CDM-710

Broadcast Satellite Modem
Installation and Operation Manual

IMPORTANT NOTE: The information contained in this document supersedes all previously published information regarding this product. Product specifications are subject to change without prior notice.

MN/CDM710.IOM **Revision 9**

CDM-710

Broadcast Satellite Modem
Installation and Operation Manual

Comtech EF Data is an ISO 9001
Registered Company

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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

480.333.2200 (Main Comtech EF Data number)
480.333.4357 (Customer Support Desk)
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/support.asp**:

- **Click** on "Return Material Authorization" for detailed instructions on our return procedures.
- **Click** on the "RMA Request Form" hyperlink, then fill out the form completely before sending.
- **Send e-mail** to the Customer Support Department at **service@comtechefdata.com**.

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

About this Manual

This manual provides installation and operation information for the Comtech EF Data CDM-710 Broadcast Satellite Modem. This is a technical document intended for earth station engineers, technicians, and operators responsible for the operation and maintenance of the CDM-710.

Reporting Comments or Suggestions Concerning this Manual

Comments and suggestions regarding the content and design of this manual will be appreciated. To submit comments, please contact the Comtech EF Data Technical Publications Department: techpub@comtechefdata.com.

Conventions and References

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.

Cautions and Warnings

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.

Indicates information critical for proper equipment function.

Recommended Standard Designations

Recommended Standard (RS) Designations have been superseded by the new designation of the Electronic Industries Association (EIA). References to the old designations are shown only when depicting actual text displayed on the screen of the unit (RS-232, RS-485, etc.). All other references in the manual will be shown with the EIA designations.

Electrical Safety

The CDM-710 Broadcast Satellite Modem has been shown to comply with the following safety standard:

- EN 60950: Safety of Information Technology Equipment, including electrical business machines

The equipment is rated for operation over the range 100 to 240 VAC. It has a maximum power consumption of 60 watts, and draws a maximum of 600 mA.

The user should observe the following instructions:

Fuses

The CDM-710 is fitted with two fuses - one each for line and neutral connections. These are contained within the body of the IEC power inlet connector, behind a small plastic flap.

- For 115 and 230 volt AC operation, use T2.00A, 20mm fuses.
- For 48 VDC operation, use T6.25A, 6.3x32mm fuses.

FOR CONTINUED OPERATOR SAFETY, ALWAYS REPLACE THE FUSES WITH THE CORRECT TYPE AND RATING.

Environmental

The CDM-710 shall not be operated in an environment where the unit is exposed to extremes of temperature outside the ambient range 0 to 50°C (32° to 122°F), precipitation, condensation, or humid atmospheres above 95% RH, altitudes (un-pressurized) greater than 2000 meters, excessive dust or vibration, flammable gases, corrosive or explosive atmospheres.

Operation in vehicles or other transportable installations that are equipped to provide a stable environment is permitted. If such vehicles do not provide a stable environment, safety of the equipment to EN60950 may not be guaranteed.

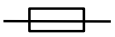
Installation

The installation and connection to the line supply must be made in compliance to local or national wiring codes and regulations.

The CDM-710 is designed for connection to a power system that has separate ground, line and neutral conductors. The equipment is not designed for connection to power system that has no direct connection to ground.

The CDM-710 is shipped with a line inlet cable suitable for use in the country of operation. If it is necessary to replace this cable, ensure the replacement has an equivalent specification. Examples of acceptable ratings for the cable include HAR, BASEC and HOXXX-X. Examples of acceptable connector ratings include VDE, NF-USE, UL, CSA, OVE, CEBEC, NEMKO, DEMKO, BS1636A, BSI, SETI, IMQ, KEMA-KEUR and SEV.

International Symbols:

International Symbols			
Symbol	**Definition**	**Symbol**	**Definition**
~	Alternating Current		Protective Earth
	Fuse		Chassis Ground

Telecommunications Terminal Equipment Directive

In accordance with the Telecommunications Terminal Equipment Directive 91/263/EEC, this equipment should not be directly connected to the Public Telecommunications Network.

CE Mark

Comtech EF Data declares that the CDM-710 Broadcast Satellite Modem meets the necessary requirements for the CE Mark.

RoHS Compliancy

This unit satisfies (with exemptions) the requirements specified in the European Union Directive on the Restriction of Hazardous Substances, Directive 2002/95/EC, (EU RoHS).

EMC (Electromagnetic Compatibility)

In accordance with European Directive 89/336/EEC, the CDM-570/570L Modem has been shown, by independent testing, to comply with the following standards:

Emissions: EN 55022 Class B - Limits and methods of measurement of radio interference characteristics of Information Technology Equipment.

(Also tested to FCC Part 15 Class B)

Immunity: EN 50082 Part 1 - Generic immunity standard, Part 1: Domestic, commercial and light industrial environment.

Additionally, the CDM-570/570L has been shown to comply with the following standards:

EN 61000-3-2	Harmonic Currents Emission
EN 61000-3-3	Voltage Fluctuations and Flicker
EN 61000-4-2	ESD Immunity
EN 61000-4-4	EFT Burst Immunity
EN 61000-4-5	Surge Immunity
EN 61000-4-6	RF Conducted Immunity
EN 61000-4-8	Power frequency Magnetic Field Immunity
EN 61000-4-9	Pulse Magnetic Field Immunity
EN 61000-4-11	Voltage Dips, Interruptions, and Variations Immunity
EN 61000-4-13	Immunity to Harmonics

To ensure that the Modem continues to comply with these standards, observe the following instructions:

- Connections to the transmit and receive IF ports (‘N’ type female connectors) should be made using a good quality coaxial cable - for example, RG213/U.
- All 'D' type connectors attached to the rear panel must have back-shells that provide continuous metallic shielding. Cable with a continuous outer shield (either foil or braid, or both) must be used, and the shield must be bonded to the back-shell.
- The equipment must be operated with its cover on at all times. If it becomes necessary to remove the cover, the user should ensure that the cover is correctly re-fitted before normal operation commences.

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.

Notes:

Chapter 1. INTRODUCTION

The CDM-710 Broadcast Satellite Modem (Figure 1-1) is a high symbol/bit-rate unit, intended for operation in broadcast and enterprise applications. It operates over satellite links at symbol/data rates up to 45 Msps. Various modulations and coding combinations compliant with DVB-S, DVB-DSNG and DVB-S2 are provided. The operating frequency of the CDM-710 is available in the following versions:

70/140 MHz:	52 to 88 MHz and 104 to 176 MHz in 100 Hz resolution
L-Band:	950 to 1950 MHz in 100 Hz resolution

Individual Modulator and Demodulator cards are available for the CDM-710 for operation at either 70 /140 MHz and L-Band. The terrestrial data interfaces (Figure 1-2) are field removable to allow different combinations of interface types:

- CDI-40 Duplex ASI Interface
- CDI-70 1000 Base-T (GbE) Ethernet Interface
- CDI-60 HSSI Interface

Initialed Released Units

Rev. A and later chassis

Figure 1-1. CDM-710 Broadcast Satellite Modem (Shown with Different Keypads)

The modem is compact, being 1RU high x 18.65 inches deep with low power consumption. It has a front panel VFD display and keypad for local configuration and control, although it can be fully remote-controlled via a RS-485 bus or 10/100 Base-T Ethernet Interface.

A block diagram of the modulator is shown in Figure 1-2.

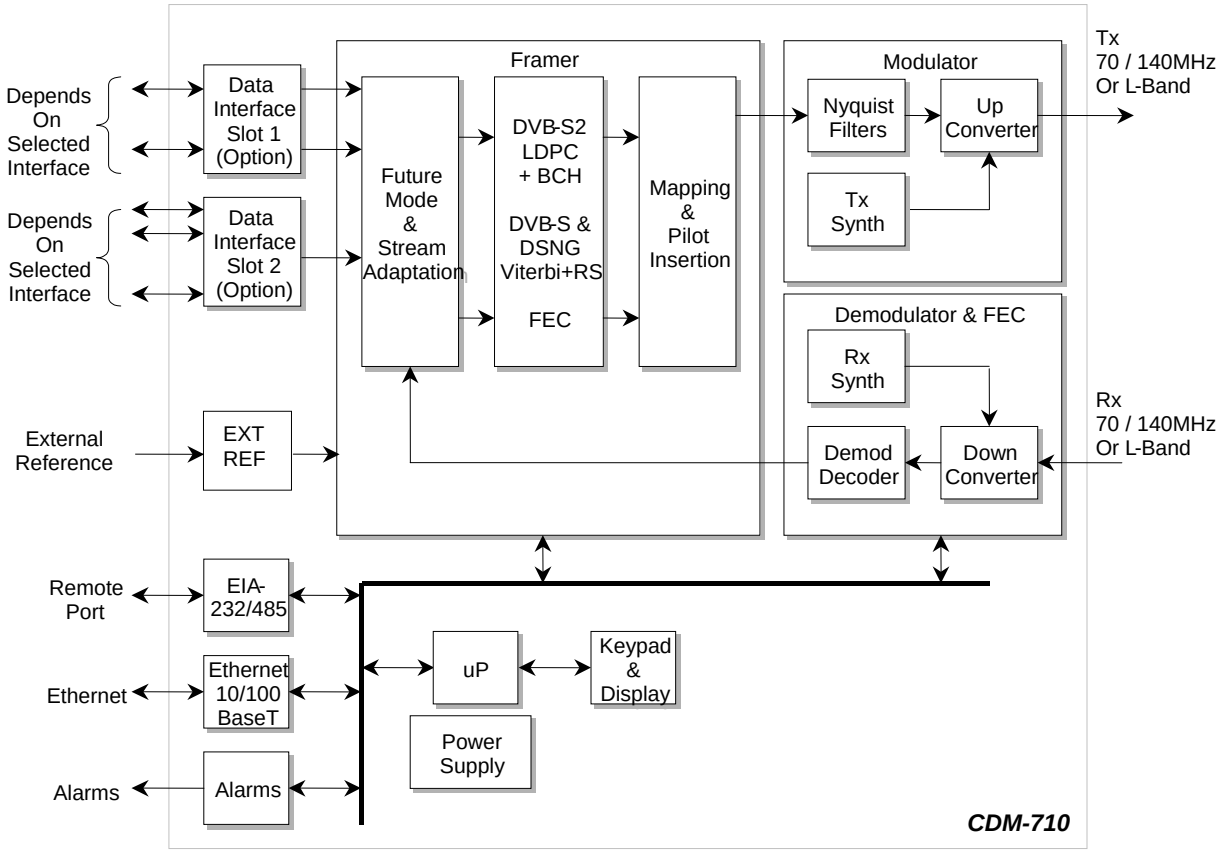


Figure 1-2. Block Diagram

1.1 Standard and Optional Features

The modem operates in DVB-S (QPSK), DVB-DSNG (8-PSK and 16-QAM) and DVB-S2 (QPSK, 8-PSK, 16-APSK, and 32-APSK) modes. The modem is operated from the front panel using the keypad and display or remote controlled via an RS-232 / RS-485 2/4 Wire bus or 10/100 Base-T Ethernet port located on the base modem.

The modem is available for either 70/140 MHz or L-Band applications. The standard 70/140 MHz Tx-IF port has a BNC female connector that is programmable for either with 50Ω or 75Ω impedance operations. Spectral rolloffs of 20, 25, and 35% are available.

1.1.1 Software – Flash Upgrading

The internal software is both powerful and flexible, permitting storage and retrieval of up to 10 different configurations. The modem uses 'flash memory' technology internally, and new firmware is uploaded to the unit from an external PC. This simplifies software upgrading, and updates are available via the Internet. The upgrade is performed without opening the unit by simply connecting the modem to the Ethernet port of a computer.

1.1.2 Verification

The unit includes a number of tests for rapid verification of the correct functioning of the unit. Selection of a CW carrier permits measurement of carrier center frequency or phase noise characteristic. A single-sideband carrier also is available at the operating symbol rate to check I and Q phase and amplitude balance. When normal operation is again selected, all of the previous values are restored.

1.1.3 Data Interfaces

The modulator has plug-in data interfaces that are removed or installed from the rear of the chassis while the unit remains in the rack. The same terrestrial interface should be used in a modulator and demodulator used in a single satellite link. The interfaces offered (one active at a time) include:

- CDI-40 Duplex ASI Interface
- CDI-70 1000 Base-T (GbE) Interface
- CDI-60 HSSI Interface

Allowable Data Interface Combinations	
Slot 1	**Slot 2**
CDI-40 ASI	None CDI-70 Gigabit Ethernet
CDI-60 HSSI	None CDI-70 Gigabit Ethernet
None	CDI-70 Gigabit Ethernet

ASI Interface Usage By Application (Also see Chapter 10)	
PL/10881-3	Standard non-redundant applications. Tx only 1:1 redundancy. Rx output (J2 and J3) is the standard ASI level Full duplex 1:N redundancy. Rx output (J2 and J3) is the standard ASI level
PL/10881-4	Standard non-redundant applications (excluding J3) Tx only, Rx only or full duplex (Tx and Rx) 1:1 redundancy. ▪ Rx output J2 is standard level ▪ Rx output J3 is higher so the standard level is delivered after a 3 dB combiner Full duplex 1:N redundancy (excluding J3)

1.2 Redundancy Support

Redundancy support for the CDM-710 is as follows (refer also to para. 1.1.3):

- 1:1 Redundancy(CDI-40 ASI only): CRS-170A (L-Band) or CRS-180 (70/140 MHz)
- CRS-170A MN/CRS170A.IOM
- CRS-180 MN/CRS180.IOM

1.3 Major Assemblies

Later units are Rev A chassis and later. Refer to the Notes following the table.

Later Units	Earlier Units	Description
PL/10002-1	PL/10002-1	Modulator, 70/140 MHz
	PL/11230-1	Modulator, L-Band Card (Early Units)
PL/12113-1		Modulator, L-Band Card (Later Units)
PL/10003-1	PL/10003-1	Demodulator, 70/140 MHz
PL/11571-1	PL/11571-1	Demodulator, L-Band
	PL/10005-1	Encoder FEC, Tx LDPC and DVB-S (Early Units)
PL/12148-1		Encoder FEC, Tx LDPC and DVB-S, -DSNG, -S2 (Later Units)
PL/12169-1	NA	Decoder FEC, Rx LDPC and DVB-S, -DSNG, -S2
	PL/10012-1	Framing Card with 1.5 ppm reference (Early Units)
PL/12000-1		Framing Card (Later Units)
PL/10881-4		CDI-40 DVB-ASI Interface Card for 1:1 (and 1:N) Note 5
	PL/10881-3	CDI-40 DVB-ASI Interface Card for 1:N Note 5
	PL/11509-1	CDI-70 10/100/1000 BaseT (GbE) Interface (FW11509) Note 6
PL/11509-2		CDI-70 10/100/1000 BaseT (GbE) Interface (FW12547) Note 6
PL/11582-1		CDI-60 HSSI Interface Note 7

Note:

1. Earlier units are Tx only; and are not upgradeable to 16APSK or higher.
2. Earlier units do not support redundancy and are not upgradeable.
3. Later units are version 2.1.1 or later (FW/12437)
4. Earlier units are version 1.1.3 or earlier (FW/12050).
5. CDI-40 PL/10881-3 and PL/10881-4 have hardware differences that are not upgraded by Reflash. See para. 1.1.3 for 1:1 and 1:N application information.
6. The CDI-70 PL/11509-1 is upgraded to PL/11509-2 function by Reflash.
7. The CDI-60 PL/11582-1 requires version 3.0.1 or later firmware.

1.4 New in this Manual

Changes made since the previous version:

- Added Web/HTTP interface via Ethernet port
- Added selection for either Peak or Average Pilot level

Chapter 2. INSTALLATION

2.1 Unpacking

Inspect shipping containers for damage. If shipping containers are damaged, keep them until the contents of the shipment have been carefully inspected and checked for normal operation.

The modem and manual are packaged in pre-formed, reusable, cardboard cartons containing foam spacing for maximum shipping protection.

Do not use any cutting tool that will extend more than 1 inch into the container. This can cause damage to the modem.

Unpack the modem as follows:

Step	Procedure
1	Cut the tape at the top of the carton indicated by **"OPEN THIS END.**"
2	Remove the cardboard/foam space covering the modem.
3	Remove the modem, manual, and power cord from the carton.
4	Save the packing material for storage or reshipment purposes.
5	Inspect the equipment for any possible damage incurred during shipment.
6	Check the equipment against the packing list to ensure the shipment is correct.
7	Refer to the following sections for further installation instructions.

2.2 Mounting

If the modem is to be mounted in a rack, ensure that there is adequate clearance for ventilation, particularly at the sides. In rack system where there is high heat dissipation, forced air-cooling must be provided by top or bottom mounted fans or blowers. Under no circumstance should the highest internal rack temperature be allowed to exceed 50°C (122°F).

2.2.1 Optional Rear-Mounting Support Brackets

Install optional rear-mounting support brackets using mounting kit KT/6228-2:

Quantity	Part Number	Description
2	HW/10-32SHLDR	Screw, #10 Shoulder
4	HW/10-32FLT	Washer, #10 Flat
2	HW/10-32SPLIT	Washer, #10 Split
2	HW/10-32HEXNUT	Nut, #10 Hex
2	FP/6138-1	Bracket, Rear Support
4	HW/10-32x1/2RK	Bolt, #10 Rack Bracket

The tools required for this installation are a **medium Phillips™ screwdriver** and a **5/32-inch SAE Allen™ Wrench.** The kit is installed as illustrated in Figure 2-1 and per the following procedure:

Step	Procedure
1	Secure the #10 shoulder screws to the unit chassis through the rear right and left side mounting slots, using the #10 flat washers, #10 split washers, and #10 hex nuts as shown.
2	Install the rear support brackets onto the equipment rack threaded rear mounting rails, using the #10 rack bracket bolts.
3	Mount the unit into the equipment rack, ensuring that the shoulders of the #10 shoulder screws properly engage into the rear support bracket slots.

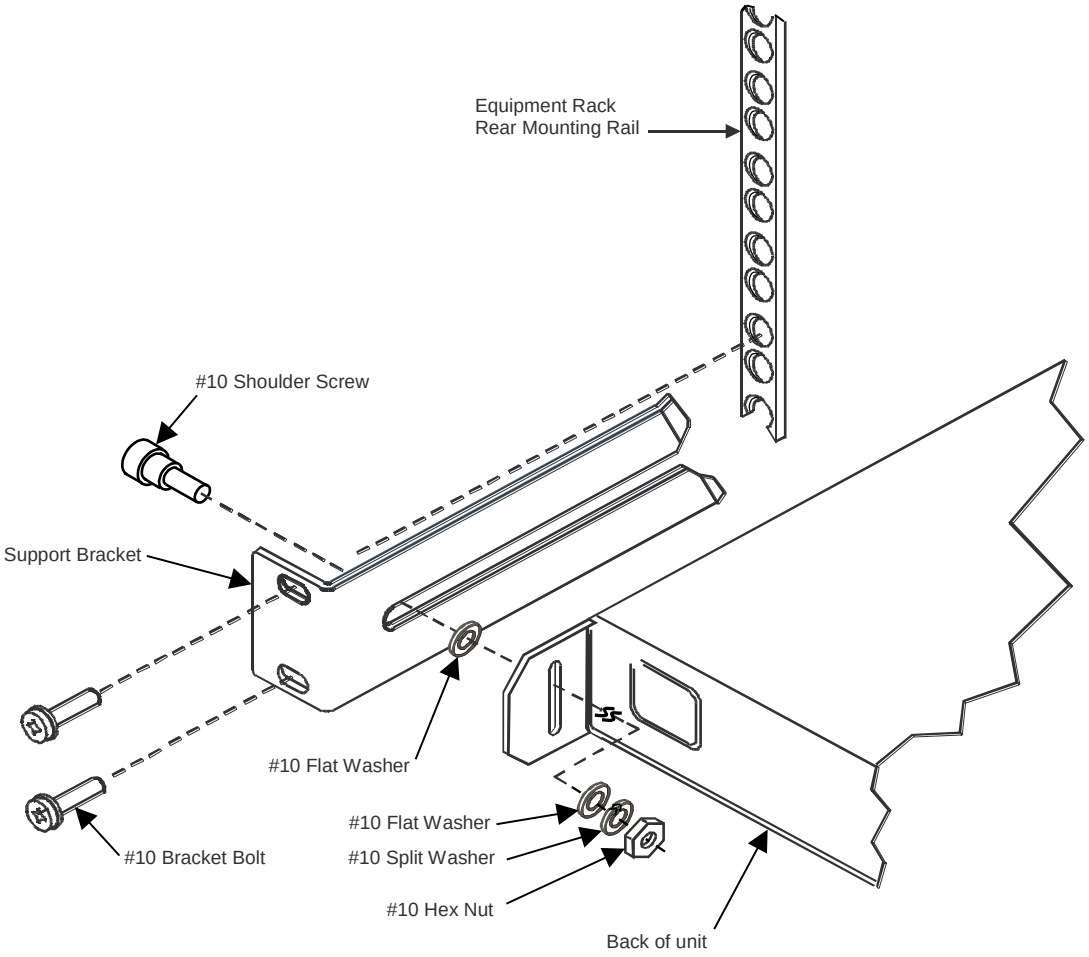


Figure 2-1. Installation of the Optional Rear-Mounting Support Brackets

Notes:

Chapter 3. FUNCTIONAL AND PHYSICAL DESCRIPTIONS

The modem is constructed as a 1RU high rack-mounting chassis, which can be freestanding, if desired. Rack handles at the front facilitate removal from and placement into a rack.

