Downlink Frequency = 3,920 MHz L-Band Frequency =   3,920 MHz – 5,150 MHz   L-Band Frequency =   - 1,230 MHz   L-Band Frequency = 1,230 MHz</p>

## D.4 Configure the Equipment

### Web Interface Example

In the following Web interface graphic, the data is shown **entered two different ways** for the primary and secondary frequency configurations. The frequencies used are as follows:

Primary (entered as L-Band format):	Secondary (entered as standard format):
Ku-Band LO = 10,750 MHz Downlink Frequency = 12,425 MHz L-Band Frequency =   12,425 MHz – 10,750 MHz   L-Band Frequency = 1,675 MHz Symbol Rate = 32 Msps DVB Type = DVB-S2 Modulation = 8-PSK FEC = 9/10 Spectral Inversion = Both/Off Pilot = On (DVB-S2 Only) Filter Roll Off = 20% (DVB-S2 Only)	Ku-Band LO = 10,750 MHz Downlink Frequency = 12,177 MHz Symbol Rate = 23 Msps DVB Type = DVB-S Modulation = QPSK FEC = 3/4 Spectral Inversion = Both/Off Pilot = Off (DVB-S2 Only) Filter Roll Off = 35% default (DVB-S2 Only)

The screenshot shows the Digicast MediaRouter S2 web interface. At the top, there is a navigation menu with links: HOME, ADMIN, REDUNDANCY, NETWORK, IGMP, UNICAST, MPE/IP, MPEG-TS, TUNER, and STATS. The 'TUNER' link is highlighted.

Below the navigation menu is the 'Tuner Statistics' section, which includes a table with the following data:

Lock	Es/No	Eb/No	Power
P	17.9dB	20.6dB	-56dBm

There is a 'Refresh' button next to the table.

Below the statistics is the 'Tuner Configuration' section, which includes a table with the following data:

Config	LNB	Downlink	Modulation	Symbol Rate (Msps)	Polarity	Spectral Inversion	22KHz Tone	Pilot (S2)	Roll Off	DiSeqC
Primary	0	1675	DVB-S2 8PSK 9/10	32.000	Horizontal (18V)	Both Off	Off	On	20%	Off
Backup	10750	12177	DVB-S QPSK 3/4	23.000	Off	Both Off	Off	Off	35%	Off

Below the table are several configuration options:

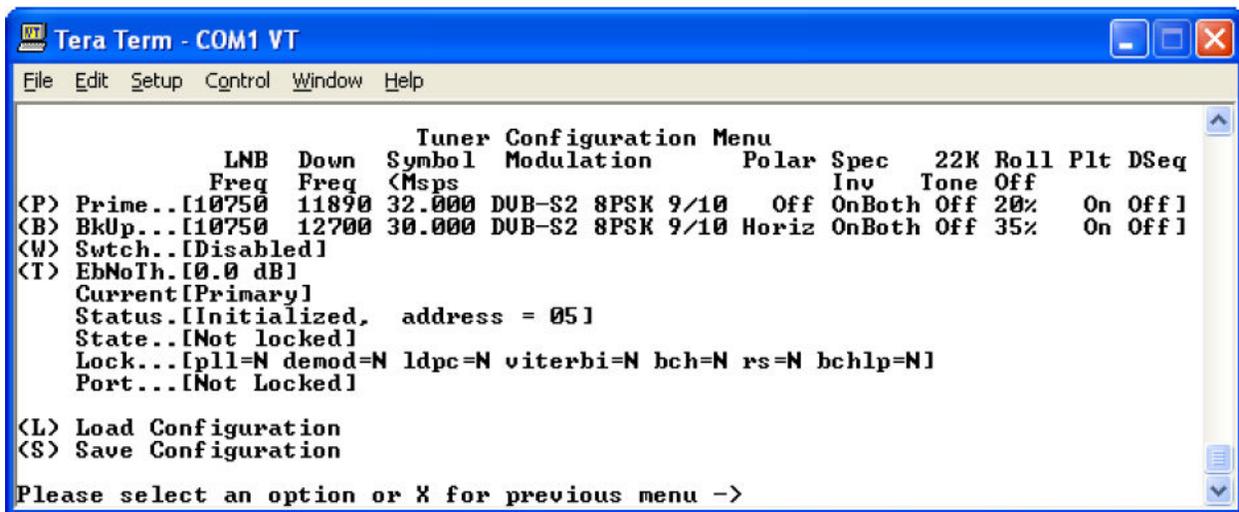
- Switch time: 0 (0=Disable, minimum=5)
- Enable EbNo Monitoring:
- EbNo error threshold: (min=-10.000000, max=40.000000)

There are 'Submit' and 'Cancel' buttons. At the bottom, it says 'Enter Tuner settings, press submit to make changes' and '\* Indicates a required field'.

**Terminal Interface Example**

In the following Terminal interface graphic, the data is shown **entered the same way** for both the primary and secondary frequency configurations. The frequencies used are as follows:

<b>Primary (entered as L-Band format):</b>	<b>Secondary (entered as standard format):</b>
Ku-Band LO = 10,750 MHz Downlink Frequency = 11,890 MHz L-Band Frequency =   11,890 MHz – 10,750 MHz   L-Band Frequency = 1,140 MHz Symbol Rate = 32 Msps DVB Type = DVB-S2 Modulation = 8-PSK FEC = 9/10 Spectral Inversion = Both/On Pilot = On (DVB-S2 Only) Filter Roll Off = 20% (DVB-S2 Only)	Ku-Band LO = 10,750 MHz Downlink Frequency = 12,700 MHz Symbol Rate = 30 Msps DVB Type = DVB-S2 Modulation = 8-PSK FEC = 9/10 Spectral Inversion = Both/On Pilot = Off (DVB-S2 Only) Filter Roll Off = 35% (DVB-S2 Only)



## D.5 Important Terms to Understand

Backup Carrier	Whether there is a backup carrier provided.
Band	<p>The Digicast satellite receiver operates at L-Band (950 to 2,150 MHz). The LNB located up at the satellite dish, down-converts the incoming satellite signal at either C-, X-, Ku- or Ka-Band to L-Band, where it is fed into the receiver.</p> <p>The frequency bands are:</p> <p style="padding-left: 40px;">L-Band 950 to 2,150 MHz                  C-Band 3,700 to 4,200 MHz                  X-Band 7,000 to 12,500 MHz                  Ku-Band 11,000 to 18,000 MHz                  Ka-Band 18,000 to 40,000 MHz</p>
Downlink Frequency	The RF frequency received from the satellite to the remote site.
DVB	Digital Video Broadcasting The type of DVB transmission either DVB-S or DVB-S2.
Earth Station	Where the transmission signal originates
FEC	Forward Error Correction Additional coding added to the transmission to enable the receiving site (Digicast satellite receiver) to detect and correct errors experienced during transmission over the satellite.
Filter Roll Off	The filter roll off is known as the Alpha coefficient ( $\alpha$ ). For DVB-S, $\alpha$ is fixed at 35%, but for DVB-S2, $\alpha$ can be configured as 20%, 25% or 35%. The smaller the $\alpha$ , the less bandwidth will be required on the satellite.
IFL	Interfacility Link The coax connecting the LNB to the Digicast satellite receiver.
LNB	Low Noise Block converter.
Local Oscillator	The frequency of the local oscillator in the Low Noise Block converter.
Modulation	QPSK 8-PSK 16-APSK
Pilots	<p><b>On or Off</b></p> <p>DVB-S2 introduced the use of Pilots for allowing the satellite receiver to remain locked to the carrier under degraded signal conditions. The use of Pilots will allow the receiver to maintain carrier recovery, even when the user data payload cannot be decoded. Enabling Pilots does come at a slight bandwidth cost, since the Pilot requires 36 symbols out of every 16 payload slots, but the gain in performance offsets a minimal inefficiency.</p>

Polarization	The voltage provided to power the LNB: <b>None</b> – no power is provided to the LNB <b>Horizontal</b> – 18 VDC is provided to the LNB and can be used to switch the LNB's polarization if supported by the LNB manufacturer <b>Vertical</b> – 13 VDC is provided to the LNB and can be used to switch the LNB's polarization if supported by the LNB manufacturer
Receiver	Digicast satellite receiver.
Remote Site	Where the transmission signal terminates.
RF	Radio Frequency The carrier frequency used to go from the Earth to the satellite and back.
Satellite	A repeater located 22,300 miles above the Earth in geostationary orbit.
Spectral Inversion	Determines whether the spectrum is inverted or normal. For this parameter, it is recommended that <b>On/Both</b> or <b>Off/Both</b> be selected, since this will ensure the Digicast satellite receiver will automatically determine the correct spectrum.
Symbol Rate	The symbol rate for the downlink carrier in Msps (Mega symbols per second). The Symbol Rate is equivalent to the effective occupied bandwidth on the satellite transponder, but does not include the filter roll off. To determine the total occupied bandwidth on the satellite, the symbol rate is multiplied by $(1+\alpha)$ , where $\alpha$ is the configured filter roll off of the carrier.
Uplink Frequency	The RF frequency transmitted to the satellite from the Earth Station.

# Appendix E. Configuring and Controlling the Digicast CMR-5995 Media Router with SNMP

In general, to configure the Digicast CMR-5995 for web-based management via Simple Network Management Protocol (SNMP), first identify the required parameters listed below, then apply them to the unit (Section E.2).

---

## E.1 Required SNMP Information for Configuring a Digicast Product

To set up the Digicast CMR-5995 Media Router for SNMP, the following information must be known:

1. Which version of SNMP is desired? <input checked="" type="checkbox"/>	SNMPv1
	SNMPv2c
	SNMPv3 (Not Supported)
2. What SNMP Manager will be used (informational only)?	
3. What is the IP address of the SNMP Manager?	. . .
4. What is the desired R/O Community String?	
5. What is the desired R/W Community String?	

## E.2 Configuring the Digicast CMR-5995 Product for SNMP

Use the information gathered in Section E.1 to enter the proper parameters into the Digicast CMR-5995 Media Router to make it operational via the Web interface.

The screenshot shows the Digicast MediaRouter S2 web interface. At the top, there is a navigation menu with links: HOME, ADMIN, REDUNDANCY, NETWORK, IGMP, UNICAST, MPE/TP, MPEG-TS, TUNER, and STATS. Below this is a 'Tuner Statistics' section with a table showing Lock (P), Es/No (17.9dB), Eb/No (20.6dB), and Power (-56dBm), along with a Refresh button. The main section is 'SNMP Configuration', which includes three required fields: 'SNMP R/W Community' (empty), 'SNMP R/O Community' (empty), and 'SNMP server IP address' (0.0.0.0). There are 'Submit' and 'Cancel' buttons below the fields. A note at the bottom states: 'Enter Egress settings, press submit to make changes' and '\* Indicates a required field'.