The satellite modem performs several key functions:

- It accepts incoming data from the terrestrial interface and converts it into appropriate clock and data signals.
- The modulator operates on the data to frame and encode it for transmission.
- Encoded information is mapped for modulation.
- A modulated carrier is transmitted from the IF interface for use by uplink equipment for delivery to the satellite.
- A carrier received from the satellite link is acquired and demodulated to recover symbols and timing.
- Error correction and deframing are performed.
- User data is delivered to the to the data interface.

Transmit (Tx) data is delivered to the data interface where it is converted to clock and data signals for further processing. Depending upon the type of interface, clock and data are provided or in other cases the clock is embedded in the data and clock recovery is performed to generate clock and data signals. A **F**irst-**I**n –**F**irst-**O**ut (FIFO) follows the terrestrial interface to facilitate delivery of the data to the framing card. Data is passed to the **F**orward **E**rror **C**orrection (FEC) Encoder where the data is framed and encoded in accordance with either the DVB-S, DVB-DSNG, or DVB-S2 formats. After encoding the data is passed to the modulator where the I and Q signals are mapped to generate the appropriate constellation (QPSK, 8-PSK, 16-QAM, 16-APSK, and 32-APSK) and filtered to provide the desired spectral rolloff. Finally, a carrier is generated by a frequency synthesizer in conjunction with the I and Q signals to produce a frequency range of:

70/140 MHz:	52 to 88 or 104 to 176 MHz IF output signal at the connector on the modem.
L-Band:	950 to 1950 MHz output signal at the Frequency connector on the modem.

An Rx carrier from the satellite is received by the demodulator and reverses the process performed by the modulator. The demodulator has an FEC decoder that corrects errors incurred during transmission to improve the integrity of the data delivered to the data interface. A synthesizer in the demodulator is programmed to select the desired carrier from the transponder.

Physically the modem is comprised of several main card assemblies.

- The Data Interface card is a plug-in module that is readily installed or removed at the rear of the unit.
  Note: Power is turned off to remove or install the data interfaces.
- The Framer Card receives signals from the data interface card and routes signals to the FEC Encoder and Modulator. The microcontroller for the unit also resides on the Framer Card and is the embedded controller for the entire modem. The microcontrollers handles all of the monitor and control for unit including the front panel keypad and display, the RS-232 and RS-485 2Wire / 4Wire remote port and the 10/100 Ethernet port. Interface with the other the modules in the modem is provided by the framer assembly.
- The FEC Encoder card is a plug-in module that resides on the Framer card. It generates the encoded stream used by the modulator card.
- The Modulator card plugs into the framer card. It maps and spectrally shapes the I&Q data for delivery to the IF interface.
- The Demodulator card also plugs into the framer. It recovers the selected carrier, performs error correction and delivers data stream to the framer card.

3.1 Front Panel

Figure 3-1. Front Panel

The front panel (Figure 3-1) features a **V**acuum **F**luorescent **D**isplay (VFD), a keypad, and eight LED indicators. The user enters data via the keypad, and messages are displayed on the VFD. The LEDs indicate, in a summary fashion, the status of the unit.

The VFD is an active display showing 2 lines, each of 24 characters. It produces a blue light, the brightness of which can be controlled by the user. It has greatly superior viewing characteristics compared to a **L**iquid **C**rystal **D**isplay (LCD), and does not suffer problems of viewing angle or contrast.

The keypad has six individual keyswitches, mounted directly behind a fully sealed membrane overlay. They have a positive ‘click’ action, which provides the user with tactile feedback. These six switches are identified as [↑], [↓], [→], [←] arrows, **ENTER** and **CLEAR**. There are seven LEDs on the front panel. Refer to Chapter 5 for description of operation.

3.2 Dimensional Envelope

All dimensions are in English units (centimeters are in parentheses).

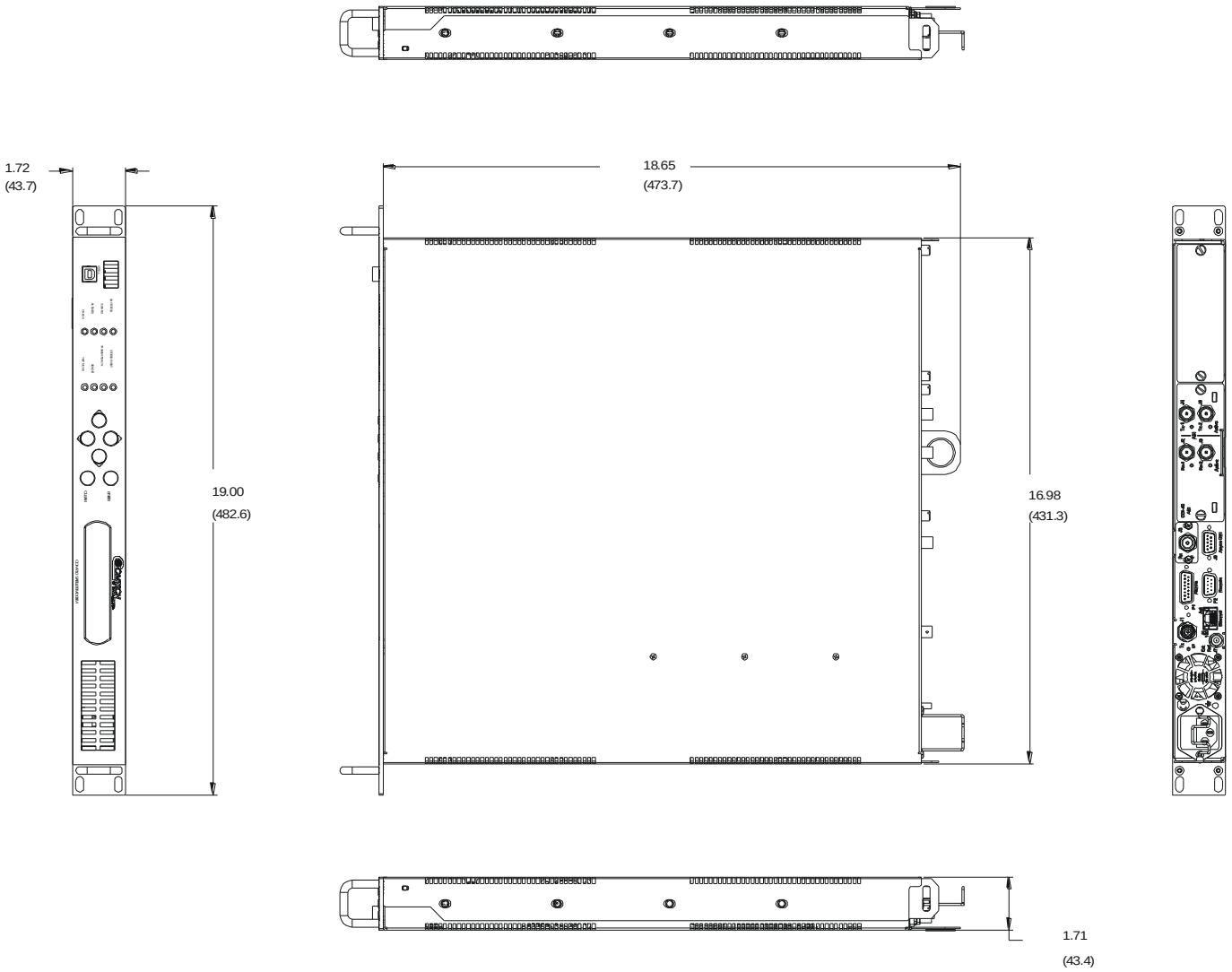


Figure 3-2. Dimensional Envelope

Notes:

Chapter 4. CONNECTOR PINOUTS

4.1 External Connections

External cables are attached to connectors on the rear panel. The connector configurations differ between chassis type and revision (70/140 MHz vs. L-Band, and initially released chassis vs. Rev. A and later), as shown in Figure 4-1.

Initially released chassis (70/140 MHz shown)

Rev. A and later chassis (70/140 MHz shown)

Figure 4-1. Rear Panel View

The initially released chassis and the Rev. A chassis differ as follows:

Initially released chassis	**J4:** RJ-45, Ethernet **J6:** RJ-45, SerDes **J7:** SMA-F, External Input
Rev. A and later chassis	**J4:** RJ-45, Ethernet **J6:** 9 Pin D-F, Async Channel **J7:** BNC-F, External Input

Refer to the applicable Data Interface chapter for pinouts.

Table 4-1. Modem Rear Panel Connectors For Initially Released Chassis

Name	Ref Des	Connector Type	Function
Tx/IF Output	J1	BNC, female Type N, female	IF Output 70/140 MHz L-Band Output
Rx/IF Input	J3	BNC, female Type N, female	IF Input 70/140 MHz L-Band Input
10/100 Ethernet	J4	RJ-45, female	Remote Interface
SerDes	J6	RJ-45, female	Private communications link
External Input	J7	SMA, female	External reference input
Alarm	P1	15-pin D male	Alarm connector and Form C contacts
RS-232/-485	P2	9-pin, D male	Remote Port
AC INPUT	NONE	IEC	Prime Power Input
GROUND	NONE	10-32 Stud	Grounding

Note : This chassis is Tx only and does not support 1:1 operation. It does not support 1:N operation and is not upgradeable. This chassis is also not upgradeable to Rx only or duplex operation.

Table 4-2. Modem Rear Panel Connectors for Rev. A and Later Chassis

Name	Ref Des	Connector Type	Function
Tx/IF Output	J1	BNC, female Type N, female	IF Output 70/140 MHz L-Band Output
Rx/IF Input	J3	BNC, female Type N, female	IF Input 70/140 MHz L-Band Input
10/100 Ethernet	J4	RJ-45, female	Remote Interface
Async Channel	J6	9-pin D female	Async Engineering Channel
External Input	J7	BNC, female	External reference input
Alarm	P1	15-pin D male	Alarm connector and Form C contacts
RS-232/-485	P2	9-pin, D male	Remote Port
AC INPUT	NONE	IEC	Prime Power Input
GROUND	NONE	10-32 Stud	Grounding

Note: This chassis is required for 1:1 or 1:N operation. It supports Tx Only, Rx Only, and Duplex operation.

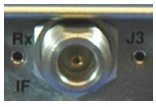
The European EMC Directive (EN55022, EN50082-1) requires using properly shielded cables for DATA I/O. These cables are double-shielded from end-to-end, ensuring a continuous ground shield.

4.1.1 Tx/Rx Connector Pinout, J1 / J3

The IF interface connectors are as follows:

J1

70/140 MHz: Transmit IF Output, BNC female
L-Band: Transmit IF Output , Type N female

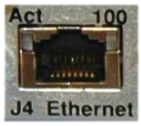


J3

70/140 MHz: Receive IF Output, BNC female
L-Band: Receive IF Output , Type N female

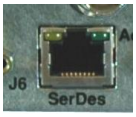
4.1.2 10/100 Ethernet Remote Port Connector Pinout, J4

The Remote connector is a RJ-45 female type.



Pin #	Description	Direction
1	Tx+	Out
2	TX-	Out
3	Rx+	In
4	N/A	
5	N/A	
6	Rx-	In
7	N/A	
8	N/A	

4.1.3 SerDes Port Connector, J6 (Initially Released Chassis Only)



RJ-45: Private communications link – not available for customer use.

4.1.4 ASYNC Port Connector Pinout, J6 (Rev. A and Later Chassis)

The ASYNC connector is a DB-9 female type.

Pin #	Description		Direction
1	Ground		
2	RS-232 Transmit Data		Out
3	RS-232 Receive Data		In
4	Not Used		
5	Not Used		
6	RS-485 Receive Data B	Note 1	In
7	RS-485 Receive Data A	Note 1	In
8	RS-485 Transmit Data B	Note 2	Out
9	RS-485 Transmit Data A	Note 2	Out

Notes:

1. Use for 2-wire RS-485 operation.
2. Pin is available for calibration of the internal 10 MHz reference. This is used primarily for Rx Only units since there is no IF carrier to use for calibration. This signal is available only when the unit is programmed to Utility: Ref for adjusting the internal reference. For Tx Only or Duplex units the Tx IF is used.

4.1.5 External Reference Input (Main Chassis), J7

The Ext Ref (External Reference) input is used to supply a master reference to the entire chassis. The clocks on the Framer Card and the Modulator and Demodulator Synthesizers are locked to this input, when it is used:

	Initially released chassis	Female SMA connector
	Rev. A and later chassis	Female BNC connector

Some data interfaces have an Ext-Clk input for synchronizing the data sources. See the individual data interface card for details.

4.1.6 Alarm Connector Pinout, P1

The Remote connector is a 15-Pin D male type, with threaded jack nuts. The pinout depends upon whether the unit is in the Normal or redundancy mode for use with the CRS-170A (L-Band) and CRS-180 (70/140 MHz) or CRS-300 redundancy switches. The unit is put into 1:1 mode under the **Config: AUX: 1:1 Mask: Ena/Dis** menu by selecting **Enable**.

Normal Mode			
Pin #	**Description**	**Name**	**Direction**
8	Rx Traffic (De-energized, Faulted) Note 1, 2	Rx-NC	I/O
15	Rx Traffic (Energized, No Fault)	Rx-NO	I/O
7	Rx Traffic	Rx-COM	I/O
14	Tx Traffic (De-energized, Faulted) Note 1, 2	Tx-NC	I/O
6	Tx Traffic (Energized, No Fault)	Tx-NO	I/O
13	Tx Traffic	Tx-COM	I/O
5	Unit Fault (De-energized, Faulted) Note 1, 2	Unit-NC	I/O
12	Unit Fault (Energized, No Fault)	Unit-NO	I/O
4	Unit Fault	Unit-Com	I/O
11	Rx I Channel (Constellation Monitor)	Rx-I	O
3	Rx Q Channel (Constellation Monitor)	Rx-Q	O
10	No Connection	NC	NC
2	AGC Voltage (Rx signal level, 0-10 volts)	AGC	O
9	Ext Carrier Off (TTL Lo = Mute, Open = Tx)	EXT-OFF	I
1	Ground	GND	Gnd

Redundancy is available only with the Rev. A chassis or later.

1:N (CRS-300/700) And 1:1 Mode (CRS-170A, CRS-180)			
Pin #	**Description**	**Name**	**Direction**
8 15 7	Summary Relay NC (De-energized, Faulted) Summary Relay NO (Energized, No Fault) Summary Relay COM Note 1, 2	PR-NC, * PR-NO PR-COM	I/O I/O I/O
14	Clock Detect	Clk Det	I
6	Aux Tx Enable	Red_Out_4	O
13	No Connection	NC	NC
5	Fused -12 VDC Output (160 mA max)	-12VDC	O
12	Fused +12 VDC Output (160 mA max)	+12VDC	O
4	Online	Red_In_2	I
11	Serial Clock	Red_Out_1	O
3	Serial Data	Red_Out_2	O
10	Receive Serial Data – auxiliary channel	Red_In_3	I
2	Transmit Serial Data – auxiliary channel	Red_Out_3	O
9	Ext Carrier Off (TTL Lo = Mute, Open = Tx)	Red_In_1	I
1	Ground	GND	Gnd

Notes :

1. The relays have low voltage contacts with transient suppressors across each pin to ground. The supressors were removed starting in October 2007 with Framer Card SN 071539628. The Summary Relay combines Tx, Rx, and Unit Faults into a single relay.
2. The maximum working voltage = 18VDC or 13VAC. The maximum current rating is 1 Amp DC or 0.5 Amp AC.

4.1.7 RS-232/-485 Remote Port Connector Pinout, P2

The Remote connector is a 9-Pin D male type, with threaded jack nuts.

Pin #	Description	Direction
1	Ground	
2	RS-232 Transmit Data	Out
3	RS-232 Receive Data	In
4	Not Used	
5	Not Used	
6	RS-485 Receive Data B *	In
7	RS-485 Receive Data A *	In
8	RS-485 Transmit Data B	Out
9	RS-485 Transmit Data A	Out

* Use for 2-wire RS-485 operation

Notes:

Chapter 5. FRONT PANEL OPERATION

5.1 Description

Figure 5-1. Front Panel View

The user can fully control and monitor the operation of the CDM-710 from the front panel, using the keypad and display. Nested menus display all available options, and prompt the user to carry out a required action.

The display has two lines each of 24 characters. On most menu screens, the user will observe a flashing solid block cursor, which blinks at a once-per-second rate. This indicates the currently selected item, digit, or field. Where this solid block cursor would obscure the item being edited (for example, a numeric field) the cursor will automatically change to an underline cursor.

If the user were to display the same screen for weeks at a time, the display could become 'burnt' with this image. To prevent this, the unit has a 'screen saver' feature, which will activate after 60 minutes. The top line of the display will show the Circuit ID (which can be entered by the user) followed by 'Press any key....'. The message moves from right to left across the screen, then wraps around. Pressing any key will restore the previous screen.

5.1.1 LED Indicators

The behavior of the front panel LEDs is described below in Table 5-1.

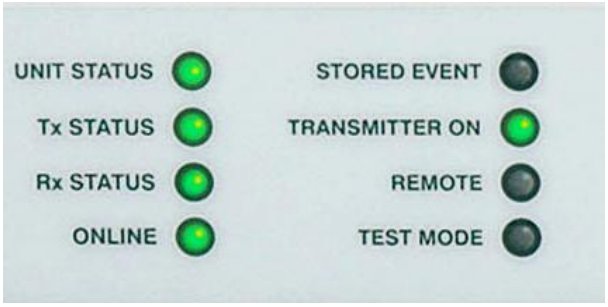


Table 5-1. Front Panel LED Indicators

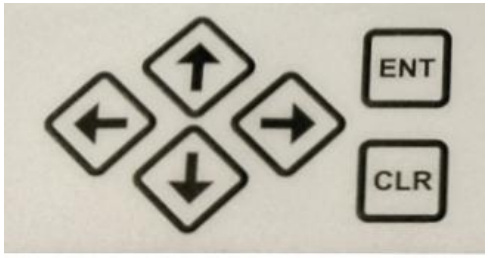
LED	Color	Condition
Unit Status	Green	No Unit Faults or Alarms exists
	Orange	A Unit Alarm exists
	Red	A Unit Fault exists
Tx Status	Green	No Tx Traffic Faults or Alarms exists
	Orange	A Tx Traffic Alarm exists
	Red	A Traffic Fault exists
	Off	Unit not configured for Modulator
Rx Status	Green	No Rx Traffic Faults or Alarms exists
	Orange	A Rx Traffic Alarm exists
	Red	A Rx Fault exists
	Off	Unit not configured for Demodulator
On line	Green	The Unit is On Line, and carrying traffic
	Off	The Unit is Off Line (standby) – forced by externally connected 1:1 or 1:N redundancy system
Stored Event	Orange	There is a Stored Event in the log, which can be viewed from the front panel, or retrieved via the remote control interface
	Off	There are no Stored Events
Transmitter On	Green	Transmitter is currently on. This indicator reflects the actual condition of the transmitter, as opposed to the programmed condition.
	Off	Transmitter is currently OFF.
Remote	Green	The Unit is in Remote Communication Mode. Local monitoring is possible, but no local control
	Off	The Unit is in Local Mode – remote monitoring is possible, but no remote control
Test Mode	Green	A Test Mode is selected (Example: IF Loopback)
	Off	There is no Test Mode currently selected.

IMPORTANT

In general, the Alarm relay state will reflect the state of the Front Panel LEDs. For instance, if the Unit Status LED is red, the Unit Alarm relay will be active, etc. The one exception is the Transmit Traffic relay. This will only be activated if a Transmit Traffic Fault exists – it does not reflect the state of the Tx carrier.

5.1.2 Keypad

The keypad is shown in Figure 5-2:



Diamond Keypad: Earlier Chassis

Button Keypad: Rev. A or Later Chassis

Figure 5-2. Keypad

The function of these keys is as follows:

ENTER (ENT)	This key is used to select a displayed function or to execute a modem configuration change.
CLEAR (CLR)	This key is used to back out of a selection or to cancel a configuration change, which has not been executed using ENTER (ENT). Pressing CLEAR (CLR) generally returns the display to the previous selection.
Left, Right ◀ ▶ **(←) (→)**	These arrows are used to move to the next selection or to move the cursor functions. At times, they may also used to move from one section to another.
Up, Down ▲ ▼ **(↑) (↓)**	These arrows are used primarily to change configuration data (numbers). At times, they may also be used to move from one section to another.

IMPORTANT

The keypad has an auto-repeat feature. If a key is held down for more than 1 second, the key action will repeat, automatically, at the rate of 15 keystrokes per second. This is particularly useful when editing numeric fields, with many digits, such as frequency or data rate.

5.1.3 Menu Tree

Para	Title	Remarks
5.2	**Opening Screen**	
5.3	**Main Menu**	**Select: Config; Monitor; Test; Info; Save/Load; Util**
5.3.1	**Configuration**	**Select: Remote; Tx; Rx: Int1; Int2; Ref, Aux, Alarms**
5.3.1.1	Config: Remote Control: Local Remote	Select: Local; Serial; Ethernet
5.3.1.2	Config: Tx	Select: FEC; Mod; Code; SymRate; Mode; Freq, Pwr; Scram
5.3.1.3	Config: Rx	Select: FEC; Dem; Code; SymRate; Mode; Freq; Eb/No, PLL
5.3.1.4	Config: Intfc2 (CDI-70 Gigabit Ethernet only)	Select: Ingress; Egress; Man; Stats
5.3.1.5	Config:Intfc1 (CDI-60 HSSI)	Select Tx, Rx, CTS/RTS
5.3.1.6	Config: Intfc1 (CDI-40 ASI only)	Select: Tx; Rx; Config
5.3.1.7	Config: Ref	
5.3.1.8	Config: Aux	Select: Ena/Dis; Force (1:1)
5.3.1.9	Config: Alarms	Select: Tx; Intfc1; Intfc2
5.3.2	**Monitor**	**Select: Alarms; Rx_Stats; Event-Log**
5.3.2.1	Monitor: Alarms	Select: Transmit; Receive; Unit
5.3.2.2	Monitor: Rx Stats	
5.3.2.3	Monitor: Event-Log	Select: View; Clear-All
5.3.3	**Test**	**Select: Mode; TestPatterns**
5.3.4	**INFO**	**Select: Rem; Tx; Rx; Intfc1; Intfc2**
5.3.5	**Save/Load**	**Select: Save; Load**
5.3.5.1	Save/Load: Save	
5.3.5.2	Save/Load: Load	
5.3.6	**Utility**	**Select: RT-CLK; Ref; ID; Display; Firmware; FAST**
5.3.6.1	Utility: RT-Clk	
5.3.6.2	Utility: Ref	
5.3.6.3	Utility: ID	
5.3.6.4	Utility: Display	
5.3.6.5	Utility: Firmware	Select: Info
5.3.6.6	Utility: FAST	Select: Cnfg; View

Notes:

1. The Pilot selection appears if the Mode selection is DVB-S2.
2. Refer to **Config:Tx: SymRate** for the Data Rate table.
3. The Impedance selection appears when the 70/140 MHz Modulator card is installed.
4. The Scrambler selection appears if the Mode selection is DVB-S2.

Figure 5-3. CDM-710 Menu Tree

5.2 Opening Screen

This screen is displayed whenever power is first applied to the unit:

```
CDM-710 MODEM
Firmware Version: X.X.X
```

The bottom line displays the internal software version. Press **ENTER** to go to the Main Menu screen.

The unit being tested could be CDM-710 or CDM-710L. For purposes of this documentation a CDM-710 was used.

5.3 Main Menu

```
SELECT: Config  Monitor
Test Info Save/Load Util
```

The following choices are presented:

Config	The Config menu provides the user selections for the desired Interface, Transmit, and Receive operations
Monitor	Permits the user to monitor the alarm status of the unit, to view the log of stored events, and to display the Receive Parameters screen.
Test	Permits the user to configure the modem into one of several Test modes, example: CW and Loopback
Info	The INFO menu provides a summary/display of the Interface, Transmit, Receive, and M&C configurations.
Save/Load	Permits the user to save and retrieve up to 10 different modem configurations.
Util	Permits the user to perform miscellaneous functions, such as setting the Real-Time Clock, adjusting the display brightness, etc.

5.3.1 CONFIG

```
CONFIG: Remote Tx Rx
Int1 Int2 Ref Aux Alarms
```

The sub-branches available are:

Remote (Remote Control)	Permits the user to define whether the unit is being controlled locally, or remotely. (See Important Note.)
Tx (Transmit)	Permits the user to define, on a parameter-by-parameter basis, the TX configuration of the unit. These menu sub-branches would be used if the user wished to change, for example, just the TX Frequency.
Rx (Receive)	Permits the user to define, on a parameter-by-parameter basis, the RX configuration of the unit. These menu sub-branches would be used if the user wished to change, for example, just the RX Frequency.
Int1 Int2 (Interface)	Permits the user to configure Interfaces plugged into Slot 1 or Slot 2 on the back of the unit. The menus change depending on the type of interface.
Ref (Reference)	Permits selection of the internal 10MHz Reference or allows the unit to phase lock to an External Reference of 1, 2, 5, 10, or 20 MHz.
Aux (Auxiliary)	Permits the user to configure the 1:1 Modem Switching parameters of the unit.
Alarms	The selection of Alarm action of certain parameters is provided.

IMPORTANT

The modem may be monitored over the remote control bus at any time. When in Local mode, however, configuration parameters may only be changed through the front panel. Conversely, when in Remote mode, the unit may be monitored from the front panel, but configuration parameters may only be changed via the remote control bus.

5.3.1.1 Config: Remote Control

```
Remote Control:
Local  Serial  Ethernet
```

Select **Local**, **Serial** or **Ethernet** by using the ◄ ► arrow keys, then press **ENTER**.

Local	If Local is selected the remote control is disabled. Remote monitoring is still possible.
Serial	When Serial is selected the RS232, RS485-2W, and RS485-4W menus are accessed.
Ethernet	If Remote is selected additional sub-menus will be displayed.

IMPORTANT

If Local is selected the remote control is disabled and local control is enabled once ENT is pressed. When Local is selected the display pops back to the Config: Menu.

Config: Remote Control: Serial

If **Serial** is selected:

```
Serial Config:
Interface  Baudrate   (◄ ►E)
```

Config: Remote Control: Serial: Interface

If **Interface** is selected:

```
M&C Bus Interface: RS232
RS485-2W  RS485-4W  (◄ ►E)
```

Select **RS232** or **RS485-2W** (2-wire) or **RS485-4W** (4-wire) using the ◄ ► **arrow** keys, then press **ENTER**.

Note: **At this point the user will be further prompted to enter the bus address.**

If **RS232** is selected:

```
In RS232 Mode the Bus
Address is fixed at 0000
```

If **RS485** is selected, the user will be further prompted:

```
RS485 Mod Address: 0001
           (◄ ►▲▼E)
```

Edit the RS485 address of the modem. This is accomplished by selecting the digit to be edited, using the ◄ ► arrow keys. The value of the digit is then changed using the ▲ ▼ arrow keys. The user should then press **ENTER**. The valid range of addresses is from 1 to 9999.

Config: Remote Control: Serial: Baudrate

If **Baud** rate is selected:

```
Local M&C Bus Baud Rate:
9600 Baud   (▲▼ E )
```

Edit the Baud rate of the remote control bus, connected locally to the M&C computer. The value is changed using the ▲ ▼ arrow keys. The user should then press **ENTER**. Values of 1200, 2400, 4800, 9600, 19200, 38400, and 57600 baud are possible.

Note: **The Asynchronous character format is FIXED at 8 data bits, No parity, and 1 stop bit (8-N-1).**

Config: Remote Control: Ethernet

If **Ethernet** is selected:

```
Ethernet Config: Gateway
Address  MAC SNMP      (◄ ► E)
```

Edit the IP Address and Range for the Ethernet M&C port for this unit. This is accomplished by selecting the digit to be edited, using the ◄ ► arrow keys. The value of the digit is then changed using the ▲ ▼ arrow keys. The user should then press **ENTER**.

Config: Remote Control: Ethernet: Gateway

If **Gateway** is selected:

```
Ethernet IP Gateway:
063.168.001.127          (◄ ►▲▼ E )
```

Use the ◄ ► ▲ ▼ arrow keys to edit the Gateway address and press **ENTER** to accept the value.

Config: Remote Control: Ethernet: Address

If **Address** is selected:

```
Ether IP Address/Range:
192.168.001.001/24  (◄ ►▲▼)
```

Use the ◄ ► ▲ ▼ arrow keys to edit the IP Address/Range address and press **ENTER** to accept the value. The range is adjustable from 08 to 30.

Config: Remote Control: Ethernet: MAC

If **MAC** is selected:

```
M&C Port MAC Address:
00-06-B0-00-56-33
```

This is a status only message.

Note: The preceding address is representative of a typical MAC address.

Config: Remote Control: Ethernet: SNMP

If **SNMP** is selected:

```
SNMP:
Community Traps   (LRE)
```

This is a status only message. Sub menus enable setting of the destination IP address for SNMP traps.

If **Community** is selected:

```
SNMP Community:
Read          (▲▼ E )
```

```
Read Community: (◄ ►▲▼ E )
public
```

5.3.1.2 Config: Tx

```
Tx:FEC Mod Code SymRate
Mode Freq Pwr Scram(◄ ►E)
```

The Scram(bler) selection only appears if the Mode selection is DVB-S2.

This modem is configured with the Mode as the highest priority.

Config: Tx: FEC

If **FEC** is selected:

```
Tx FEC:
Viterbi + Reed - Solomon   (◄ ►E)
```

This is a status only message. It depends upon the selection made under the **Config:Tx: Mode** menu.

For DVB-S2 Mode only:

```
Tx FEC:
LDPC + BCH                 (◄ ►E)
```

Config: Tx: Tx Modulation

If the Tx Modulation is selected:

```
Tx Modulation: Type Inv
α Pilot Frame          (◄ ►E)
```

The Pilot and Frame selections only appear if the Mode selection is DVB-S2.

Select the Transmit Modulation Type. Use the ◄ ► arrow keys to scroll through all the choices. The user should then press ENTER**.**

Config: Tx: Tx Modulation: Type

If **Type** is selected:

```
Tx Mod: QPSK 8PSK 16QAM
16APSK   32APSK        (◄ ►E)
```

Modulation Type	Description
QPSK	Valid for DVB-S, DVB-S2
8-PSK	Valid for DVB-S2, DVB-DSNG
16-QAM	Valid for DVB-DSNG
16-APSK	Valid for DVB-S2
32-APSK	Valid for DVB-S2

Config: Tx: Tx Modulation: Inv

If **Inv** is selected:

```
Tx Spectrum:         Normal
Inverted                (◄ ►E)
```

Config: Tx: Tx Modulation: α

If **α** is selected:

```
Tx (α) Rolloff %:   20  25
35               (◀ ▶E)
```

The default setting for Rolloff (α) is **20%**. Whenever the Mode is changed, **(α)** reverts to **20%**, but **(α)** is modified to the other values from this menu.

Config: Tx: Tx Modulation: Pilot

This menu is only available when the Mode selection is DVB-S2.

```
Tx Modulation Pilot:
Off/On    Avg/Peak    (◀ ▶E)
```

This menu is active only in the DVB-S2 mode. The selections **Off/On** enable or disable the insertion of pilot symbols into the physical layer frame. The default value is **Off**.

Config: Tx: Tx Modulation: Pilot: Avg/Peak

```
Tx Modulation Pilot:
Average   Peak   (◀ ▶E)
```

The selections **Avg/Peak** sets the pilots and header to the average power band of the transmitted constellation(QPSK, 8PSK, 16APSK or 32APSK) per DVB-S2 and to the outer ring of the transmitted constellation(QPSK, 8PSK, 16APSK or 32ASK) respectively. The CDM-710 automatically adjusts but the default value is **Avg**.

Note: **Not all demodulators will function well with the Peak pilot level.**

Config: Tx: Tx Modulation: Frame Size

This menu is only available when the Mode selection is DVB-S2.

```
Tx Frame Size:
Long Short        (◀ ▶E)
```

This menu is active only in the DVB-S2 mode. The selection Long enables the standard FECFRAME = 64,800 bits and selecting Short enables the 16,200 bit frame. Only DVB-S2 allows a FECRAME choice. The default value is **Long**.

Config: Tx: Code Rate

```
CodeRate:1/2 3/5 2/3
3/4 4/5 5/6 7/8 8/9 9/10
```

Refer to data rate menu for valid code rates.

All possible choices are presented at all times.

If an option is not installed (either Hardware or FAST) is valid, or if a code rate is not available for the Mode selected, the ◀ ▶ arrow keys will force the cursor to skip past the unavailable choice.

This is accomplished by selecting the digit to be edited, using the ◀ ▶ arrow keys. The user should then press ENTER**.**

Config: Tx: SymRate

```
Data: 038.723635 Mbps
Sym: 017.379483 Msps(E)
```

Use the ◀ ▶ arrow keys to select the desired digit of the Symbol Rate. The value of the digit is then changed using the ▲ ▼ arrow keys. The user should then press ENTER.

The Data Rate digits also change as the Symbol Rate values are edited. The value of the Data Rate depends upon the code rate, modulation type, and the Mode type selected.

When modulation, code rate and other parameters are changed the modem attempts to maintain the same symbol rate, provided it is still in range when one of the other parameters is changed.

The valid range of Symbol Rate and Data Rate Range for DVB-S2, DVB-S and DVB-DSNG are shown in the following table. When programming a new data or symbol rate the modulator will not accept it unless it is in the range. If a new rate is not accepted, change the Modulator Code Rate or Mode. There is some round off in the data rate ranges in the last digit. The first table is for the standard FEC frame and the second table is for the short frame. QPSK 1/4, 1/3 and 2/3 data is for information only.

The tables are based on a 188 byte frame format. When a 204 byte format is selected the data rate increases by 204/188.

Symbol Rate / Data Rate Range – Standard FEC Frame and 188 Byte Format

Modulation	FEC Code	Inner Code Rate	Symbol Rate (Msps)		Spectral Efficiency	Data Rate (Mbps) Pilot OFF		Spectral Efficiency	Data Rate (Mbps) Pilot ON	
			Min	Max	Pilot OFF	Min	Max	Pilot ON	Min	Max
DVB-S2 - Standard FEC Frame = 64,800 Bits										
QPSK	LDPC+BCH	1/4	1	45	0.490243	0.490243	22.060942	0.478577	0.478577	21.535965
		1/3			0.656448	0.656448	29.540166	0.640827	0.640827	28.837209
		2/5			0.789412	0.789412	35.523546	0.770627	0.770627	34.678204
		1/2			0.988858	0.988858	44.498615	0.965327	0.965327	43.439697
		3/5			1.188304	1.188304	53.473684	1.160026	1.160026	52.201190
		2/3			1.322253	1.322253	59.501385	1.290788	1.290788	58.085452
		3/4			1.487473	1.487473	66.936288	1.452076	1.452076	65.343429
		4/5			1.587196	1.587196	71.423823	1.549426	1.549426	69.724175
		5/6			1.654663	1.654663	74.459834	1.615288	1.615288	72.687939
		8/9			1.766451	1.766451	79.490305	1.724416	1.724416	77.598702
		9/10			1.788612	1.788612	80.487535	1.746049	1.746049	78.572201
8PSK	LDPC+BCH	3/5	1	45	1.779991	1.779991	80.099585	1.739569	1.739569	78.280616
		2/3			1.980636	1.980636	89.128631	1.935658	1.935658	87.104623
		3/4			2.228124	2.228124	100.265560	2.177525	2.177525	97.988646
		5/6			2.478562	2.478562	111.535270	2.422276	2.422276	109.002433
		8/9			2.646012	2.646012	119.070539	2.585924	2.585924	116.366586
		9/10			2.679207	2.679207	120.564315	2.618365	2.618365	117.826440
16APSK	LDPC+BCH	2/3	1	35	2.637201	2.637201	92.302026	2.574613	2.574613	90.111471
		3/4			2.966728	2.966728	103.835482	2.896320	2.896320	101.371209
		4/5			3.165623	3.165623	110.796808	3.090495	3.090495	108.167326
		5/6			3.300184	3.300184	115.506446	3.221863	3.221863	112.765192
		8/9			3.523143	3.523143	123.310006	3.439530	3.439530	120.383555
		9/10			3.567342	3.567342	124.856967	3.482680	3.482680	121.893803
32APSK	LDPC+BCH	3/4	1	28	3.703295	3.703295	103.692261	3.623332	3.623332	101.453291
		4/5			3.951571	3.951571	110.643985	3.866247	3.866247	108.254911
		5/6			4.119540	4.119540	115.347126	4.030589	4.030589	112.856500
		8/9			4.397854	4.397854	123.139923	4.302894	4.302894	120.481032
		9/10			4.453027	4.453027	124.684751	4.356875	4.356875	121.992503
DVB-S & DVB-DSNG FEC Frame Does Not Apply										
QPSK	Conv+RS	1/2	1	45	0.921569	0.921569	41.470588	-	-	-
		2/3			1.228758	1.228758	55.294118	-	-	-
		3/4			1.382353	1.382353	62.205882	-	-	-
		5/6			1.535948	1.535948	69.117647	-	-	-
		7/8			1.612745	1.612745	72.573529	-	-	-
8-PSK	Conv+RS	2/3	1	45	1.843137	1.843137	82.941176	-	-	-
		5/6			2.303922	2.303922	103.676471	-	-	-
		8/9			2.457516	2.457516	110.588235	-	-	-
16-QAM	Conv+RS	3/4	1	45	2.764706	2.764706	124.411765	-	-	-
		7/8			3.225490	3.225490	145.147059	-	-	-

Symbol Rate / Data Rate Range – Short FEC Frame and 188 Byte Format

Modulation	FEC Code	Inner Code Rate	Symbol Rate (Msps)		Spectral Efficiency Pilot OFF	Data Rate (Mbps) Pilot OFF		Spectral Efficiency Pilot ON	Data Rate (Mbps) Pilot ON	
			Min	Max		Min	Max		Min	Max
DVB-S2 - Short FEC Frame = 16,200 Bits										
QPSK	LDPC+BCH	1/4	1	45	0.365324	0.365324	16.439560	0.357467	0.357467	16.086022
		1/3			0.629060	0.629060	28.307692	0.615532	0.615532	27.698925
		2/5			0.760928	0.760928	34.241758	0.744564	0.744564	33.505376
		1/2			0.848840	0.848840	38.197802	0.830585	0.830585	37.376344
		3/5			1.156532	1.156532	52.043956	1.131661	1.131661	50.924731
		2/3			1.288400	1.288400	57.978022	1.260693	1.260693	56.731183
		3/4			1.420269	1.420269	63.912088	1.389725	1.389725	62.537634
		4/5			1.508181	1.508181	67.868132	1.475747	1.475747	66.408602
		5/6			1.596093	1.596093	71.824176	1.561768	1.561768	70.279570
		8/9			1.727961	1.727961	77.758242	1.690800	1.690800	76.086022
		9/10			NA	NA	NA	NA	NA	NA
8PSK	LDPC+BCH	3/5	1	45	1.725319	1.725319	77.639344	1.692033	1.692033	76.141479
		2/3			1.922040	1.922040	86.491803	1.884959	1.884959	84.823151
		3/4			2.118761	2.118761	95.344262	2.077885	2.077885	93.504823
		5/6			2.381056	2.381056	107.147541	2.335120	2.335120	105.080386
		8/9			2.577778	2.577778	116.000000	2.528046	2.528046	113.762058
		9/10			NA	NA	NA	NA	NA	NA
16APSK	LDPC+BCH	2/3	1	35	2.548792	2.548792	89.207729	2.505223	2.505223	87.682811
		3/4			2.809662	2.809662	98.338164	2.761633	2.761633	96.657170
		4/5			2.983575	2.983575	104.425121	2.932574	2.932574	102.640076
		5/6			3.157488	3.157488	110.512077	3.103514	3.103514	108.622982
		8/9			3.418357	3.418357	119.642512	3.359924	3.359924	117.597341
		9/10			NA	NA	NA	NA	NA	NA
32APSK	LDPC+BCH	3/4	1	28	3.493093	3.493093	97.806607	3.419165	3.419165	95.736626
		4/5			3.709309	3.709309	103.860661	3.630805	3.630805	101.662551
		5/6			3.925526	3.925526	109.914715	3.842446	3.842446	107.588477
		8/9			4.249850	4.249850	118.995796	4.159906	4.159906	116.477366
		9/10			NA	NA	NA	NA	NA	NA

Config: Tx: Mode

```
Transmission Mode:
DVB-S2 DVB-S DVB-DSNG
```

The Mode is a key parameter for setting all modem parameters, and it is generally easier if it is set first. The Mode determines which modulation, code rates, FEC type and symbol rate range are available and also if Pilots or Gold Code settings are available. Changing the Mode will change one or more of these.

After changing modes, check the modulation, code, and data rate selections.

Config: Tx: Frequency

```
TX Freq: 0140.0000 MHz
          (◄ ► ▲ ▼ E)
```

Edit the TX IF Frequency. This is accomplished by selecting the digit to be edited, using the ◄ ► arrow keys. The value of the digit is then changed using the ▲ ▼ arrow keys. The user should then press ENTER**.**

70/140 MHz	The ranges of frequencies are from 52 to 88 MHz and from 104 to 176 MHz with a resolution of 100 Hz.
L-Band	The range is 950 to 1950 MHz with 100 Hz resolution.

CAUTION

The bandwidth of the modulated Tx carrier must stay within the IF frequency range. The modem disallows settings that exceed the range.

Config: Tx: Pwr

```
TX Power: Level
On/Off Imped    (◄ ► E)
```

IMPORTANT

The Imped(ance) selection is only available when the 70/140 MHz Modulator card is installed.

Select On **or** Off **using the ◄ ► arrow keys. The user should then press** ENTER**.**

Config: Tx: Pwr: Level

```
TX Output Power Level:
-10.0 dBm    (◄ ► ▲ ▼ E)
```

Edit the TX Power level. This is accomplished by selecting the digit to be edited, using the ◄ ► arrow keys. The value of the digit is then changed using the ▲ ▼ arrow keys. The user should then press ENTER**.**

70/140 MHz	0 to -20 dBm
L-Band	-5 to -25 dBm

Config: Tx: Pwr: On/Off

```
Tx Output State:
Off On         (◄ ► E)
```

Select Off **or** On **using the ◄ ► arrow keys. The user should then press** ENTER**.**

Config: Tx: Pwr: Imped

```
TX Impedance (Ohms):
50 75                (◄ ► E)
```

IMPORTANT

The Imped(ance) selection is only available when the 70/140 MHz Modulator card is installed.

This menu is displayed only when the 70/140 MHz modulator is installed.