There are three values that must be enabled to fully utilize all of the SNMP capabilities of the Media Router:

**SNMP R/W Community:** (default = private)

- The community string provided for reading and writing to the private MIB elements on the agent.
- The value entered will not be displayed to the user when entering the information or displaying the Web page.

**SNMP R/O Community:** (default = public)

- The community string provided for reading the private MIB elements on the agent.
- The value entered will not be displayed to the user when entering the information or displaying the Web page.

**SNMP Server IP Address:**

- The IP address of the SNMP server where the agent directs traps,

---

## E.3 SNMP and Digicast Products

Digicast products may be managed using numerous protocols:

Connection Oriented Protocols	Connectionless Protocol
Web (Hypertext Transport Protocol)	SNMP
Terminal	
Telnet	

SNMP is an IP management tool that can be used to provide remote management for communications products. The SNMP protocol is a manager/agent-based design, where a manager oversees multiple agents (or remotes).

Unlike connection-oriented protocols, the SNMP protocol is based on a connectionless-oriented design, where data is exchanged between the manager and agent in a “best effort” manner – if a packet is lost, it will not be retransmitted. SNMP uses a packet structure known as a Protocol Data Unit (PDU) that uses the User Datagram Protocol (UDP) for sending information over an IP-enabled network.

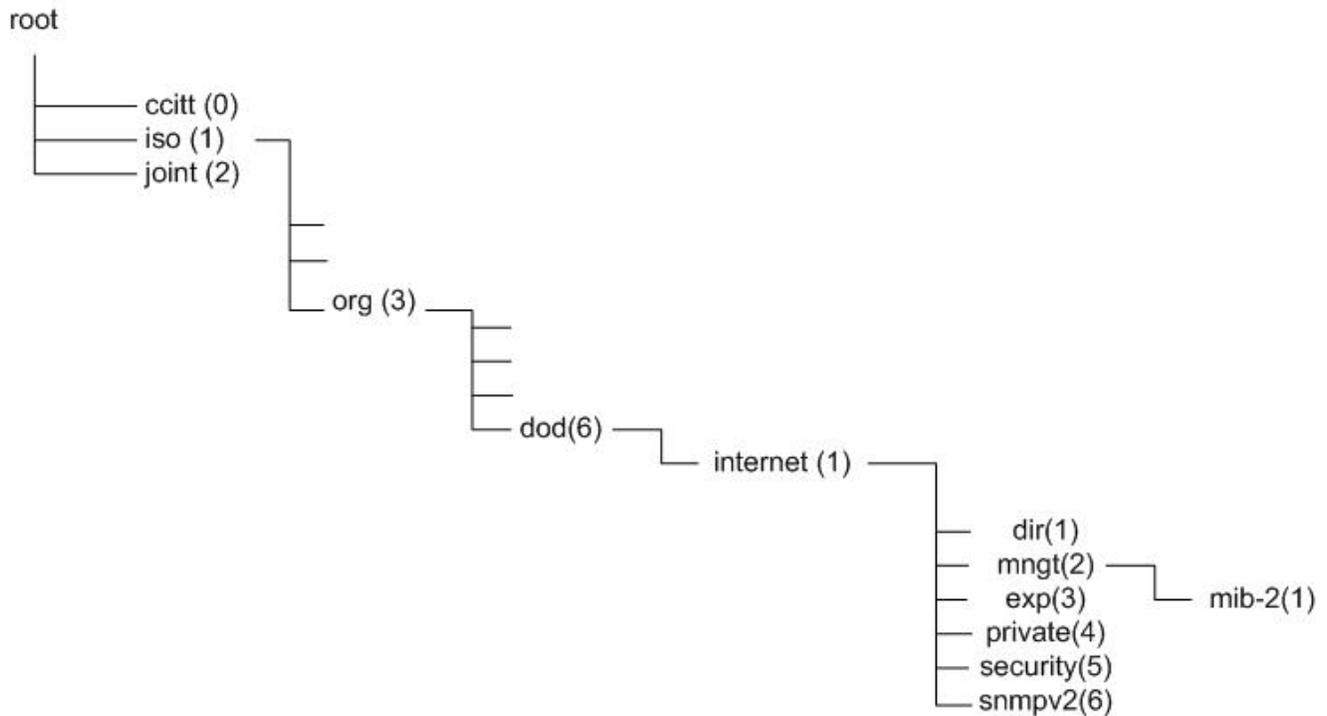
There are currently three versions of SNMP in existence:

1. **SNMP version 1 (SNMPv1)** was the first version and is the most widely used today. However, SNMPv1 has serious security problems which resulted in SNMP version 2 (SNMPv2) being created.
2. **SNMPv2 and SNMPv2c** provide an improved Management Information Base (MIB), a modified PDU and enhanced security features.
3. **SNMP version 3 (SNMPv3)** was introduced to address additional security shortcomings and complexity issues existent in SNMPv2. However, SNMPv3 has not been widely accepted, and most equipment only supports SNMPv2c, which is backwards-compatible with SNMPv1.

SNMP can further be divided into more areas that involve the Management Information Base (MIB) and **polled** versus **unsolicited** messages known as *traps*. The MIB is a file that is used by the SNMP manager to identify available Object Identifiers (OIDs), otherwise known as variables that can be set or retrieved on the agent device. Two types of MIBs are described here – MIB II and private MIB.