70/140 MHz	**Select 50 or 75Ω, using the ◄ ► arrow keys, then press** ENTER**.**
L-Band	**Not Applicable.**

Config: Tx: Scram

The Scam(bler) menu is available only when the Mode selection is DVB-S2.

```
Tx Scrambling Index:
Gold-n = 000000   (◄ ►▲▼E)
```

The Scrambling menu is active only for DVB-S2. Use the ◄ ► arrow keys to select the desired digit. The value of the digit is then changed using the ▲ ▼ arrow keys. The user should then press ENTER.

The Gold-n index can be set from 0 to 262,141 and it indicates the Physical Layer spreading sequence number. The default setting is all 0s.

5.3.1.3 Config: Rx

```
Rx: FEC Dem Code SymRate
Mode Freq EbNo PLL (◄ ►E)
```

This modem is configured with the Mode as the highest priority.

Config: Rx: FEC

If **FEC** is selected:

This is a status only message. It depends upon the selection made under the **Config: Rx : Mode** menu.

```
Rx FEC:
Viterbi + Reed - Solomon   (◄ ►E)
```

For DVB-S2 Mode only:

```
Rx FEC:
LDPC + BCH                 (◄ ►E)
```

Config: Rx: Demod

If the **Dem** is selected:

```
Rx Demod: Type Inv Acq α
Eq IQ-TP Pilot Scr (◄ ►E)
```

The Pilot and Scrambler selections only appear if the Mode selection is DVB-S2.

Select the Rx Demodulation. Use the ◄ ► arrow keys to scroll through all the choices. The user should then press ENTER.

Config: Rx: Dem: Type

If **Type** is selected:

```
Rx Dem:  QPSK 8PSK 16QAM
16APSK  32APSK              (◄ ►E)
```

If the Mode selected is DVB-S then the menu is read only and the cursor rests under QPSK. If the Mode is DVB-DSNG the allowable modes are selectable depending upon the equipment options purchased.

In DVB-S2 mode the menu is status only and the type of modulation is determined automatically. Prior to synchronization of the Rx path the cursor may reside in any position. After synchronization (Rx Traffic LED is Green) re-enter the Type menu to update the display and the cursor rests under the modulation type.

Config: Rx: Dem: Inv

If **Inv** is selected:

```
Rx Spectrum:
Automatically Detected
```

This menu is read only. The demodulator automatically resolves frequency inversion. Normal or Inverted is not reported in the demodulation.

Config: Rx: Dem: Acq

If **Acq** is selected:

```
Demod Acquisition Range:
+/-010 kHz              (◄ ►▲▼E)
```

Edit the acquisition search range of the demodulator (the value entered here determines the amount of frequency uncertainly the demodulator will search over in order to find and lock to an incoming carrier). Editing the value is accomplished by selecting the digit to be edited, using the ◄ ► ▲▼ arrow keys. The value of the digit is then changed. The user should then press **ENTER**.

The range varies from ± 001 kHz to ± 100 kHz.

The value entered here determines the amount of frequency uncertainty the demodulator will search over in order to find and lock to an incoming carrier.

Config: Rx: Dem: α

If **α** is selected:

```
RX (α) Rolloff %: 20  25
35                (◄ ►E)
```

The rolloff or α dictates how fast the spectral edges of the carrier are attenuated beyond the 3 dB bandwidth. With 20% rolloff the edge falls off more quickly than with 25% and 35%.

Config: Rx: Dem: Adap-Eq

If **Adap-Eq** is selected:

```
Rx Adaptive Equalizer:
 Off On             (◄ ►E)
```

The adaptive equalizer helps correct for linear distortion in the rest of the link. Linear distortion includes amplitude and phase that would occur due to imperfect filtering effects, but it does not include distortion due to non linear amplifiers.

Config: Rx: Dem: IQ-TP

If **IQ-TP** is selected:

```
Rx IQ TPs (J2-11,J2-3):
Pre-EQ   Post-EQ              (◄ ►E)
```

This selection determines whether the IQ test point located on the Alarm Connector samples the IQ signal before or after the Adaptive Equalizer. J2-11 and J2-3 refer to the pins on the Alarm Connector that an oscilloscope is connected to monitor I and Q.

Config: Rx: Dem: Pilot

This menu is only available when the Mode selection is DVB-S2.

If **Pilot** is selected:

```
Rx Demodulation Pilot:
Off On              (◄ ►E)
```

This read only menu is active only in the DVB-S2 mode. The demodulator automatically determines if the pilots are on or off.

Config: Rx: SCR (Descrambler)

The SCR (Descrambler) menu is available only when the Mode selection is DVB-S2.

```
Rx Descrambling Index:
Gold-n = 000000   (◄ ►▲▼E)
```

The Descrambling menu is active only for the DVB-S2 Mode. Use the ◄ ► arrow keys to select the desired digit. The value of the digit is then changed using the ▲ ▼ arrow keys. The user should then press ENTER**.**

The Gold-n index can be set from 0 to 262,141 and it indicates the Physical Layer spreading sequence number. The default setting is all 0s.

Config: Rx: Code Rate

If **Code Rate** is selected:

```
Code Rate: 1/2 3/5 2/3
3/4 4/5 5/6 7/8 8/9 9/10
```

The cursor only lands on valid code rates depending upon the mode and purchased options. If the Mode is set to DVB-S2 the menu is read only and the demodulator automatically resolves the code rate.

Enter this enter menu from the one above to update the display. Prior to synchronization of the Rx path the cursor may reside in any position.

All possible choices are presented at all times.

If an option is not installed (either Hardware or FAST) or valid, or if a code rate is not available for the Mode selected, the ◄ ► arrow keys will force the cursor to skip past the unavailable choice.

This is accomplished by selecting the digit to be edited, using the ◄ ► arrow keys. The user should then press ENTER**.**

Config: Rx: Symbol Rate

If **SymRate** is selected:

```
Data: 017.185842 Mbps
 Sym: 017.379483 Msps     (E)
```

If the Rx Path is not locked, the message should read:

```
Data: Demod Unlocked
 Sym: 017.379483 Msps     (E)
```

Use the ◄ ► arrow keys to select the desired digit of the Symbol Rate. The value of the digit is then changed using the ▲ ▼ arrow keys. The user should then press ENTER**.**

In DVB-S and DVB-DSNG mode the Data Rate digits also change as the Symbol Rate values are edited. The value of the Data Rate depends upon the code rate, modulation type. See the table under the **Config:Tx:SymRate** menu for the valid range of symbol / data rates. When programming a new symbol rate (or indirectly a data rate) the value is not accepted unless it is within a valid range.

In DVB-S2 mode **Demod Unlocked** appears while the Rx path is not synchronized. After synchronization the correct data rate appears in the display and the demodulator has automatically resolved the modulation type, code rate, pilots ON/OFF, FECframe length, spectral inversion, etc. from the DVB-S2 carrier.

Config: Rx: Mode

If **Mode** is selected:

```
Receive Mode:
DVB-S2  DVB-S  DVB-DSNG   (◄ ►E)
```

The Mode is a key parameter for setting all modem parameters, and it is generally easier if it is set first. The Mode determines which modulation, code rates, FEC type and symbol rate range are available. The available range also determines on the FAST options selected at time of purchase.

After changing modes, check the modulation, code, and data rate selections.

Config: Rx: Frequency

If **Freq** is selected:

```
RX Freq: 0140.0000 MHz
                   (◄ ►▲▼E)
```

Edit the RX IF Frequency. This is accomplished by selecting the digit to be edited, using the ◄ ► arrow keys. The value of the digit is then changed using the ▲ ▼ arrow keys. The user should then press ENTER**.**

70/140 MHz	The ranges of frequencies are from 52 to 88 MHz and from 104 to 176 MHz with a resolution of 100 Hz.
L-Band	The range is 950 to 1950 MHz with 100 Hz resolution.

The bandwidth of the modulated carrier must stay within the IF frequency range.

Config: Rx: Eb/No

If **Eb/No** is selected:

```
Eb/No Alarm: Threshold
Alarm/Fault      (◄ ►E)
```

Select **Threshold**, **Alarm/Fault**, or **Masked** using the arrow keys. The user should then press **ENTER**.

Config: Rx: Eb/No: Threshold

If **Threshold** is selected:

```
Eb/No Alarm Threshold:
2.0 dB  Masked           (◄ ►▲ ▼E)
```

Edit the Eb/No alarm point. This is accomplished by selecting the digit to be edited, using the ◄ ► arrow keys. The value of the digit is then changed using the ▲ ▼ arrow keys. The user should then press **ENTER**.

The range of values is from 0.1 to 16.0 dB. The user may select a value here, and if the Eb/No falls below this value, a receive traffic fault will be generated.

Config: Rx: Eb/No: Alarm/Fault

If **Alarm** is selected:

```
Eb/No Alarm:
Alarm  Fault  Mask        (◄ ►E)
```

Select choice to defining the Eb/No Alarm as an Alarm or a Fault or completely Mask the alarm. This choice effects operation in 1:1 redundancy.

Config: Rx: PLL

If **Alarm** is selected:

```
Carrier PLL Bandwidth:
1x 2x           (◄ ►E)
```

This selection is sometimes useful when high phase noise is present. 1x is the normal operating mode.

5.3.1.4 Config: Intfc2 (For Gigabit Ethernet Interface Only)

Note: **Assumes the interface is installed in Slot 1. For this discussion;**

- Ingress refers to IP packets received from the LAN
- Egress refers to IP packets transmitted to the LAN
- Transmit refers to MPEG packets transmitted to the WAN
- Receive refers to MPEG packets received from the WAN

```
Intfc2 Gigabit Ethernet:
Ingress Egress  Man  Stats  (◄ ► E)
```

This menu tree shows what is presented if Interface 1 (the Interface in Slot 2) is populated with a Gigabit Ethernet Interface. The following specified menu would depend on the installed interface.

Config: Intfc2: Ingress

```
Intfc2 Gigabit Ingress:
Ena/Dis FEC Str       (E)
```

This is a status only message. Select **Ena/Dis, FEC, or Str.**

If **Ena/Dis** is selected:

```
Intfc2 Ingress Enable:
Enable Disable
```

Enter **Enable** for transmission of the ingress (received from LAN) MPEG-2 transmission stream. Entering Disable turns off the MPEG-2 transmission to the WAN.

Config: Intfc2: Ingress: FEC

If **FEC** is selected:

```
Intfc2 Ingress FEC
Enable Disable
```

Select **Enable** or **Disable**.

Select **Enable** for the GbEI to perform **SMPTE 2022 / Pro-MPEG COP3** error recovery. Select **Disable** to bypass the **SMPTE 2022 / Pro-MPEG COP3** function.

Note: SMPTE absorbed the per-MPEG Forum and released SMTE 2022.

Config: Intfc2: Ingress: Str

If **Str** is selected:

```
Intfc2 Streams        Act=1
IP  Mode  Pri  Red  Timeout
```

Config: Intfc2: Str: IP

Enter Multicast IP address for stream 1.

```
Intfc2 Multicast Stream:
1  2  Port
```

If **1** is selected:

```
Intfc2 Address 1
Group Source
```

Select **Group** or **Source**.

If **Group** is selected:

```
Intfc2 Multicast 1
224.001.001.002        ◄ ► ▲ ▼
```

Enter Group Multicast IP address for stream 1.

If **Source** is selected:

```
Intfc2 Source IP 1
000.000.000.000        ◄ ► ▲ ▼
```

If **Group** is selected:

Enter Source Multicast IP address for stream 2.

If **2** is selected:

```
Intfc2 Address 2
Group Source
```

Select **Group** or **Source**.

If **Group** is selected:

```
Intfc2 Multicast 2:
224.001.001.001        ◄ ► ▲ ▼
```

Enter Group Multicast IP address for stream 2.

If **Source** is selected:

```
Intfc2 Source IP 2
000.000.000.000        ◄ ► ▲ ▼
```

Enter Source Multicast IP address for stream 2.

If **Port** is selected:

```
Intfc2 UDP Port
05060                  ◄ ► ▲ ▼
```

Enter Destination UDP port for ingress streams.

Config: Intfc2: Streams: Mode

If **Mode** is selected:

```
Intfc2 Multicast Mode
Single  Dual
```

Select **Single** if one IP connection carrying an MPEG-2 transport stream is present or if automatic redundancy switching is disabled. Select **Dual** for redundancy operation with dual IP connections, each transporting an MPEG-2 transport stream, and automatic switching between the two streams is performed.

Config: Intfc2: Streams: Primary

If **Primary** is selected:

```
Intfc2 Primary Stream
1  2
```

Select either stream 1 or stream 2 as the primary stream. In single mode, this assigns which (of up to two) streams is processed. In redundancy mode, this identifies which of two streams are initially processed before any redundancy switch takes place.

Config: Intfc2: Streams: Redundancy

If **Redundancy** is selected:

```
Intfc2 Redundancy:
Revertive Non-Revertive
```

Select **Revertive** or **Non-revertive**. In revertive redundancy mode, either stream can be processed in the event of the failure of the other stream. In non-revertive mode, a switch from the primary stream to the secondary stream can occur, but a switch from the secondary stream to the primary stream will not occur in the event of a failure of the secondary stream. In this latter case, user intervention is required.

Config: Intfc2: Streams: Timeout

If **Timeout** is selected:

```
Intfc2 Stream Timeout
0500 mS                  (▲▼)
```

Assign the period (in 100 mS increments) for a primary connection failure to be present before switchover to the secondary connection occurs. For use in **Dual** stream mode only.

Config: Intfc2: Egress

```
Intfc2 Gigabit Egress:
Ena/Dis FEC IP
```

Select: Ena/Dis, FEC, or **IP**

If **Ena/Dis** is selected:

```
Intfc2 Egress Enable:
Enable Disable
```

Enter **Enable** to enable reception of the MPEG transport stream from the WAN. Entering enable also enables transmission of the IP-encapsulated MPEG packets to the LAN (egress). Entering **Disable** turns off egress packets to the LAN.

If **FEC** is selected:

```
Intfc2 FEC:
Ena/Dis  Matrix   (◄ ► E)
```

This menu allows enabling and configuration of the SMPTE 2022 / Pro-MPEG COP3 FEC stream to the LAN.

If **Ena/Dis** is selected:

```
Intfc2 Egress FEC:
Enable Disable
```

Enter **Enable** to generate SMPTE 2022 / Pro-MPEG COP3 FEC IP packets to the LAN, in addition to the stream of IP-encapsulated MPEG packets. Enter **Disable** to run off the generation of FEC packets to the LAN.

If **Matrix** is selected:

```
Intfc2 Egress FEC Matrix:
Length = 10,  Depth = 10
```

Configure the dimension of the egress FEC matrix. Valid values for L and D are as follows:

- L * D </= 100
- 1 </= L </= 20
- 4 </= D </= 20

If **IP** is selected:

```
Intfc2 Egress IP:
Group SrcPort DestPort
```

This menu allows configuration of IP header fields for the egress packets.

If **Group** is selected:

```
Intfc2 Egress Multicast:
239.010.010.010  ◄ ► ▲▼
```

Enter the valid destination IP multicast group address for egress IP packets.

If **Src Port** is selected:

```
Intfc2 Egress Src Port:
01024            ◄ ► ▲▼
```

Enter a valid UDP source port address for your network.

If **Dest Port** is selected:

```
Intfc2 Egress Dest Port:
01024            ◄ ► ▲▼
```

Enter a valid UDP destination port address for the egress packet stream. Media packets will be addressed to this UDP port; FEC packets (if FEC generation is enabled) will be addressed to (UDP destination port +2).

Config: Intfc1: Man

If **Man** (Management) is selected:

```
Intfc2 Management IP
192.168.001.008/24
```

Enter management IP address/subnet mask for Gigabit Ethernet Interface management channel.

Config: Intfc1: Stats

If **Stats** is selected:

```
Intfc1 Statistics
View Clear
```

If **View** is selected:

```
FPGA Packets Dropped
00000000000000000000  (▲▼)
```

Note: The following statistics may be viewed:

GBEI Statistics Summary	
1000Base-T Link Statistics	LAN Good Octets (In) – The sum of lengths of all good Ethernet frames received from the LAN
	LAN Bad Octets (In) – The sum of lengths of all bad Ethernet frames received from the LAN
	LAN Unicast (In) – The sum of good frames received from the LAN that have a unicast destination MAC address
	LAN Broadcast (In) – The sum of good frames received from the LAN that have a broadcast destination MAC address
	LAN Multicast (In) – The sum of good frames received from the LAN that have a multicast destination MAC address
	LAN Pause (In) – The number of good flow control frames received from the LAN
	LAN Undersize (In) – Total frames received from the LAN with a length of less than 64 octets but with a valid FCS
	LAN Fragments (In) – Total frames received from the LAN with a length of less than 64 octets and an invalid FCS
	LAN Oversize (In) – Total frames received form the LAN with a length greater than the maximum size of octets but with a valid FCS
	LAN Jabber (In) – Total frames received form the LAN with a length greater than the maximum size of octets but with an invalid FCS
	LAN Rx Err (In) – Total frames received from the LAN for which an error was detected at the PHY
	LAN FCS Err (In) – Total frames received from the LAN with a CRC error which was not counted in the Fragments or Rx Err totals
	LAN Octets (Out) – The sum of the lengths of all Ethernet frames transmitted to the LAN
	LAN Unicast (Out) – The sum of frames transmitted to the LAN that have a unicast destination MAC address
	LAN Broadcast (Out) -) – The sum of frames transmitted to the LAN that have a broadcast destination MAC address
	LAN Multicast (Out) -) – The sum of frames transmitted to the LAN that have a multicast destination MAC address
WAN Port Statistics	WAN Octets (Out)) – The sum of the lengths of all Ethernet frames which are forwarded to the MPEG processing logic for MPEG extraction and transmission to the WAN
	WAN Unicast (Out)) – The number of good frames with unicast destination MAC addresses which are forwarded to the MPEG processing logic for MPEG extraction and transmission to the WAN
	WAN Broadcast (Out)) – The number of good frames with broadcast destination MAC addresses which are forwarded to the MPEG processing logic for MPEG extraction and transmission to the WAN
	WAN Multicast (Out)) – The number of good frames with multicast destination MAC addresses which are forwarded to the MPEG processing logic for MPEG extraction and transmission to the WAN
	FPGA Media Received – When FEC is enabled, indicates the number of media packets received by the FEC logic; does not include FEC packets
	FPGA Media Recovered – When FEC is enabled, indicates number of bad or lost Ethernet packets which have been recovered using FEC

GBEI Statistics Summary	
	FPGA Media Unrecovered – When FEC is enabled, indicates number of bad or lost Ethernet packets that could not be recovered, for which a packet with a payload of null MPEG packets has been substituted
	FPGA UDP Checksum Error – Indicated number of Ethernet packets received with incorrect UDP checksums
	FPGA Non-Compliant Pkt – Indicates number of Ethernet packets received which are not valid transport stream packets
	FPGA Packets Dropped – Indicates number of IP packets that have been dropped due to a buffer overrun condition
	FPGA Null Underrun – Indicated number of Null MPEG packets generated to the WAN due to buffer underrun conditions
	FPGA Null Out-of-Sync – Indicates the number of null MPEG packets that have been generated to the WAN due to a loss of (MPEG packet) synchronization condition
	FPGA Overrun Events – Indicates the number of times that a buffer overrun condition has occurred
	FPGA Underrun Events – Indicates the number of times that a buffer underrun condition has occurred
	FPGA Out-of-Sync Events – Indicates the number of times that a loss of MPEG synchronization condition has occurred
	WAN Good Octets (IN) - The sum of lengths of all good Ethernet frames received from the IP encapsulation logic (which contains MPEG packets received from the WAN)
	WAN Unicast (IN)) – The sum of good frames received from the WAN IP encapsulation logic that have a unicast destination MAC address
	WAN Broadcast (IN) – The sum of good frames received from the WAN IP encapsulation logic that have a broadcast destination MAC address
	WAN Multicast (IN) – The sum of good frames received from the WAN IP encapsulation logic that have a multicast destination MAC address
Management Port Statistics	Mng Good Octets (In) – The sum of lengths of all good Ethernet frames received from the local GBEI management processor
	Mng Bad Octets (In)) – The sum of lengths of all bad Ethernet frames received from local GBEI management processor
	Mng Unicast (In)) – The sum of good frames received from the local GBEI management processor that have a unicast destination MAC address
	Mng Broadcast (In)) – The sum of good frames received from the local GBEI management processor that have a broadcast destination MAC address
	Mng Multicast (In)) – The sum of good frames received from the local GBEI management processor that have a multicast destination MAC address
	Mng Pause (In)) – The number of good flow control frames received from local GBEI management processor
	Mng Undersize (In) – Total frames received from the local GBEI management processor with a length of less than 64 octets but with a valid FCS
	Mng Fragments (In) – Total frames received from the local GBEI management processor with a length of less than 64 octets and an invalid FCS
	Mng Oversize (In) – Total frames received form the local GBEI management processor with a length greater than the maximum size of octets but with a valid FCS

GBEI Statistics Summary	
	Mng Jabber (In) – Total frames received form the local GBEI management processor with a length greater than the maximum size of octets but with an invalid FCS
	Mng Rx Err (In) – Total frames received from the local GBEI management processor for which an error was detected by its physical interface
	Mng FCS Err (In) – Total frames received from the local GBEI management processor with a CRC error which was not counted in the Fragments or Rx Err totals
	Mng Octets (Out) – The sum of the lengths of all Ethernet frames transmitted to the local GBEI management processor
	Mng Unicast (Out) – The sum of frames transmitted to the local GBEI management processor that have a unicast destination MAC address
	Mng Broadcast (Out) – The sum of frames transmitted to the local GBEI management processor that have a broadcast destination MAC address
	Mng Multicast (Out) – The sum of frames transmitted to the local GBEI management processor that have a multicast destination MAC address

5.3.1.5 Config: Intfc1 (CDI-60 HSSI)

The menus are shown for the HSSI Interface installed in Slot1. The CDM-710 supports a single HSSI Interface (Intfc1).

```
Intfc1  HSSI:
Tx Rx CTS/RTS    (◄►E)
```

There is a single port on a CDI-60 HSSI Interface. Select **Tx, Rx** or **CTS/RTS**, using the ◄ ► arrow keys. The user should then press [**ENTER**].

Config: Intfc1: HSSI: Tx

```
Intfc1  Tx
Data Clock Enable    (◄►E)
```

Select **Data, Clock** or **Enable**, using the ◄ ► arrow keys. The user should then press [**ENTER**].

Config: Intfc1: HSSI: Tx: Data

```
Intfc1  Tx Data:
Datarate Invert      (◄►E)
```

Select **Datarate** or **Invert**, using the ◄ ► arrow keys. The user should then press [**ENTER**].

Config: Intfc1: HSSI: Tx: Datarate

```
Intfc1  Data Rate:
Tx: 032.000000 Mbps
```

This is a status only message which indicates the data rate of the transmit MPEG-2 transport stream.

Config: Intfc1: HSSI: Tx: Invert

```
Intfc1  Tx Data Invert:
Normal Inverted      (◄►E)
```

Select **Normal** or **Inverted**, using the ◄ ► arrow keys to control data inversion (added for compatibility with certain older equipment).

Config: Intfc1: HSSI: Tx: Clock

```
Intfc1  Tx Clock:
Normal  Inverted    (◄►E)
```

Select **Normal** or **Inverted**, using the ◄ ► arrow keys to control clock inversion (added for compatibility with certain older equipment).

Config: Intfc1: HSSI: Tx: Enable

```
Intfc1  Tx Enable:
Enable  Disable    (◄►E)
```

Select **Enable** or **Disable**, using the ◄ ► arrow keys. The user should then press [**ENTER**]. This selection is use to activate and deactivate the Tx side of this interface.
Disabling the Tx side deactivates it and changes the data rate to 0.

Config: Intfc1: HSSI: Rx

```
Intfc1  Rx:
Data  Buffer  Clock  Enable    (◄►E)
```

Select **Data, Buffer, Clock** or **Enable**, using the ◄ ► arrow keys. The user should then press [**ENTER**].

Config: Intfc1: HSSI: Rx: Data

```
Intfc1  Rx Data:
Datarate  Invert  (◄►E)
```

Select **Datarate** or **Invert**, using the ◄ ► arrow keys. The user should then press [**ENTER**].

Config: Intfc1: HSSI: Rx: Datarate

```
Intfc1  Data Rate:
Rx: 032.000000 Mbps
```

This is a status only message indicating the data rate of the received MPEG-2 transport stream.

Config: Intfc1: HSSI: Rx: Invert

```
Intfc1  Rx Data Invert:
Normal Inverted      (◄►E)
```

Select **Normal** or **Inverted**, using the ◄ ► arrow keys to control data inversion (added for compatibility with certain older equipment).

Config: Intfc1: HSSI: Rx: Buffer

```
Intfc1  Rx Buffer:
Size  Recenter    (◄►E)
```

Select **Size** or **Recenter** using the ◄ ► arrow keys. The user should then press [**ENTER**].

Config: Intfc1: HSSI: Rx: Buffer: Size

```
Intfc1 Rx Buffer Size:
10.0 mSec (0343,680 Bits) (▲ ▼ ◄►E)
```

Edit the Rx Buffer Size. This is accomplished by selecting the digit to be edited, using the ◄ ► arrow keys. The value of the digit is then changed using the ▲ ▼ arrow keys. The user should then press **ENTER**.

The range of values is from 5.0 to 32.0 mSec in 0.1 msec increments.

Config: Intfc1: HSSI: Rx: Buffer: ReCenter

```
Intfc1 Rx Buffer Fill:
(046%) ReCenter   (◄►E)
```

The percentage (046%) indicates the current buffer fill status. Selecting **Re-Center** resets the buffer to the midpoint (50%).

Config: Intfc1: HSSI: Rx: Clock

```
Intfc1 Rx Clock:
Source  Invert    (◄►E)
```

Select **Source** or **Invert** using the ◄ ► arrow keys. The user should then press [**ENTER**].

Config: Intfc1: HSSI: Rx: Clock: Source

```
Intfc1  Rx Clock:
Rx-Sat Tx-Terr Internal   (◄►E)
```

Select **Rx-Sat, Tx-Terr** or **Internal**, using the ◄ ► arrow keys. The user should then press [**ENTER**]. This selection determines which source clocks the output of the Rx Buffer for delivering data to the Rx port at the user interface.

Rx-Sat (default)	Effectively disables the Rx Buffer because the input and output clocks are the same. Normally, the Rx Buffer is set for minimum when Rx-Sat is selected.
Tx-Terr	Uses the clock from the Tx input (TT) to clock out the Rx Buffer.
Internal	Derives a clock from the internal 10 MHz reference clock.

Config: Intfc1: HSSI: Rx: Clock: Invert

```
Intfc1 Rx Clock Invert:
Normal  Inverted    (◄►E)
```

Select **Normal** or **Inverted**, using the ◄ ► arrow keys to control clock inversion (added for compatibility with certain older equipment).

Config: Intfc1: HSSI: Rx: Enable

```
Intfc1 Rx Enable:
Enable Disable    (◄►E)
```

Select **Enable** or **Disable**, using the ◄ ► arrow keys. The user should then press [**ENTER**]. This selection is use to activate and deactivate the Rx side of this interface.
Disabling the Rx side deactivates it and changes the data rate to 0.

Config: Intfc1: HSSI: Tx: RTS/CTS

```
Intfc1 CTS/RTS:
Normal  Fault
```

Select **Normal** or **Fault** using the ◄ ► arrow keys. The user should then press [**ENTER**]. RTS is the same as TA and CTS is the same as CA. The selections operate as follows:

Normal: CTS = RTS
Fault: CTS = RTS when no fault is present. CTS is not asserted when a fault is present.

5.3.1.6 Config: Intfc1 (For ASI Interface Only)

```
Intfc2 ASI:
Tx    Rx    Config (◄ ► E)
```

This menu tree shows what is presented if Interface 1(the Interface in Slot 1) is populated with the ASI Interface. The following specified menu would depend on the installed interface.

If **Tx** is selected:

```
Intfc1 ASI Tx:
Ena/Dis  Frame (◄ ► E)
```

If **Ena/Dis** is selected:

```
Intfc1 ASI Tx:
Enable   Disable   (◄ ► E)
```

Selecting **Enable** or **Disable** activates or deactivates the Tx side of this interface. **Disabling** the Tx side deactivates it and sets the data rate to 0.

If **Frame** is selected:

```
Intfc1 ASI Tx Frame:
188    204     (◄ ► E)
```

The user should select either **188** or **204** to enable either the 188 sync mode or the 204 sync mode.

If **Rx** is selected:

```
Intfc1 ASI Rx:
Ena/Dis  Frame (◄ ► E)
```

If **Ena/Dis** is selected:

```
Intfc1 ASI Rx:
Enable   Disable   (◄ ► E)
```

Selecting **Enable** or **Disable** activates or deactivates the Rx side of this interface. **Disabling** the Rx side deactivates it and sets the data rate to 0.

If **Frame** is selected:

```
Intfc1 ASI Rx Frame:
188    204     (◄ ► E)
```

The user should select either **188** or **204** to enable either the 188 sync mode or the 204 sync mode.

If **Config** is selected:

```
Intfc1 ASI Config:
Port  Bandwidth  (◄ ► E)
```

If **Port** was selected:

```
Intfc1 ASI Port:
J4 J5            (◄ ► E)
```

When J4 or J5 is selected it becomes the active port on the ASI interface.

Also see **Config: AUX: 1:1 Mode** for redundancy operation.

If **Bandwidth** is selected:

```
Intfc1 ASI Bandwidth:
Wide  Narrow  (◄ ►E)
```

The loop bandwidth of the ASI input is selected. **Wide** corresponds to about 2 Hz and **Narrow** is approximately 0.5 Hz. Normally, the **Wide** selection is adequate, but when higher amounts of terrestrial jitter are present in the incoming ASI data stream the **Narrow** setting will help reduce jitter. Terrestrial jitter sometimes increases when data is sent across the **P**ublic **S**witched **T**elecom **N**etwork (PSTN).

This menu allows enabling or disabling of the ASI interface. The ASI interface is available in Slot 1 only.

5.3.1.7 Config: Ref

```
Frequency Reference
External  10 MHz  (▲▼E)
```

External 10 MHz	**The unit phase locks to an external input at the BNC connector labeled** EXT REF**. Other selections are available for External 1, 2, 5, 10, or 20 MHz input.**

Note: Internal selection is available at 10 MHz.

5.3.1.8 Config: Aux

Config: Aux: 1:1 Mode: Enable / Disable

```
Redundancy
Ena/Dis  Force (1:1)  (◄ ► E)
```

If **Ena/Dis** is selected:

```
Redundancy Mode:
Enable   Disable (◄ ► E)
```

Selecting **Enable** sets up the unit for operation with the 1:1 IF switch. Internally an auxiliary relay sets the alarms connector for the 1:1 operation mode.

Note: When redundancy is selected, J5 becomes the active port – J4 is not available for 1:1 operation. Either J4 or J5 is available for 1:N operation.

Config: Aux: 1:1 Mode: Force

```
Press ENT To Force Modem
To Standby  (1:1 Only)
```

5.3.1.9 Config: Alarms

```
Alarm Mask: Tx
Intfc1 Intfc2   (◄ ► E)
```

5.3.1.10 Alarm: Tx

If **Tx** is selected:

```
Tx Alarm Mask: None
```

Currently, masking of Tx Alarms (associated with the modulator) is not allowed.

Config: Alarm: Intfc2

Note: This message is only valid for the ASI Interface.

If **Intfc2** is selected:

```
Intfc1 Alarms: TxClk
               (◄ ► E)
```

The **Intfc1 Alarms: TxClk** menu allows the user to designate the action when the Tx clock is lost on the incoming data. This often occurs when the data cable is disconnected. Press Enter for the menu to choose the fault action.

5.3.2 Monitor

```
Monitor: Alarms  Rx_Stats
Event-Log
```

Alarms are reported under three main categories.

- Tx path alarms are displayed under the Tx Category
- Rx path alarms are displayed under the Rx Category
- Alarms common to the unit are available under the Unit selection

See table 5.5, Summary of Alarms Reported for Tx and Unit Categories, for additional information regarding alarms.

Monitor: Alarms: Live Alarms: Transmit

```
TX Traffic:  GBEI Card
PHY Not Connected   (E)
```

This will only report if there are modulator errors, otherwise it will report "**No Errors**." The alarm above usually indicates the data cable is disconnected from the modem.

Monitor: Alarms: Live Alarms: Rx

```
RX Traffic:
Demod  Unlocked      (E)
```

This will report only if Demod is unlocked, otherwise it will report "**No Errors**."

Monitor: Alarms: Live Alarms: Unit

```
Unit Fault: No Errors
                     (E)
```

The menu screen appears on the left and a brief description appears on the right.

5.3.2.1 Monitor: Rx_Stats

For DVB-S2 only:

```
EsNo=14.0  PER=0.0E+00
EbNo=12.8  BER=N/A          ▼
```

```
EbNo=12.8  BER=N/A          ▲
ΔF=-000.2k RSL=-16          ▼
```

```
ΔF=-000.2k RSL=-16          ▲
Link_Margin=+10.4
```

When the demodulator is locked this menu reports Eb/No, PER (packet error rate), ΔF (frequency offset of incoming carrier) and RSL (receive signal level).

For DVB-S and DVB-DSNG only:

```
EsNo=16.0   PER=N/A
EbNo=15.1   BER=0.0E+00          ▼
```

```
EbNo=15.1   BER=0.0E+00          ▲
ΔF=-000.1k  RSL=-16              ▼
```

```
ΔF=-000.4k  RSL=-16              ▲
Link_Margin=+10.1
```

Note: In this mode, BER monitoring is not available.

Link Margin corresponds to:

Standard	Link Margin	Threshold
DVB-S2	= Es/No (measured) – Es/No (threshold)	Table 8-2
DVB-S or DVB-DSNG	= Eb/No (measured) – Eb/No (threshold)	Table 8-4 or 8-5, BER = 10^{10}

Usable Es/No Range (Typical)

DVB-S2		DVB-S and DVB-DSNG	
Modulation	**Es/No Range (dB)**	**Modulation**	**Es/No Range (dB)**
QPSK	0.0 to 14.0	QPSK	2.0 to 16.0
8QPSK	4.5 to 18.5	8 PSK	8.5 to 20.0
16APSK	8.0 to 22.0	16QAM	11.0 to 21.0
32APSK	11.5 to 25.00		

5.3.2.2 Monitor: Event-Log:

```
Stored Events: View
Clear-All       (◀ ▶E)
```

Monitor: Event-Log: Stored Events: View

```
Log015 23/05/06  09:27:15
Fault – No PHY Link  (▲▼)
```

- This window displays (253) Alarms.
- To display the alarms press ▲ ▼ keys to display the individual alarm.
- The Event-Log stores the live alarms along with a timestamp for review and troubleshooting. The date is dd/mm/yy
- Refer to Table 5-2 for a listing of alarms.

Monitor: Event-Log: Stored Events: Clear-All

```
Clear All Stored Events
No  Yes     (◀ ▶E)
```

Similar to the live alarms but space only permits shorter labels and provides the Event-Log mnemonic along with its meaning.

Table 5-2. Summary of Alarms Reported for Tx and Unit Categories

Unit Faults / Alarms	
Menu Mnemonic	**Description**
FPGA Load Framer Card	Framer FPGA not loading
+1.5V JPSU Framer Card	1.5V Vdc Framer / FEC regulator exceeds +/- 5%
+1.5V PSU Interface Card #1	1.5V Vdc Slot 1 regulator exceeds +/- 5%
+1.5V PSU Interface Card #2	1.5V Vdc Slot 2 regulator exceeds +/- 5%
+3.3V PSU Framer Card	3.3 Vdc Framer regulator exceeds +/- 10%
+5 PSU Framer Card	5.0 Vdc Framer regulator exceeds +/- 10%
+12V PSU Framer Card	12 Vdc Framer regulator exceeds +/- 10%
-12V PSU Framer Card	-12 Vdc Framer regulator exceeds +/- 10%
+18V PSU Framer Card	+18 Vdc Framer regulator exceeds +/- 10%
FLASH Checksum Error	Flash Load Error
FPGA Load Decoder Card	Decoder FPGA not loading
FPGA Load Encoder Card	Encoder FPGA not loading
FPGA Load Interface Card #1	Slot 1 FPGA not loading
FPGA Load Interface Card #2	Slot 2 FPGA not loading
PLL Clock Framer – 192MHz	192MHz PLL Clock Framer failure
PLL Clock Framer – Ext Ref	External Reference PLL Clock Framer failure
FPGA Temp Framer Card	Framing FPGA temperature out of range
Modem Ambient Temp	Framing card (modem) ambient temperature out of range
Modem Cooling Fans	Framing card – sense cooling fan problem
Intfc1 has been removed	Slot 1 interface card removed
Intfc2 has been removed	Slot 2 interface card removed
+1.5V PSU Modulator Card	1.5 Vdc regulator exceeds +/- 5%
FPGA Load Modulator Card	Mod FPGA not loading
PLL Clock Symbol Rate	Mod symbol rate defitter PLL unlocked over overflowing
Tx Synth Unlocked	Mod synthesizer unlocked
Tx CDM Unlocked	Mod Digital Clock Manager unlocked
I & Q are inactive	Mod I or Q no activity
FPGA Temp Modulator Card	Mod FPGA outside temperature range
Nyq Filter Clipping	Mod Nyquist filter clipping
ASI Port TxFifo Empty Slot 1	ASI Tx FIFO empty Slot 1
ASI Port TxFifo Empty Slot 2	ASI Tx FIFO empty Slot 2
ASI Port TxFifo Full Slot 1	ASI Tx FIFO full Slot 1
ASI Port TxFifo Full Slot 2	ASI Tx FIFO full Slot 2
ASI Port Tx Data Loss Slot 1	ASI Tx Data not present Slot 1
ASI Port Tx Data Loss Slot 2	ASI Tx Data not present Slot 2
ASI Frame not Sync'ed Slot 1	ASI Tx Data framing not detected Slot 1
ASI Frame not Sync'ed Slot 2	ASI Tx Data framing not detected Slot 2
Tx Clock Loss Slot 1	Transmit clock not present at Slot 1
Tx Clock Loss Slot 2	Transmit clock not present at Slot 2
GBEI Card DataRate > +200PPM	Data rate from GBEI to modulator exceeds nominal by >+200PPM
GBEI Card DataRate < -200PPM	Data rate from GBEI to modulator exceeds nominal by <-200PPM
GBEI Card PHY Not Connected	Ethernet cable not connected to GBEI, or cable fault

Demodulator Faults / Alarms	
Menu Mnemonic	**Description**
Encoder FIFO Empty	Transmit Encoder FIFO is empty
Encoder FIFO Full	Transmit Encoder FIFO is full
ASI TrxSlot 1 DR > +110PPM	Transmit data rate exceeds nominal by >+100PPM Slot 1
ASI TrxSlot 2 DR > +110PPM	Transmit data rate exceeds nominal by >+100PPM Slot 1
ASI TrxSlot 1 DR <-110PPM	Transmit data rate exceeds nominal by <-100PPM Slot 1
ASI TrxSlot 2 DR < -110PPM	Transmit data rate exceeds nominal by <-100PPM Slot 1
SERDES Parity Errors	SERDES parity errors have been detected
+1.5V PSU Demodulator Card	1.5 Vdc regulator exceeds +/- 5%
FPGA Load Demodulator Card	Demod FPGA not loading
Demod Unlocked	Demodulator is not locked
DSNG Sync Error	DSNG synchronization error
FPGA Temp Demodulator Card	Demod FPGA outside temperature range
BER limit Exceeded	Bit error rate limit exceeded
AGC Level Out of Range	AGC level is out of range
Eb/No limit exceeded	EB/No limit has been exceeded
Demodulator Synth 1 PLL	Demodulator Synth 1 PLL fault
Demodulator Synth 2 PLL	Demodulator Synth 2 PLL fault
Demodulator SERDES Dmd->Framer	Demodulator SERDES fault
Demodulator SERDES Framer > FEC1	Demodulator SERDES fault
Demodulator SERDES Framer > FEC2	Demodulator SERDES fault
FAST option not installed	FAST option for selected feature has not been installed
MPEG-TS Check Failed	MPED-TS error has been detected
ASI1 Rx PLL FIFO Empty	ASI Rx FIFO empty Slot 1
ASI1 Rx PLL FIFO Full	ASI Rx FIFO full Slot 1
ASI1 Rx PLL Lower Limit Reached	ASI Rx PLL Lower Limit Reached Slot 1
ASI1 Rx PLL Upper Limit Reached	ASI Rx PLL Upper Limit Reached Slot 1
ASI2 Rx PLL FIFO Empty	ASI Rx FIFO empty Slot 2
ASI2 Rx PLL FIFO Full	ASI Rx FIFO full Slot 2
ASI2 Rx PLL Lower Limit Reached	ASI Rx PLL Lower Limit Reached Slot 2
ASI2 Rx PLL Upper Limit Reached	ASI Rx PLL Upper Limit Reached Slot 2
Rx DCM Unlocked	Demod Digital Clock Manager unlocked
ASI1 Rx SERDES Parity Error	ASI Rx SERDES parity error Slot 1
ASI1 Rx SERDES Unlock	ASI Rx SERDES not locked Slot 1
ASI2 Rx SERDES Parity Error	ASI Rx SERDES parity error Slot 2
ASI2 Rx SERDES Unlock	ASI Rx SERDES not locked Slot 2
HSSI1 Rx Buffer Underflow	HSSI Rx buffer has underrun Slot 1
HSSI1 Rx Buffer Overflow	HSSI Rx buffer has overflowed Slot 1
HSSI2 Rx Buffer Underflow	HSSI Rx buffer has underrun Slot 2
HSSI2 Rx Buffer Overflow	HSSI Rx buffer has overflowed Slot 2
SERDES Par Framer -> Intf1	SERDES parity error detected on framer FPGA interface 1
SERDES Par Framer ->Intf2	SERDES parity error detected on framer FPGA interface 2
Rx Clock Source Interface 1	Rx Clock Source fault Interface 1
Rx Clock Source Interface 2	Rx Clock Source fault Interface 2

5.3.3 Test

```
Test:
Mode TestPatterns    ◀ ▶E)
```

Test selections for the Tx carrier and Patterns are selected in this menu.

Test: Mode

The CDM-710 supports many useful test modes. Not all modes are available in all configurations. They depend upon the modem configuration (Duplex, Rx-Only, Tx-Only) and the data interface(s).

```
Test: Normal  RF  IF  I/O
Tx-CW  Tx-1,0 (◀ ▶ E)
```

Tx-CW produces a CW carrier at the output of the modulator. Tx=1,0 generates a Single Sideband Carrier to evaluate carrier leakage and sideband suppression.