## E.4 MIB II

The SNMP MIB-II, as defined by Request for Comments (RFC) 1213, is a compilation of OIDs fashioned in a hierarchical structure, as shown below:



The resulting notation used inside the MIB is represented in dotted decimal notation as follows:

**1.3.6.1.2.1.**  
**1 = iso**  
**3 = org**  
**6 = dod**  
**1 = internet**  
**2 = mngt**  
**1 = mib-2**  
**etc.**

Any remaining digits to the right of the last digit shown are sub elements and represent the actual variables in the MIB.

## E.4.1 MIB II OIDs on the Digicast Media Router (Model CMR-5995)

The following describes how MIB-II elements (OIDs) can be used to obtain (GET) information from a Digicast CMR-5995 product:

The MIB-II elements are broken down into sections as follows:

MIB-II Number	Type	Description
mib-II 1	system	General information about device for administration purposes
mib-II 2	interfaces	Keeps track of each interface on device
mib-II 3	at	Address translation (only for backward compatibility)
mib-II 4	ip	Tracks IP (Internet Protocol) aspects
mib-II 5	icmp	Tracks ICMP (Internet Control Message Protocol) aspects
mib-II 6	tcp	Tracks TCP (Transmission Control Protocol) aspects
mib-II 7	udp	Tracks UDP (User Datagram Protocol) aspects
mib-II 8	egp	Tracks EGP (Exterior Gateway Protocol) aspects
mib-II 9	(no longer used)	
mib-II 10	transmission - currently not used	
mib-II 11	snmp	Tracks SNMP aspects

Supported MIB-II OIDs on the Digicast CMR-5995 Media Router product are as follows:

MIB-II Number	Type	Sub Type	OID	Description	Supported
mib-II 1	system		1.3.6.1.2.1.1	General information about device for administration purposes	
		sysDescr	1.3.6.1.2.1.1.1	System Description	Yes
		sysObjectID	1.3.6.1.2.1.1.2	System Object ID	Yes
		sysUpTime	1.3.6.1.2.1.1.3	System Up Time	Yes
		sysContact	1.3.6.1.2.1.1.4	System Contact	Yes
		sysName	1.3.6.1.2.1.1.5	System Name	Yes
		sysLocation	1.3.6.1.2.1.1.6	System Location	Yes
		sysServices	1.3.6.1.2.1.1.7	System Services	Yes
mib-II 2	interfaces		1.3.6.1.2.1.2	Keeps track of each interface on device	
		ifNumber	1.3.6.1.2.1.2.1	Interface Number	Yes
		ifTable	1.3.6.1.2.1.2.2	Interface Table	Yes
mib-II 3	at		1.3.6.1.2.1.3	Address translation (only for backward compatibility)	
		atTable	1.3.6.1.2.1.3.1	Address Translation	No
mib-II 4	ip		1.3.6.1.2.1.4	Tracks IP (Internet Protocol)	

MIB-II Number	Type	Sub Type	OID	Description	Supported
				aspects	
		ipForwarding	1.3.6.1.2.1.4.1	IP Forwarding Enabled	No
		ipDefaultTTL	1.3.6.1.2.1.4.2	IP Default Time-to-Live	Yes
		ipInReceives	1.3.6.1.2.1.4.3	IP In Received	Yes
		ipInHdrErrors	1.3.6.1.2.1.4.4	IP In Header Errors	Yes
		ipInAddrErrors	1.3.6.1.2.1.4.5	IP In Address Errors	Yes
		ipForwDatagrams	1.3.6.1.2.1.4.6	IP Forwarded Datagrams	Yes
		ipInUnknownProtos	1.3.6.1.2.1.4.7	IP In Unknown Protocol	Yes
		ipInDiscards	1.3.6.1.2.1.4.8	IP In Discards	Yes
		ipInDelivers	1.3.6.1.2.1.4.9	IP In Deliveries	Yes
		ipOutRequests	1.3.6.1.2.1.4.10	IP Out Requests	Yes
		ipOutDiscards	1.3.6.1.2.1.4.11	IP Out Discards	Yes
		ipOutNoRoutes	1.3.6.1.2.1.4.12	IP Out No Route	Yes
		ipReasmTimeout	1.3.6.1.2.1.4.13	IP Reassembly Timeouts	Yes
		ipReasmReqds	1.3.6.1.2.1.4.14	IP Reassembly Reqs	Yes
		ipReasmOKs	1.3.6.1.2.1.4.15	IP Reassembly Okays	Yes
		ipReasmFails	1.3.6.1.2.1.4.16	IP Reassembly Fails	Yes
		ipFragOKs	1.3.6.1.2.1.4.17	IP Fragmentation Okay	Yes
		ipFragFails	1.3.6.1.2.1.4.18	IP Fragmentation Fails	Yes
		ipFragCreates	1.3.6.1.2.1.4.19	IP Fragmentation Creates	Yes
		ipAddrTable	1.3.6.1.2.1.4.20	IP Address Table	Yes
		ipRouteTable	1.3.6.1.2.1.4.21	IP Route Table	Yes
		ipNetToMediaTable	1.3.6.1.2.1.4.22	IP Net to Media Table	Yes
		ipRoutingDiscards	1.3.6.1.2.1.4.23	IP Routing Discards	Yes
mib-II 5	icmp		1.3.6.1.2.1.5	Tracks ICMP (Internet Control Message Protocol) aspects	
		icmplnMsgs	1.3.6.1.2.1.5.1	ICMP In Messages	Yes
		icmplnErrors	1.3.6.1.2.1.5.2	ICMP In Errors	Yes
		icmplnDestUnreachs	1.3.6.1.2.1.5.3	ICMP In Dest Unreachable	Yes
		icmplnTimeExcds	1.3.6.1.2.1.5.4	ICMP In Time Exceeds	Yes
		icmplnParmProbs	1.3.6.1.2.1.5.5	ICMP In Parm Problems	Yes
		icmplnSrcQuenchs	1.3.6.1.2.1.5.6	ICMP In Source Quench	Yes
		icmplnRedirects	1.3.6.1.2.1.5.7	ICMP In Redirects	Yes
		icmplnEchos	1.3.6.1.2.1.5.8	ICMP In Echoes	Yes
		icmplnEchoReps	1.3.6.1.2.1.5.9	ICMP In Echo Reps	Yes
		icmplnTimestamps	1.3.6.1.2.1.5.10	ICMP In Time Stamps	Yes
		icmplnTimestampReps	1.3.6.1.2.1.5.11	ICMP In Time Stamp Reps	Yes
		icmplnAddrMasks	1.3.6.1.2.1.5.12	ICMP In Address Masks	Yes