Select **Norm, IF Loop, I/O Loop, RF Loop, Tx-CW** or **Tx-1.0** using ◀ ▶ arrow keys, then press **ENTER**.

Norm (Normal)	This clears any test modes or loopbacks and places the unit back into an operational state.
IF (IF Loop)	This test mode invokes an internal IF loop. This is a particularly useful feature, as it permits the user to perform a quick diagnostic test without having to disturb external cabling. Furthermore, all of the Rx configuration parameters are temporarily changed to match those of the Tx-side. When Norm is again selected, all of the previous values are restored.
I/O (Input / Output Loop)	This test mode invokes two distinct loopbacks. The first Loopback is an inward loop, which takes data being received from the satellite direction, and passes it directly to the modulator. Simultaneously, the outward loop is invoked, whereby data being fed to the Tx data interface is routed directly back out of the Rx data interface.
RF (RF Loop)	This RF loop is almost identical to the IF loop mode. All of the Rx configuration parameters (except Rx Spectrum Invert) are temporarily changed to match those of the Tx-side, however, no internal connection is made. This is useful for performing a satellite Loopback. When Norm is again selected, all of the previous values are restored.
Tx-CW (Transmit CW)	This test mode forces the modulator to transmit a pure carrier (unmodulated).
Tx-1,0 (Tx 1, 0, 1, 0 Pattern)	This is a test mode, which forces the modulator to transmit a carrier modulated with an alternating 1,0,1,0 pattern, at the currently selected symbol rate. This causes single sideband spectral lines to appear, spaced at ± half the symbol rate, about the carrier frequency. This mode is used to check the carrier suppression of the Modulator. Also, it verifies quadrature and amplitude balance.

Test: Test Patterns

```
Test Pattern Subst:
Off 2047  2^23-1    (◀ ▶E)
```

The availability of test patterns depends on the type of interface.

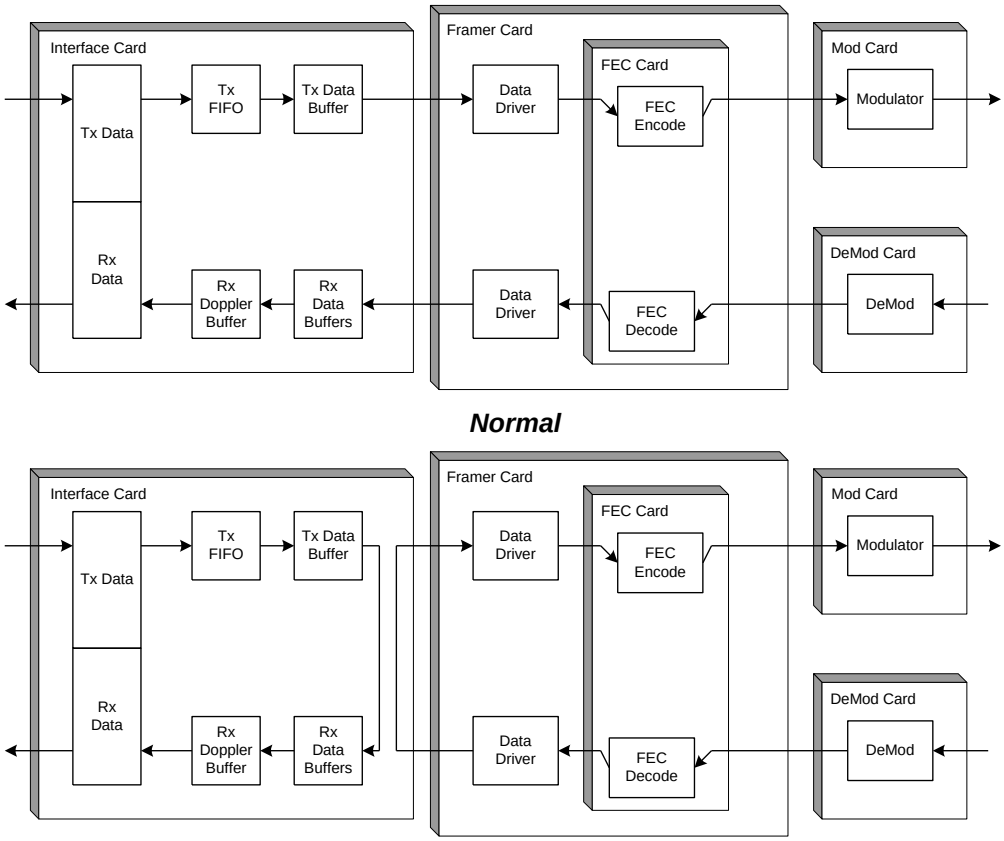


Figure 5-4. Traffic Data Flow – Loopback Block Diagrams

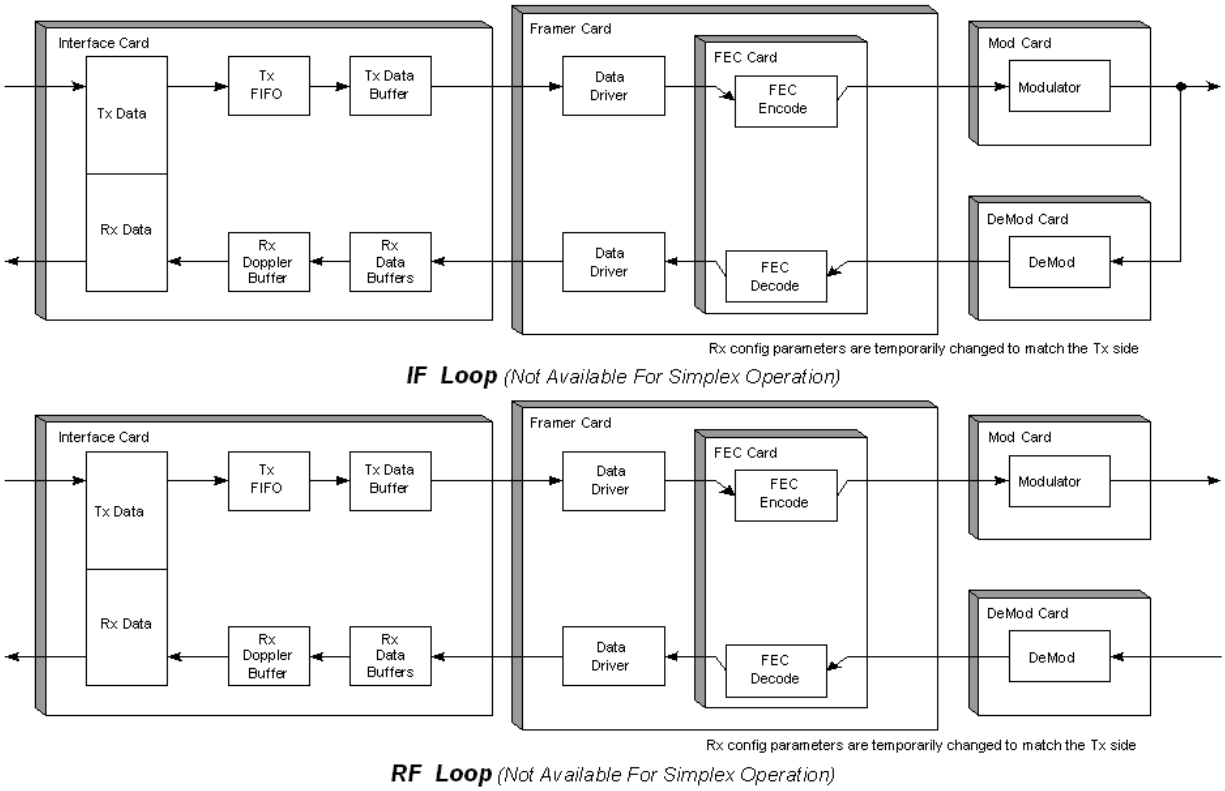


Figure 5-4. Traffic Data Flow – Loopback Block Diagrams (Continued)

5.3.4 INFO

```
INFO: Rem Tx Rx
Intfc1 Intfc2   (◀ ▶E)
```

This menu sequentially displays all **Info** screens on a *read-only basis*: the user is not permitted to edit an **Info** screen, just view it.

Note: INFO screens display information on the current configuration of the modem without risking inadvertent changes.

INFO: Rem

```
Remote M&C: 100BaseTx
IP Addr: 192.168.001.006
```

INFO: Rem: Tx

```
Tx: 0140.0000  17.379483
DVBS2 8P 3/4  -10.0 ON
```

The info items are as follows:

0140.0000	Tx Frequency in MHz
17.379483	Data rate in Mbps
DVBS2	Transmission mode: DVBS2 DVB-S DSNG
QP **8P** **16Q** **16A** **32A**	Modulation: QP = QPSK 8P = 8-PSK 16Q = 16-QAM 16A = 16-APSK 32A = 32-APSK
3/4	Code Rate
-10.0	Tx Power level in dBm
ON	Tx Power ON = On, OF = Off

INFO: Rx

```
RX: 0140.0000 17.379483
DVBS2 QP 1/2 LF
```

The info items are as follows:

0140.0000	Tx Frequency in MHz
17.279483	Data rate in Mbps
DVBS2	Transmission mode: DVBS2 DVB-S DSNG
QP **8P** **16Q** **16A** **32A**	Modulation: QP = QPSK 8P = 8-PSK 16Q = 16-QAM 16A = 16-APSK 32A = 32-APSK
1/2	Code Rate
LF	FECFrame Type SF = Short Frame LF = Long Frame

INFO: INTFCx

```
Intfc1: ASI DISABLED
188  J4  Wide
```

ASI Only:

ASI	Interface Type ASI = Asynchronous Serial Interface per DVB GBEI = Gigabit Ethernet
Enabled	Enable / Disable status
188	Transport Stream Frame Type 188 = 188 byte frame ; 204 = 204 byte frame
J4	Tx Data Input Connector on Data Interface J4 or J5
Wide	Bandwidth Selection ASI (Tx Data) Wide or Narrow

5.3.5 Save/Load

```
Save/Load Configuration:
Save  Load    (◄ ►E)
```

Select **Save** or **Load**, using ◄ ► arrow keys, then press **ENTER**.

These sub-menus permit the user to store or load up to 10 different modem configurations in a non-volatile memory of the modem.

Save/Load: Save

```
Save Config to Loc: 0
Empty           (▲▼E)
```

The second line is a time stamp for a Saved Configuration. If no configuration is saved the second line is **Empty**.

If **Loc#** is selected, the following window appears:

```
Save Config to Loc: 0
01:02:43  05/08/05   (▲▼E)
```

If **Loc#** is selected, the following window appears:

```
Loc 0 Contains Data !
Overwrite? NO YES (◄ ►E)
```

Save/Load: Load

```
Load Config from Loc: 0
11:02:43  05/08/05 (▲▼E)
```

The second line is a time stamp for a Saved Configuration. If no configuration is saved the second line is **Empty**.

If **Loc#** is selected, the following window appears:

```
New Config has been
Loaded from Loc #   (◄ ►E)
```

5.3.6 Utility

```
UTIL: RT-Clk Ref ID
Display Firmware FAST
```

5.3.6.1 Utility: RT-Clk

```
Edit Real-Time Clock:
10:23:51 23/05/06 (◄ ► ▲ ▼ E)
```

Edit the time and date settings of the real-time clock. This is accomplished by selecting the digit to be changed, using the ◄ ► arrow keys. The value of the digit is then changed using ▲ ▼ arrow keys. The user should press **ENTER**.

Note: In accordance with international convention, the date is shown in **DAY-MONTH-YEAR** format.

5.3.6.2 Utility: Ref

```
Internal 10 MHz Ref Freq
Fine Adjust:+1911
```

This menu provides a fine adjustment for the internal 10 MHz reference.

For 'Tx Only' or 'Full Duplex' units, use the Tx IF Carrier to check the reference frequency by first placing the unit in the **Tx-CW** mode from the **Test** menu.

In 'Rx Only' units, 10 MHz is available at J6-8 or J6-9 only while within the **Utility: Ref** menu.

5.3.6.3 Utility: ID

```
Edit Circuit ID:  (◄ ►▲▼ E)
------------------------
```

Edit the Circuit ID string, using the ▲ ▼ ◄ ► arrow keys. Only the bottom line is available (24 characters). The cursor selects the position on the bottom line (◄ ►) and the character is then edited (▲ ▼). The following characters are available:

Space ( ) * + - , . / 0-9 and A-Z

When the user has composed the string, press **ENTER**.

5.3.6.4 Utility: Display

```
Edit Display Brightness:
100%   (▲▼ E)
```

Edit the display brightness, using the ▲ ▼ arrow keys. The user should then press **ENTER**.

5.3.6.5 Utility: Firmware

```
Firmware Images:
Info  Select       (◄ ► E)
```

Select **Info** or **Select** using the ◄ ► arrow keys. The user should then press **ENTER**.

Utility: Firmware: Info

```
Firmware Info: Bootrom
Image#1  Image#2
```

Selecting **Bootrom** presents the current firmware (FW) in the modem along with the date and revision version information. Also, see the table following the next menu.

Utility: Firmware: Info: Image

```
Image#1: Bulk App Framer
FEC Mod   Demod   Interfaces
```

Note: The following information is representative. Actual status is viewed in the modem menu.

Utility: Firmware: Info: Image#1	
BootRom	Bootrom: 09/09/04 CDM7XX_Boot 1.0.1
Image#1	Image#1: Bulk App Framer FEC Mod Interfaces
Utility: Firmware: Info: Image#1: XXXXXX	
Bulk	Bulk: 10/16/06 FW12437- 2.1.1
App	App: 10/16/06 FW12438 2.1.1
Framer	Framer: 08/09/06 FW12548- 2.1.1
FEC	Enc-S2 Enc-S Dec-S2
FEC: Enc-S2	DVB-S2 Enc 09/14/06 FW12439- 1.0.1
FEC: Enc-S	DVB-S Enc 09/14/06 FW12440- 1.0.1
FEC: Dec-S2	DVB-S2 Dec 06/14/06 FW12436- 1.0.1
Mod	Filters FPGA
Mod: Filters	Mod Filters: 11/23/05 FW12695- 1.1.1
Mod: FPGA	Mod FPGA 05/16/06 FW12549- 2.1.1
Demod	Filters UDD Equalizer
Demod: Filters	Demod Filters: 08/27/06 FW12694- 1.1.1
Demod: UDD	UDD FPGA: 07/18-06 FW12442- 1.0.1
Demod: Equalizer	EQ FPGA: 08/21/06 FW12441- 1.0.1
Interfaces	ASI GBEI
Intfc: ASI	ASI: 09/18/06 FW12546 1.0.1
Intfc: HSSI	HSSI: 08/09/07 FW0000024 1.0.0
Utility: Firmware: Info: Image#2	
BootRom	Bootrom: 09/09/04 CDM7XX_Boot 1.0.1
Image#2	Image#2: Bulk App Framer FEC Mod Interfaces

Utility: Firmware: Info: Image#2: XXXXXX	
Bulk	Bulk: 10/16/06 FW12437- 2.1.1
App	App: 10/16/06 FW12438 2.1.1
Framer	Framer: 08/09/06 FW12548- 2.1.1
FEC	Enc-S2 Enc-S Dec-S2
FEC: Enc-S2	DVB-S2 Enc 09/14/06 FW12439- 1.0.1
FEC: Enc-S	DVB-S Enc 09/14/06 FW12440- 1.0.1
FEC: Dec-S2	DVB-S2 Dec 06/14/06 FW12436- 1.0.1
Mod	Filters FPGA
Mod: Filters	Mod Filters: 11/23/05 FW12695- 1.1.1
Mod: FPGA	Mod FPGA 05/16/06 FW12549- 2.1.1
Demod	Filters UDD Equalizer
Demod: Filters	Demod Filters: 08/27/06 FW12694- 1.1.1
Demod: UDD	UDD FPGA: 07/18-06 FW12442- 1.0.1
Demod: Equalizer	EQ FPGA: 08/21/06 FW12441- 1.0.1
Interfaces	ASI GBEI
Intfc: ASI	ASI: 09/18/06 FW12546- 1.0.1
Intfc: HSSI	HSSI: 08/09/07 FW0000024 1.0.0

Utility: Firmware: Select

```
Current Active Image: #2
Next Reboot Image: #1 #2
```

This menu is used to select the active software image. The top line shows the active image. On the second line, select the desired image, then press **ENTER.** To make the selected image active it is necessary to power cycle the modem to reboot the new software.

5.3.6.6 Utility: FAST:

```
FAST:Cnfg View
MainBoard S/N: 333333333
```

Utility: FAST: Configuration

If **Cnfg** is selected:

```
FAST Configuration
Edit Code  Demo Mode
```

Utility: FAST: Configuration: Edit

If **Edit** is selected:

```
Edit 20 digit FAST Code:
00000000000000000000 ENT
```

Utility: FAST: Configuration: Demo

If **Demo** is selected:

Not available at this time.

Utility: FAST: Configuration: View

If **View** is selected:

```
View Options: 01 (▲▼)
IF Modulator Installed
```

Press ▲ ▼ keys to view each of the installed options.

Chapter 6. FLASH UPGRADING

Refer to Chapter 11 for the Gigabit Ethernet Interface upgrade procedure.

The CDM-710 eliminates the need for updating firmware by physically replacing EPROMs. Instead, the CDM-710 modem uses 'flash memory' technology internally, and new firmware can be uploaded to the unit from an external PC, as follows:

- Go online to: **www.comtechefdata.com**
- Click on: **Support**
- Click on: **Software Downloads**
- Click on: **Flash Update Files**

This makes software upgrading very simple, and updates can now be sent via the Internet, E-mail, or on disk. The upgrade can be performed without opening the unit, by simply connecting the modem to the Ethernet port of a computer.

The user must reflash both images with the same firmware version for the unit to function properly.

The upgrade from an earlier version to 4.x.x is a one way upgrade path. Once an upgrade to 4.0.1 is completed it is no longer possible to revert to earlier versions. If reflash to an earlier version is attempted the modem will detect and disallow it as a protective measure. The unit will also disallow an attempt to switch to an image with an earlier version of firmware.

6.1 Ethernet FTP upload procedure:

1. Identify the reflashable product, firmware number, and version for download.

The current base modem M&C version can be viewed at the top-level menu of the front panel display (press "CLR" button several times to view). Also, you can find the firmware information within the <Util > <Firmware > <Info> <Image#1, Image#2 > menu tree.

Using serial remote control, you can query the firmware revision levels with the <0/SWR? Command. (Abbreviated)
Or
<0/FRW? Command (Detailed)

2. Create a temporary directory (folder) on your PC.

Windows: Select File > New > Folder > and rename the New Folder to "**temp**" or another convenient and unused name. Assuming "**temp**" works, you should now have a "**c:\temp**" folder created.

> **Note:** The **c:** is the drive letter used in this example. Any valid writable drive letter can be used.

Alternative Method – CMD Prompt: At the command prompt (**c:\>**) type "**MD temp**" without quotes (MD stands for make directory). This is the same as creating a new folder from Windows. You should now have a "**c:\temp**" subdirectory created, where **c:** is the drive letter used in the example.

3. Download the correct firmware file to this temporary folder.

Access the download server with the flash firmware data files link,
http://206.223.8.10/linksite/flashupgrades/CDM710/

About Firmware Numbers, File Versions, and Formats:

The flashable files on the download server are organized by product first, then by firmware number, (make sure you know the correct firmware number; see step 1) version, if applicable, and release date. The base modem bulk firmware for the CDM-710 is:

FW12437*_*_*. Later Units with version 2.1.1 or later (round keypad buttons)
FW12050*_*_*. Earlier Units with version 1.1.3 or earlier
(where the asterisks show revision, version and date)

The current version firmware release is provided. If applicable, one version prior to the current release is also available. Be sure to identify and download the desired version.

The downloadable files are stored in two formats: *.exe (self extracting) and *.zip (compressed). Some firewalls will not allow the downloading of *.exe files. In this case, download the *.zip file instead.

For additional help with "zipped" file types, refer to "pkzip for windows", "winzip", or "zip central" help files. Pkzip for DOS is not supported due to file naming conventions.

4. Unzip the files in the temporary folder on your PC.

At least 3 files should be extracted:

a. **FW12437**x.bin, where "x" is the version (bulk image file) for later units.
Note: **FW12050**x.bin for earlier units.
b. **FW12437**x.txt, where "x" is the version (history notes) for later units.
Note: **FW12050**x.txt for earlier units.
c. README.TXT installation notes

5. **Connect the client PC to the CDM-710 modem 10/100 Ethernet M&C via a hub or a switch, or directly to a PC with a crossover cable.**

Verify the communication and connection by issuing a "ping" command to the modem. You can find the IP address of the modem either remotely using the <0/IPA? command or from the front panel with the <Config> <Remote> <Remote> <Ethernet> menus.

To PING and FTP from DOS, press the “Start” button on the Windows toolbar, and select the “Run...” option. From Win95 or Win98, type “command”. From WinNT, Win2K or WinXP, type “cmd”. You can also use the “DOS Prompt” or “Command Prompt” icons in the Start Menu. Now change to the temporary directory you created earlier with “cd c:\temp”. A quick “dir” will show the downloaded files.

6. **Initiate an FTP session with the modem. The example is with a DOS window.**

a. From the PC, type "ftp xxx.xxx.xxx.xxx" where "xxx.xxx.xxx.xxx" is the IP address of the CDM-710.

b. Enter your admin user name and password to complete login.
Factory Default user is: COMTECH
Password is: COMTECH

c. Verify your FTP transfer is binary by typing "bin".

d. Type "prompt" then type "hash" to facilitate the file transfers.