MIB-II Number	Type	Sub Type	OID	Description	Supported
		icmpInAddrMaskReps	1.3.6.1.2.1.5.13	ICMP In Address Mask Reps	Yes
		icmpOutMsgs	1.3.6.1.2.1.5.14	ICMP Out Messages	Yes
		icmpOutErrors	1.3.6.1.2.1.5.15	ICMP Out Errors	Yes
		icmpOutDestUnreachs	1.3.6.1.2.1.5.16	ICMP Out Dest Unreachable	Yes
		icmpOutTimeExcds	1.3.6.1.2.1.5.17	ICMP Out Time Exceeds	Yes
		icmpOutParmProbs	1.3.6.1.2.1.5.18	ICMP Out Parm Problems	Yes
		icmpOutSrcQuenchs	1.3.6.1.2.1.5.19	ICMP Out Source Quench	Yes
		icmpOutRedirects	1.3.6.1.2.1.5.20	ICMP Out Redirects	Yes
		icmpOutEchos	1.3.6.1.2.1.5.21	ICMP Out Echoes	Yes
		icmpOutEchoReps	1.3.6.1.2.1.5.22	ICMP out Echo Reps	Yes
		icmpOutTimestamps	1.3.6.1.2.1.5.23	ICMP Out Time Stamps	Yes
		icmpOutTimestampReps	1.3.6.1.2.1.5.24	ICMP Out TimeStamp Reps	Yes
		icmpOutAddrMasks	1.3.6.1.2.1.5.25	ICMP Out Addr Masks	Yes
		icmpOutAddrMaskReps	1.3.6.1.2.1.5.26	ICMP Out Address Mask Rep	Yes
mib-II 6	tcp		1.3.6.1.2.1.6	Tracks TCP (Transmission Control Protocol) aspects	
		tcpRtoAlgorithm	1.3.6.1.2.1.6.1	TCP Retrans Algorithm	Yes
		tcpRtoMin	1.3.6.1.2.1.6.2	TCP Retrans Min	Yes
		tcpRtoMax	1.3.6.1.2.1.6.3	TCP Retrans Max	Yes
		tcpMaxConn	1.3.6.1.2.1.6.4	TCP Max Conn	Yes
		tcpActiveOpens	1.3.6.1.2.1.6.5	TCP Active Conn Open	Yes
		tcpPassiveOpens	1.3.6.1.2.1.6.6	TCP Passive Conn Open	Yes
		tcpAttemptFails	1.3.6.1.2.1.6.7	TCP Attempts Failed	Yes
		tcpEstabResets	1.3.6.1.2.1.6.8	TCP Established Resets	Yes
		tcpCurrEstab	1.3.6.1.2.1.6.9	TCP Current Connections	Yes
		tcpInSegs	1.3.6.1.2.1.6.10	TCP In Segments	Yes
		tcpOutSegs	1.3.6.1.2.1.6.11	TCP Out Segments	Yes
		tcpRetransSegs	1.3.6.1.2.1.6.12	TCP Retransmitted Segments	Yes
		tcpConnTable	1.3.6.1.2.1.6.13	TCP Connection Table	Yes
		tcpInErrs	1.3.6.1.2.1.6.14	TCP In Errors	Yes
		tcpOutRsts	1.3.6.1.2.1.6.15	TCP Out Resets	Yes
mib-II 7	udp		1.3.6.1.2.1.7	Tracks UDP (User Datagram Protocol) aspects	
		udpInDatagrams	1.3.6.1.2.1.7.1	UDP In Datagrams Received	Yes
		udpNoPorts	1.3.6.1.2.1.7.2	UDP No Ports Available	Yes
		udpInErrors	1.3.6.1.2.1.7.3	UDP In Errors	Yes
		udpOutDatagrams	1.3.6.1.2.1.7.4	UDP Out Datagrams Sent	Yes