7. **Transfer the files.**

Type "put **FW12437***.bin bulk:" (for later units with round keypad buttons) or "put **FW12050***.bin bulk:" (for earlier units) to begin the file transfers. The destination “bulk:” must be all lower-case. It will take approximately one minute to transfer the file.

8. **Verify the file transfer.**

    a. The PC should report that the file transfer has occurred, and the display on the modem will start reporting "PROGRAMMING FLASH SECTOR#xx – PLEASE WAIT".

Stopping the FTP before the "PROGRAMMING FLASH SECTOR#xx-PLEASE WAIT" screen has finished could lead to an incomplete download and a repeat of step 8a.

    b. Terminate the FTP session by typing "bye" and closing the DOS window.

    c. Verify that the new file loaded using the procedure in step 1.

9. **Change the desired image to boot using the <Util> <Firmware> <Select> <left or right arrow to change to the other image>, then cycle power to reboot the modem.**

10. **Verify the new software versions are booting by observing the following messages on the modem display (version number will vary):**

```
Comtech CDM-710 Modem
Firmware Version: 2.1.x
```

11. **Repeat steps 6 through 10 for the opposite image, using the same downloaded firmware file.**

Chapter 7. FORWARD ERROR CORRECTION OPTIONS

7.1 Introduction

The CDM-710 Modem operates with error correction base upon the DVB standards:

- DVB-S: QPSK with concatenated Viterbi and Reed Solomon.
- DVB-DSNG: 8-PSK and 16-QAM with concatenated Viterbi and Reed Solomon.
- DVB-S2: QPSK, 8-PSK, 16-APSK and 32-APSK with concatenated Low Density Parity Code (LDPC) and Bose-Chaudhuri-Hocquenghem (BCH).

DVB-S and DVB-DSNG anchor one the most widely adopted modulation and coding schemes deployed today and are universally employed for satellite broadcast and related applications today. Now DVB-S2 has defined a new generation of performance that boosts throughput by about 30% over the same transponders using a new type coding that exceeds the capability of concatenated Viterbi and Reed Solomon coding.

7.2 Viterbi and Reed Solomon

The concatenated Viterbi and Reed Solomon coding technique produces significant improvement over Viterbi decoding alone. Simplistically, a Reed Solomon block decoder follows the convolutional Viterbi decoder to further enhance error correction. Errors exiting the Viterbi decoder tend to occur in clusters or errors bursts. The Reed Solomon decoder works well correcting burst errors so the combination delivers improved performance. To further improve the error correcting capability, an interleaver is placed between the two schemes to spread the errors so fewer occur in a given block.

7.3 LDPC and BCH

LDPC and BCH is also concatenated technique. LDPC is a very powerful coding scheme with significant, near Shannon bound, performance. In some cases, as the carrier to noise ratio increases, the LDPC error correction starts flaring toward an error floor so BCH error correction follows LDPC and eliminates the flare for any practical range of error rates.

LDPC also functions differently than Viterbi decoding by using iterative decoding. In this process the data initially corrected by the LDPC decoder is re-encoded and run through the decoder again to correct additional errors. Key to this is the soft decision output from the LDPC decoder and a high-speed processor operating at a rate much higher than the data rate. The LDPC decoder runs the iterative process as many times as possible before corrected data is finally outputted to make way for a new block of data entering the decoder. LDPC also uses interleaving to spread the errors. In contrast, Viterbi error correction operates by passing data through the convolutional error correction process a single time.

The error correcting capability of LDPC is improved by using large block sizes. This also increases latency. However, in one-way broadcast applications this is not a drawback. Links with LDPC normally operate at multi-megabit data rates where latency effects are reduced. The standard block size for LDPC is 64,800 bits, and for lower data rate applications there is a short frame block at 16,800 bits that suffers only a small error correcting loss (0.2 to 0.3 dB) compared to the standard block.

7.3.1 Range of Data Rates

Note: For a detailed Data Rate Range refer to Chapter 8, Summary of Specifications.

7.3.2 Eb/No, Es/No Spectral Efficiency and Occupied Bandwidth

Depending upon the operating mode DVB standard uses different modes of specifying performance with a modem in IF Loop and additive white Gaussian noise (AWGN):

- **DVB-S (QPSK with Viterbi and Reed Solomon):** BER = $2x10^{-4}$ after Viterbi (before Reed Solomon) and QEF after Reed Solomon at the specified Eb/No and includes a modem implementation loss of 0.8 dB and the noise bandwidth increase due to the outer code (10 log 188/204 = 0,36 dB).

  QEF is Quasi-Error-Free (QEF) and corresponds to less than one uncorrected error event per hour, or BER = 10^{-10} to 10^{-11} at the input of an MPEG-2 demultiplexer. This is the error rate most commonly used.

- **DVB-DSNG (8-PSK and 16-QAM with Viterbi and Reed Solomon):** Similar to DVB-S. The modem implementation ranges from 1.0 dB (8-PSK 2/3) to 2.1 dB (16-QAM 7/8).

- **DVB-S2 (QPSK, 8-PSK, 16-APSK and 32-APSK with LDPC and BCH):** PER (packet error rate) = 10-7 after LDPC and BCH at the specified Es/No. This is a theoretical value with perfect carrier recovery and symbol synchronization, and no modem oscillator phase noise. The manufacturer decides the implementation margin and specifies performance.

  The other difference is the use of PER (packet error rate) based upon a 188 or 204 byte MPEG frame size instead of BER (bit error rate).

  Also, note the use of Es/No instead of Eb/No. When links operate at constant symbol rate so this is good method for comparing the performance of different modulation types and code rates. The relation between the two quantities is given by:

  Eb/No = Es/No - 10xLog(Spectral Efficiency)

The table that follows provides the spectral efficiency for all of the DVB schemes. Another useful parameter is the occupied bandwidth is the bandwidth between -10 dB points of the power spectral density, which are approximately:

Occupied Bandwidth = 1.19 x Symbol **Rate**, for 35% Rolloff
= 1.15 x Symbol **Rate**, for 25% Rolloff
= 1.12 x Symbol **Rate**, for 20% Rolloff

Table 7-1 provides the Eb/No, spectral efficiency and occupied bandwidth for the CDM-710.

Table 7-1. Eb/No, Spectral Efficiency and Occupied Bandwidth

Mode	Type	FEC Code	Inner Code Rate	Eb/No At QEF	Spectral Efficiency (bps/Hz)	Normalized Symbol Rate (= Bit Rate x)	Occupied * Bandwidth for 10 Mbps (35% Rolloff)
DVB-S	QPSK	Conv+RS	1/2	4.5	0.921569	1.085	12.913
DVB-S	QPSK	Conv+RS	2/3	5.0	1.228758	0.814	9.685
DVB-S	QPSK	Conv+RS	3/4	5.5	1.382353	0.723	8.609
DVB-S	QPSK	Conv+RS	5/6	6.0	1.535948	0.651	7.748
DVB-S	QPSK	Conv+RS	7/8	6.4	1.612745	0.620	7.379
DVB-DSNG	8-PSK	Conv+RS	2/3	6.9	1.843137	0.543	6.456
DVB-DSNG	8-PSK	Conv+RS	5/6	8.9	2.303922	0.434	5.165
DVB-DSNG	8-PSK	Conv+RS	8/9	9.4	2.457516	0.407	4.842
DVB-DSNG	16-QAM	Conv+RS	3/4	9.0	2.764706	0.362	4.304
DVB-DSNG	16-QAM	Conv+RS	7/8	10.7	3.225490	0.310	3.689

QPSK 1/4, 1/3 and 2/5 are for information purposes.

DVB-S2 Standard FECFrame = 64, 800 bits

Type	Inner FEC Code	**Es/No At PER = 10^{-7}	Spectral Efficiency (bps/Hz)	Normalized Symbol Rate (= Bit Rate x)	* Occupied BW for 10 Mbps (25% Rolloff)	Spectral Efficiency (bps/Hz)	Normalized Symbol Rate (= Bit Rate x)	* Occupied BW for 10 Mbps (25% Rolloff)
			Pilots Off			Pilots On		
QPSK	1/4	-1.85	0.490243	2.040	23.458	0.478577	2.090	24.030
QPSK	1/3	-0.74	0.656448	1.523	17.519	0.640827	1.560	17.946
QPSK	2/5	0.20	0.789412	1.267	14.568	0.770627	1.298	14.923
QPSK	1/2	1.50	0.988858	1.011	11.630	0.965327	1.036	11.913
QPSK	3/5	2.73	1.188304	0.842	9.678	1.160026	0.862	9.914
QPSK	2/3	3.60	1.322253	0.756	8.697	1.290788	0.775	8.909
QPSK	3/4	4.53	1.487473	0.672	7.731	1.452076	0.689	7.920
QPSK	4/5	5.18	1.587196	0.630	7.245	1.549426	0.645	7.422
QPSK	5/6	5.68	1.654663	0.604	6.950	1.615288	0.619	7.119
QPSK	8/9	6.70	1.766451	0.566	6.510	1.724416	0.580	6.669
QPSK	9/10	6.92	1.788612	0.559	6.430	1.746049	0.573	6.586
8PSK	3/5	6.20	1.779991	0.562	6.461	1.739569	0.575	6.611
8PSK	2/3	7.32	1.980636	0.505	5.806	1.935658	0.517	5.941
8PSK	3/4	8.61	2.228124	0.449	5.161	2.177525	0.459	5.281
8PSK	5/6	10.15	2.478562	0.403	4.640	2.422276	0.413	4.748
8PSK	8/9	11.49	2.646012	0.378	4.346	2.585924	0.387	4.447
8PSK	9/10	11.78	2.679207	0.373	4.292	2.618365	0.382	4.392
16APSK	2/3	9.97	2.637201	0.379	4.361	2.574613	0.388	4.467
16APSK	3/4	11.21	2.966728	0.337	3.876	2.896320	0.345	3.971
16APSK	4/5	12.03	3.165623	0.316	3.633	3.090495	0.324	3.721
16APSK	5/6	12.61	3.300184	0.303	3.485	3.221863	0.310	3.569
16APSK	8/9	13.89	3.523143	0.284	3.264	3.439530	0.291	3.343
16APSK	9/10	14.13	3.567342	0.280	3.224	3.482680	0.287	3.302
32APSK	3/4	13.73	3.703295	0.270	3.105	3.623332	0.276	3.174
32APSK	4/5	14.64	3.951571	0.253	2.910	3.866247	0.259	2.974
32APSK	5/6	15.28	4.119540	0.243	2.792	4.030589	0.248	2.853
32APSK	8/9	16.69	4.397854	0.227	2.615	4.302894	0.232	2.673
32APSK	9/10	17.05	4.453027	0.225	2.583	4.356875	0.230	2.640

*The occupied bandwidth is 1.19 x Symbol Rate for 35% and 1.15 x Symbol Rate for 25% taken at the -10 dB points on the plot of power spectral density.
**Includes implementation loss.

The figures that follow contain the error performance characteristics. To convert Es/No to Eb/No use Eb/No = Es/No - 10xLog(Spectral Efficiency).

QPSK 1/4, 1/3 and 2/5 are for information purposes. Es/No for short FECFrame is about 0.3 dB higher than the standard. Values in the table are approximate.

DVB-S2 Short FECFrame = 16,200 bits

Type	Inner FEC Code	**Es/No At PER = 10^{-7}	Spectral Efficiency (bps/Hz)	Normalized Symbol Rate (= Bit Rate x)	* Occupied BW for 10 Mbps (25% Rolloff)	Spectral Efficiency (bps/Hz)	Normalized Symbol Rate (= Bit Rate x)	* Occupied BW for 10 Mbps (25% Rolloff)
			Pilots Off			Pilots On		
QPSK	1/4	-1.55	0.365324	2.737	31.479	0.357467	2.797	32.171
QPSK	1/3	-0.44	0.629060	1.590	18.281	0.615532	1.625	18.683
QPSK	2/5	0.50	0.760928	1.314	15.113	0.744564	1.343	15.445
QPSK	1/2	1.80	0.848840	1.178	13.548	0.830585	1.204	13.846
QPSK	3/5	3.03	1.156532	0.865	9.944	1.131661	0.884	10.162
QPSK	2/3	3.90	1.288400	0.776	8.926	1.260693	0.793	9.122
QPSK	3/4	4.83	1.420269	0.704	8.097	1.389725	0.720	8.275
QPSK	4/5	5.48	1.508181	0.663	7.625	1.475747	0.678	7.793
QPSK	5/6	5.98	1.596093	0.627	7.205	1.561768	0.640	7.363
QPSK	8/9	7.00	1.727961	0.579	6.655	1.690800	0.591	6.802
QPSK	9/10	7.22	NA	NA	NA	NA	NA	NA
8PSK	3/5	6.50	1.725319	0.580	6.665	1.692033	0.591	6.797
8PSK	2/3	7.62	1.922040	0.520	5.983	1.884959	0.531	6.101
8PSK	3/4	8.91	2.118761	0.472	5.428	2.077885	0.481	5.534
8PSK	5/6	10.45	2.381056	0.420	4.830	2.335120	0.428	4.925
8PSK	8/9	11.79	2.577778	0.388	4.461	2.528046	0.396	4.549
8PSK	9/10	12.08	NA	NA	NA	NA	NA	NA
16APSK	2/3	10.27	2.548792	0.392	4.512	2.505223	0.399	4.590
16APSK	3/4	11.51	2.809662	0.356	4.093	2.761633	0.362	4.164
16APSK	4/5	12.33	2.983575	0.335	3.854	2.932574	0.341	3.921
16APSK	5/6	12.91	3.157488	0.317	3.642	3.103514	0.322	3.705
16APSK	8/9	14.19	3.418357	0.293	3.364	3.359924	0.298	3.423
16APSK	9/10	14.43	NA	NA	NA	NA	NA	NA
32APSK	3/4	14.03	3.493093	0.286	3.292	3.419165	0.292	3.363
32APSK	4/5	14.94	3.709309	0.270	3.100	3.630805	0.275	3.167
32APSK	5/6	15.58	3.925526	0.255	2.930	3.842446	NA	NA
32APSK	8/9	16.99	4.249850	0.235	2.706	4.159906	0.240	2.764
32APSK	9/10	17.35	NA	NA	NA	NA	NA	NA

*The occupied bandwidth is 1.19 x Symbol Rate for 35% and 1.15 x Symbol Rate for 25% taken at the -10 dB points on the plot of power spectral density.
**Includes implementation loss.

The figures that follow contain the error performance characteristics. To convert Es/No to Eb/No use Eb/No = Es/No - 10xLog(Spectral Efficiency).