MIB-II Number	Type	Sub Type	OID	Description	Supported
		udpTable	1.3.6.1.2.1.7.5	UDP Table	No
mib-II 8	egp			Tracks EGP (Exterior Gateway Protocol) aspects	No
mib-II 9	(no longer used)				
mib-II 10	transmission - currently not used				
mib-II 11	snmp		1.3.6.1.2.1.11	Tracks SNMP aspects	
		snmpInPkts	1.3.6.1.2.1.11.1	SNMP In Packets	Yes
		snmpOutPkts	1.3.6.1.2.1.11.2	SNMP Out Packets	Yes
		snmpInBadVersions	1.3.6.1.2.1.11.3	SNMP Bad Version Numbers	Yes
		snmpInBadCommunityNames	1.3.6.1.2.1.11.4	SNMP In Bad Comm Names	Yes
		snmpInBadCommunityUses	1.3.6.1.2.1.11.5	SNMP In Bad Comm Users	Yes
		snmpInASNParseErrs	1.3.6.1.2.1.11.6	SNMP In ASN Parse Errors	Yes
		snmpInTooBigs	1.3.6.1.2.1.11.8	SNMP In too Big	Yes
		snmpInNoSuchNames	1.3.6.1.2.1.11.9	SNMP In No Such Name	Yes
		snmpInBadValues	1.3.6.1.2.1.11.10	SNMP In Bad Values	Yes
		snmpInReadOnlys	1.3.6.1.2.1.11.11	SNMP In Read Onlys	Yes
		snmpInGenErrs	1.3.6.1.2.1.11.12	SNMP In Gen Errors	Yes
		snmpInTotalReqVars	1.3.6.1.2.1.11.13	SNMP In Total Req Variables	Yes
		snmpInTotalSetVars	1.3.6.1.2.1.11.14	SNMP In Total Set Variables	Yes
		snmpInGetRequests	1.3.6.1.2.1.11.15	SNMP In Get Requests	Yes
		snmpInGetNexts	1.3.6.1.2.1.11.16	SNMP IN Get Nexts	Yes
		snmpInSetRequests	1.3.6.1.2.1.11.17	SNMP In Set Requests	Yes
		snmpInGetResponses	1.3.6.1.2.1.11.18	SNMP In Get Responses	Yes
		snmpInTraps	1.3.6.1.2.1.11.19	SNMP In Traps	Yes
		snmpOutTooBigs	1.3.6.1.2.1.11.20	SNMP Out Too Bigs	Yes

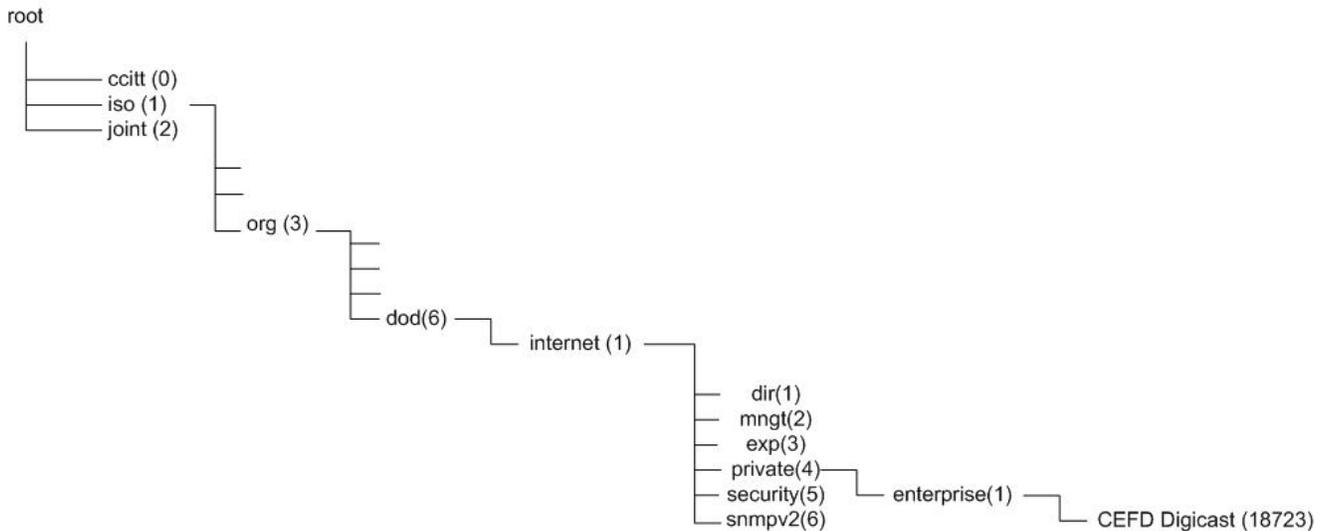
MIB-II Number	Type	Sub Type	OID	Description	Supported
		snmpOutNoSuchNames	1.3.6.1.2.1.11.21	SNMP Out No Such Name	Yes
		snmpOutBadValues	1.3.6.1.2.1.11.22	SNMP Out Bad Values	Yes
		snmpOutGenErrs	1.3.6.1.2.1.11.24	SNMP Out Gen Errors	Yes
		snmpOutGetRequests	1.3.6.1.2.1.11.25	SNMP Out Get Requests	Yes
		snmpOutGetNexts	1.3.6.1.2.1.11.26	SNMP Out Get Nexts	Yes
		snmpOutSetRequests	1.3.6.1.2.1.11.27	SNMP Out Set Requests	Yes
		snmpOutGetResponses	1.3.6.1.2.1.11.28	SNMP Out Get Responses	Yes
		snmpOutTraps	1.3.6.1.2.1.11.29	SNMP Out Traps	No
		snmpEnableAuthenTraps	1.3.6.1.2.1.11.30	SNMP Enable Auth Traps	No

The MIB-II Traps are broken down as follows:

Trap Name	Description
dniColdStart	Cold start: The unit is starting up from a down state
dniWarmStart	Warm Start: The unit is recovering from a reset incident
dniLinkDown	Link Down: The receiver has lost its L-Band signal
dniLinkUp	Link Up: The L-Band signal has been reestablished
dniAuthFail	Authentication Failure: An SNMP message received could not be authenticated

## E.5 Private MIB

Comtech EF Data's Digicast private enterprise number is 18732. Therefore, the private MIB for Comtech EF Data's Digicast products is as follows:



### 1.3.6.1.4.1.18723.

**1 = iso**

**3 = org**

**6 = dod**

**1 = internet**

**4 = private**

**1 = enterprise**

**18723 = Comtech EF Data's Digicast Enterprise Number**

**etc.**

## E.5.1 Private MIB OIDs on Digicast Products

The following describes how the Enterprise (Private) MIB elements (OIDs) can be used to obtain (GET) information or configure (SET) a parameter on the Digicast CMR-5995 Media Router.

The Enterprise MIB elements (OIDs) are broken down as follows:

OID Number	OID	Description	GET or SET
1.3.6.1.4.1.18723.5975.1.1	dniAggregateStatsTunerStats	Tuner Statistics	GET
1.3.6.1.4.1.18723.5975.1.2	dniAggregateStatsTunerAcquiState	Tuner Acquisition State	GET
1.3.6.1.4.1.18723.5975.1.3	dniAggregateStatsEsNo	Es/No in dB	GET
1.3.6.1.4.1.18723.5975.1.4	dniAggregateStatsEbNo	Eb/No in dB	GET

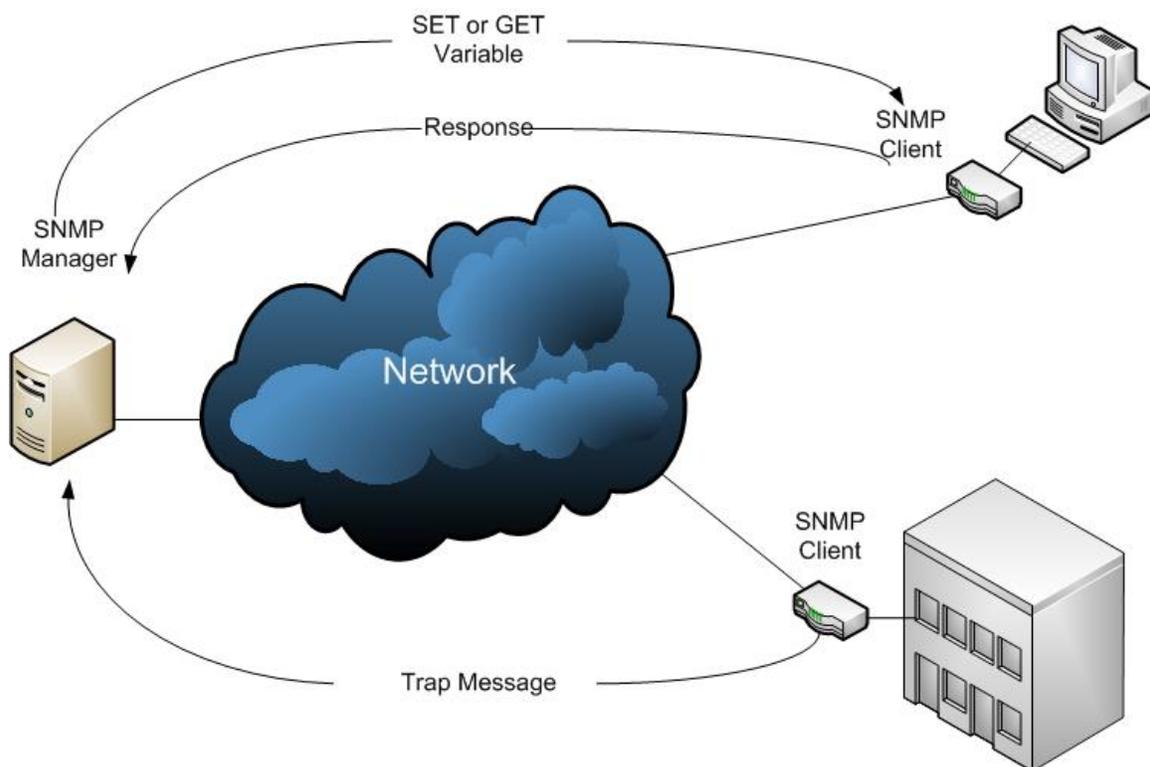
The Enterprise Traps are broken down as follows:

Trap Name	Description
software reset	Software Reset has occurred
dropping packets	Unit is dropping packets
dropping packets cleared	Unit has stopped dropping packets
redundancy primary on	Redundancy – Primary Online
redundancy backup on	Redundancy – Backup Online
dniEbNoThreshold	EbNo value is now set above the defined limit
dniEbNoThresholdFail	EbNo value has fallen below the defined limit
dniRedundancyBackup	Redundant backup unit is now active
dniRedundancyPrimary	Redundant primary unit is now active
dniRedundancyModeConflict	A conflict in redundancy mode has been detected
dniMPEGPIDConflict	MPEG-TS PID Conflict has occurred
dniDMAOverflow	DMA Overflow
dniDMAOverflowCleared	DMA Overflow Cleared

## E.6 Important Terms to Know

Get	Obtain an element (OID) of information from a agent.
GetNext	Obtains the next element (OID) of information from a agent.
GetResponse	Requests a response from the agent for information.
MIB	Message Information Base is the file that defines all the supported OIDs at the agent.
MIB II	Message Information Base II which is a MIB that is supported by most PC and communications products. MIB II is described in Request for Comments RFC 1213.
OID	Object Identifier is the variable on the agent that can be configured (SET) or obtained (GET).
PDU	Protocol Data Unit is the message that carries all SNMP messages over a network.
Private MIB	The manufacturer created and defined MIB describing the OIDs that may be configured (SET) or obtained (GET) from an agent product.
R/O Community	The community string for read only access to the MIB elements.
R/W Community	The community string for read/write access to the MIB elements.
Set	Set an element (OID) of information on a agent.
SNMP Agent	The agent (remote) that is managed by an SNMP manager.
SNMP Manager	The manager and collection point for SNMP-enabled remote agents.
Trap	an unsolicited message sent to the SNMP server from the SNMP Agent.

The following image depicts these terms and indicates where they apply:



# Appendix F. DVB-S/S2 BER Performance at Quasi-Error Free (QEF)

The Forward Error Correction (FEC) technique used in Digicast receivers complies with ETSI EN 300 421 for DVB-S and ETSI EN 302 307 for DVB-S2. The information provided below demonstrates the Es/No to provide "Quasi Error Free" (QEF) performance for a packet error rate PER of  $10^{-7}$ . A PER of  $10^{-7}$  corresponds to an approximate BER in the order of  $3 \times 10^{-10}$ .

**Test Configuration:**

Symbol Rate: 20 Msps  
Frame Size = 64,800 (Normal Frames)  
Pilots: Off  
Roll Off: 35%  
Nominal Input Power: -48 dB  
L-Band Frequency: 1,170 MHz  
Input Range: -25 to -50 dBm

**Assumptions:**

QEF =  $10^{-7}$  PER  
Es/No = C/N

**Recorded Data DVB-S:**

Type	Modulation	FEC	Es/No dB
DVB-S	QPSK	1/2	2.92
DVB-S	QPSK	2/3	4.67
DVB-S	QPSK	3/4	5.76
DVB-S	QPSK	5/6	6.73
DVB-S	QPSK	7/8	7.49

**Recorded Data DVB-S2 Pilots Off (Disabled):**

Type	Modulation	FEC	Es/No dB
DVB-S2	QPSK	1/2	1.82
DVB-S2	QPSK	3/5	2.72
DVB-S2	QPSK	2/3	3.49
DVB-S2	QPSK	3/4	4.32
DVB-S2	QPSK	4/5	5.05
DVB-S2	QPSK	5/6	5.58
DVB-S2	QPSK	8/9	6.67
DVB-S2	QPSK	9/10	6.78
DVB-S2	8-PSK	3/5	7.74
DVB-S2	8-PSK	2/3	7.70
DVB-S2	8-PSK	3/4	8.43
DVB-S2	8-PSK	5/6	9.86
DVB-S2	8-PSK	8/9	11.36
DVB-S2	8-PSK	9/10	11.69

**Recorded Data DVB-S2 Pilots On (Enabled):**

Type	Modulation	FEC	Es/No dB
DVB-S2	QPSK	1/2	1.74
DVB-S2	QPSK	3/5	2.60
DVB-S2	QPSK	2/3	3.41
DVB-S2	QPSK	3/4	4.44
DVB-S2	QPSK	4/5	5.03
DVB-S2	QPSK	5/6	5.60
DVB-S2	QPSK	8/9	6.61
DVB-S2	QPSK	9/10	6.96
DVB-S2	8-PSK	3/5	5.98
DVB-S2	8-PSK	2/3	7.24
DVB-S2	8-PSK	3/4	8.63
DVB-S2	8-PSK	5/6	10.27
DVB-S2	8-PSK	8/9	11.93
DVB-S2	8-PSK	9/10	12.44

## METRIC CONVERSIONS

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### Units of Length

Unit	Centimeter	Inch	Foot	Yard	Mile	Meter	Kilometer	Millimeter
1 centimeter	—	0.3937	0.03281	0.01094	$6.214 \times 10^{-6}$	0.01	—	—
1 inch	2.540	—	0.08333	0.2778	$1.578 \times 10^{-5}$	0.254	—	25.4
1 foot	30.480	12.0	—	0.3333	$1.893 \times 10^{-4}$	0.3048	—	—
1 yard	91.44	36.0	3.0	—	$5.679 \times 10^{-4}$	0.9144	—	—
1 meter	100.0	39.37	3.281	1.094	$6.214 \times 10^{-4}$	—	—	—
1 mile	$1.609 \times 10^5$	$6.336 \times 10^4$	$5.280 \times 10^3$	$1.760 \times 10^3$	—	$1.609 \times 10^3$	1.609	—
1 mm	—	0.03937	—	—	—	—	—	—
1 kilometer	—	—	—	—	0.621	—	—	—

### Temperature Conversions

Unit	° Fahrenheit	° Centigrade
32° Fahrenheit	—	0 (water freezes)
212° Fahrenheit	—	100 (water boils)
-459.6° Fahrenheit	—	273.1 (absolute 0)

Formulas
$C = (F - 32) * 0.555$
$F = (C * 1.8) + 32$

### Units of Weight

Unit	Gram	Ounce Avoirdupois	Ounce Troy	Pound Avoir.	Pound Troy	Kilogram
1 gram	—	0.03527	0.03215	0.002205	0.002679	0.001
1 oz. avoir.	28.35	—	0.9115	0.0625	0.07595	0.02835
1 oz. troy	31.10	1.097	—	0.06857	0.08333	0.03110
1 lb. avoir.	453.6	16.0	14.58	—	1.215	0.4536
1 lb. Troy	373.2	13.17	12.0	0.8229	—	0.3732
1 kilogram	$1.0 \times 10^3$	35.27	32.15	2.205	2.679	—



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