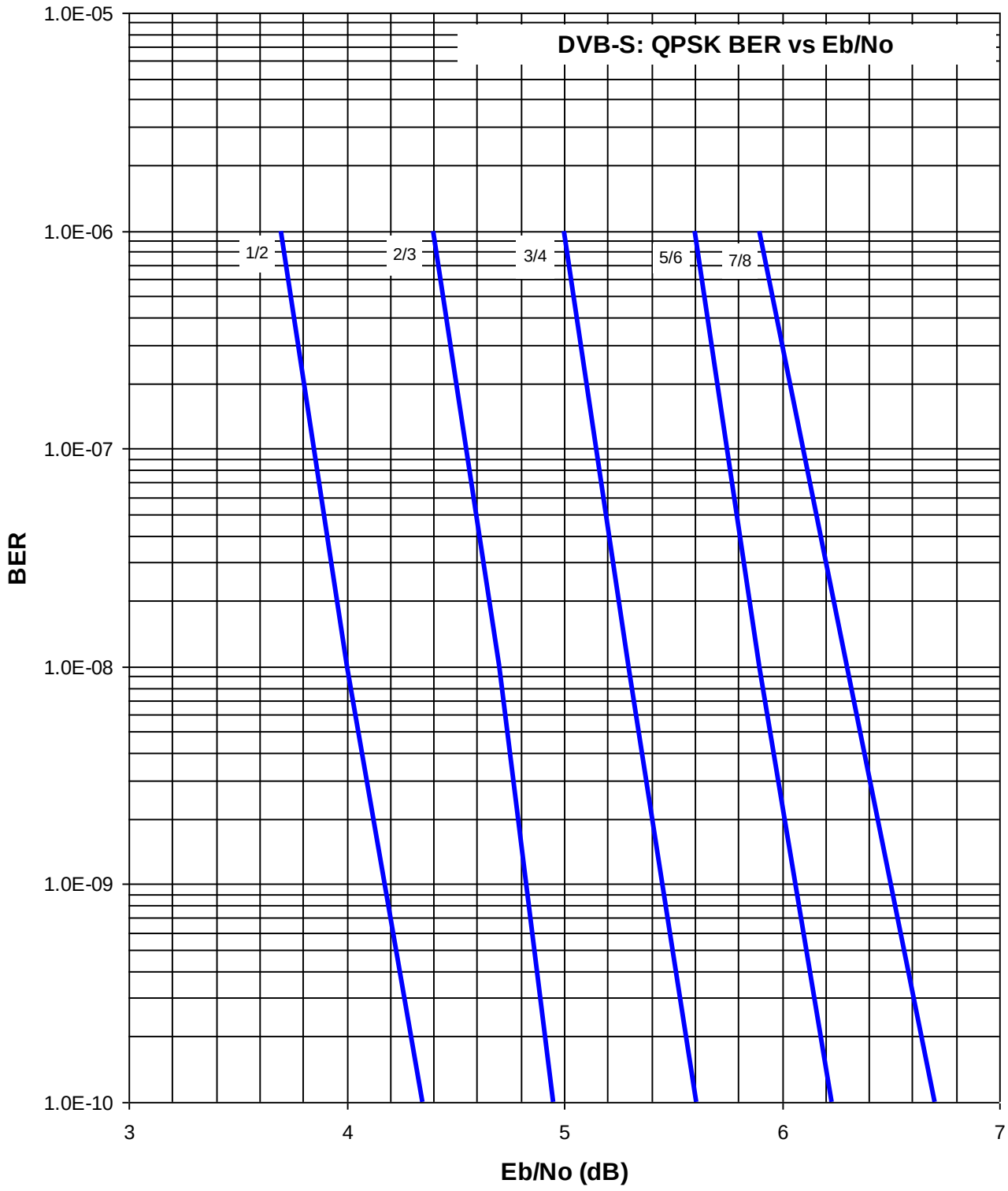


Figure 7-1. DVB-S QPSK BER versus Eb/No

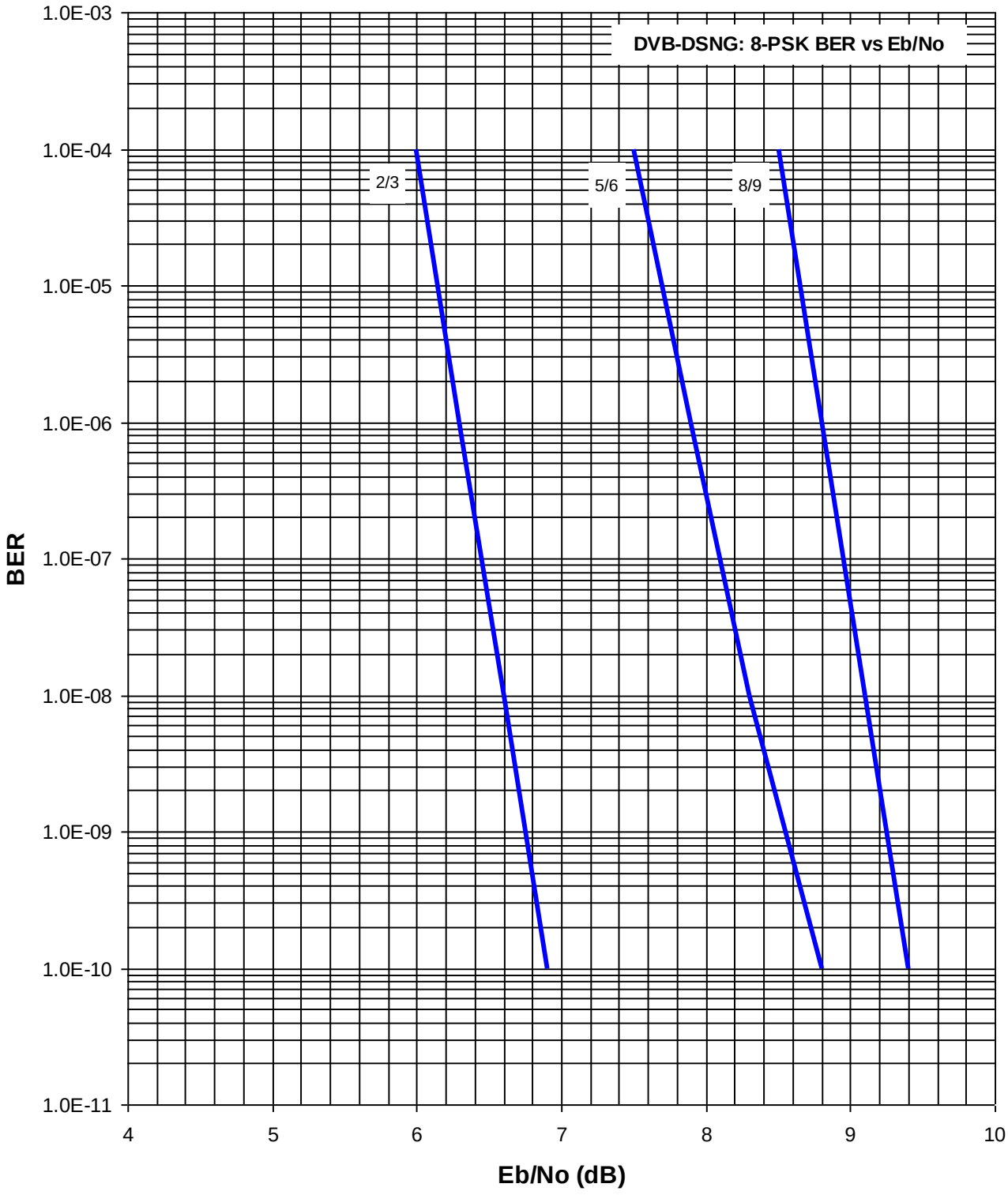


Figure 7-2. DVB-DSNG 8-PSK BER versus Eb/No

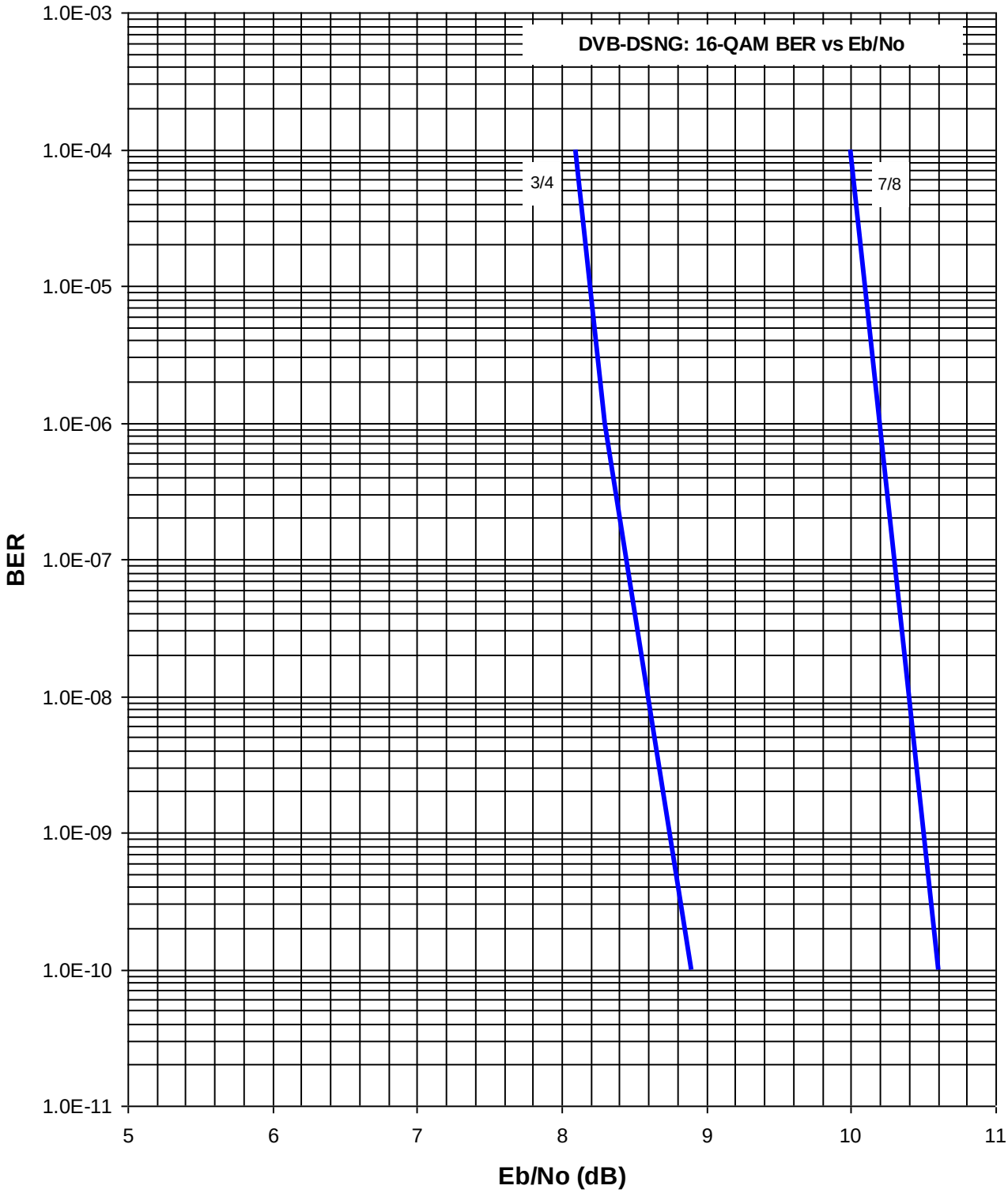


Figure 7-3. DVB-DSNG 16-QAM

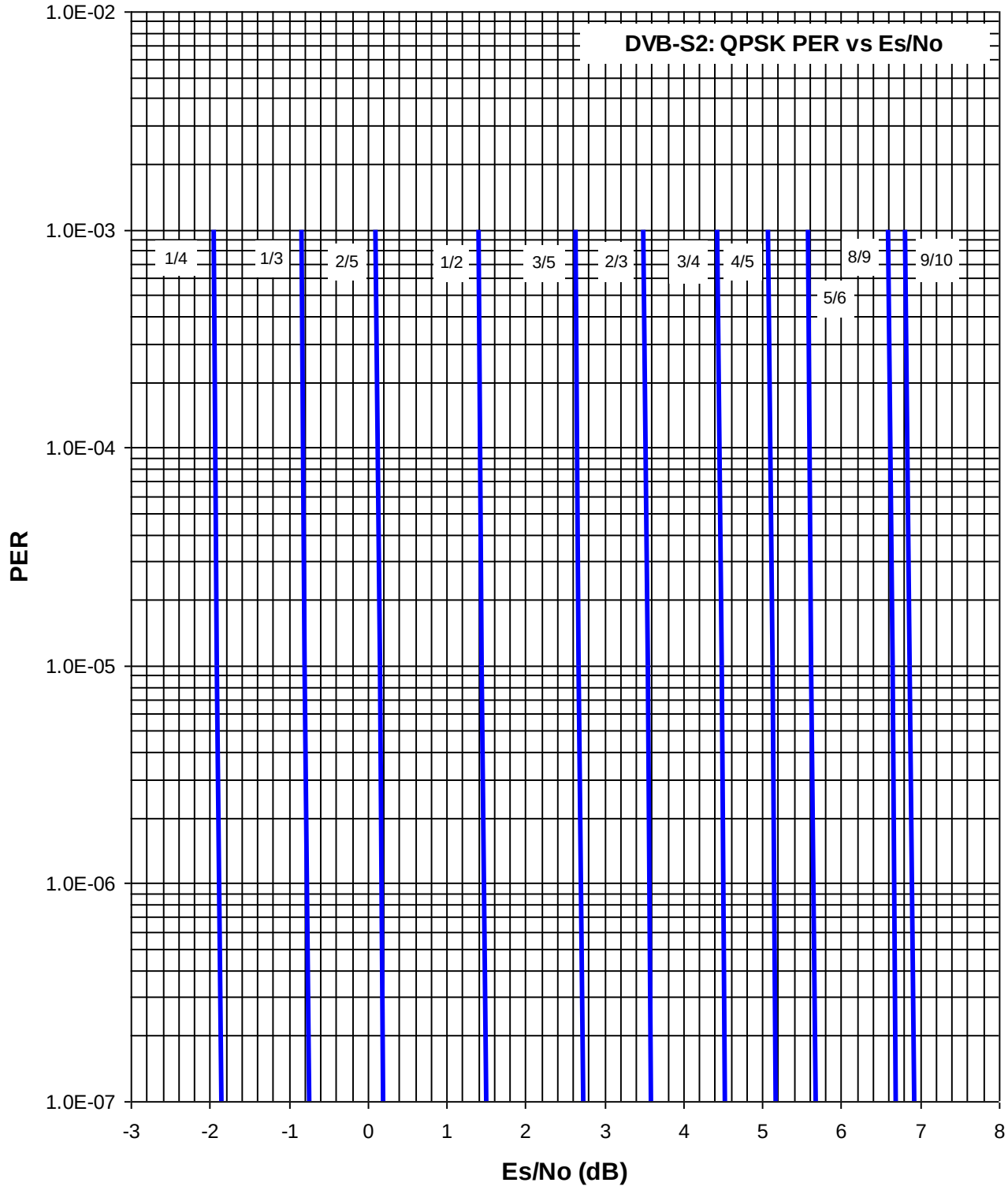


Figure 7-4. DVB-S2 QPSK Packet Error Rate versus Es/No (QPSK 1/4, 1/3, and 2/5, Information Only)

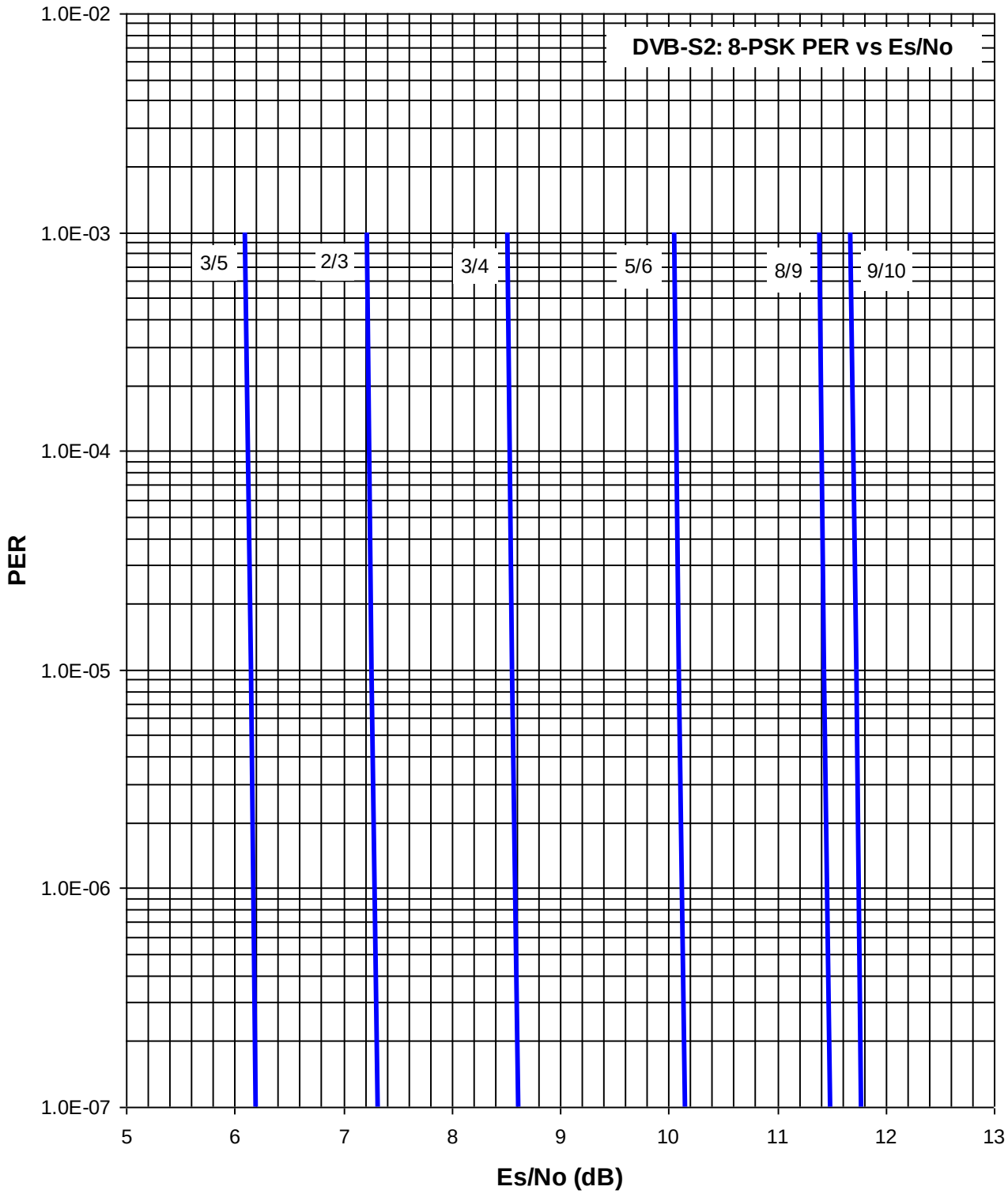


Figure 7-5. DVB-S2 8-PSK Packet Error Rate versus Es/No

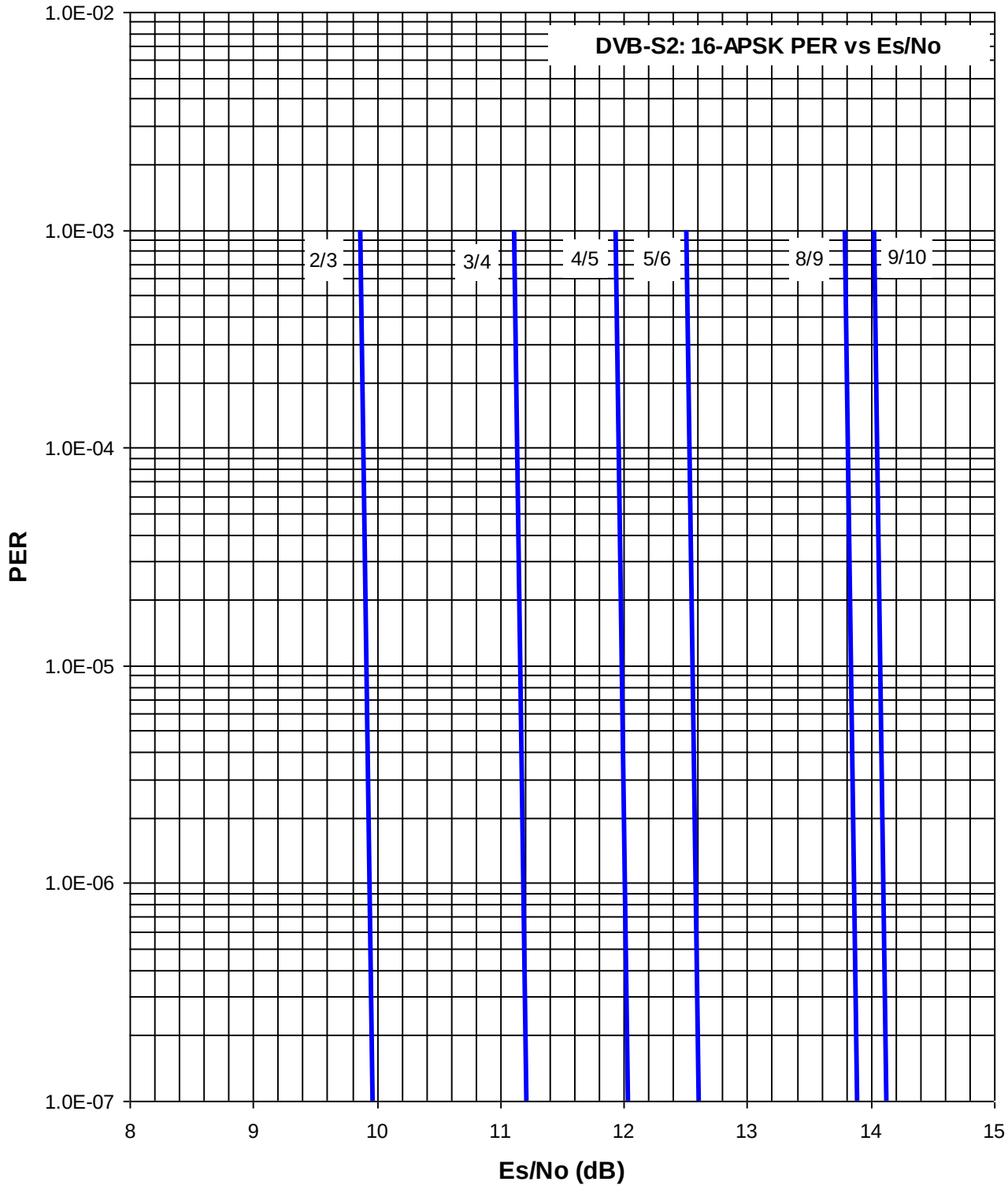


Figure 7-6. DVB-S2 16-APSK Packet Error Rate versus Es/No

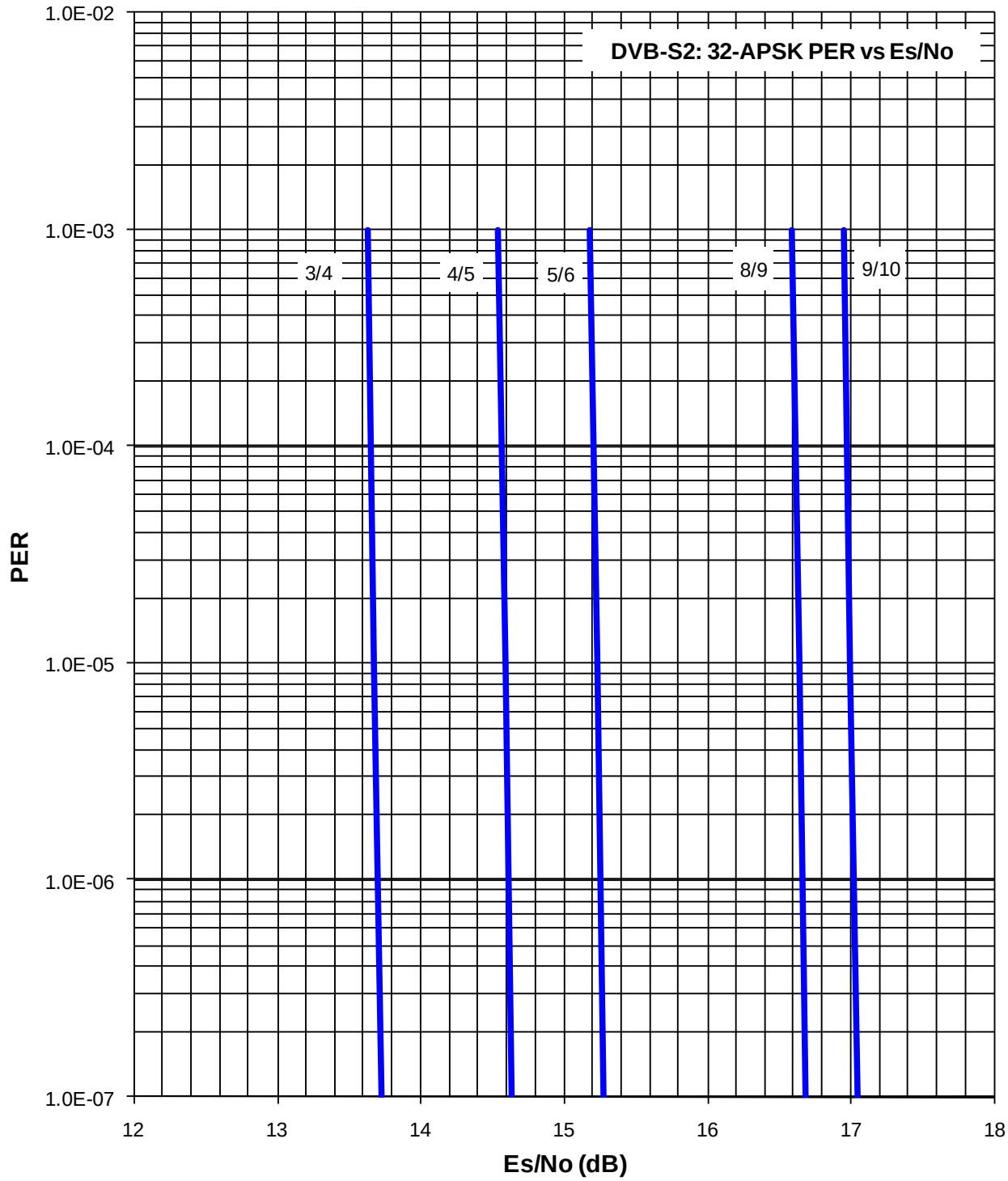


Figure 7-7. DVB-S2 32-APSK Packet Error Rate versus Es/No

Chapter 8. SUMMARY OF SPECIFICATIONS

8.1 Summary of Specifications

Description		Requirements
Type:	DVB-S2	EN 302 307
	DVB-S	EN 301 421
	DVB-DSNG	EN 301 210
Symbol Rate:	DVB-S	1 to 45 Msps
	DVB-S2	1 to 45 Msps (QPSK, 8PSK), 35 Msps (16APSK), 28 Msps (32APSK)
	DVB-DSNG	1 to 45 Msps
Data Rate		Corresponds to symbol rate. See paragraph 8.10
Symbol Rate / Data Rate		See modulator/demodulator
Modulation/FEC:		
	DVB-S2	QPSK 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10 LDPC + BCH 8-PSK 3/5, 2/3, 3/4, 5/6, 8/9, 9/10 LDPC + BCH 16-APSK 2/3, 3/4, 4/5, 5/6, 8/9, 9/10 LDPC + BCH 32-APSK 3/4, 4/5, 5/6, 8/9, 9/10
	DVB-S	QPSK 1/2, 2/3, 3/4, 5/6, 7/8 Convolutional + Reed Solomon
	DVB-DSNG	8-PSK 2/3, 5/6, 8/9 Convolutional + Reed Solomon 16-QAM 3/4, 7/8 Convolutional + Reed Solomon
Operating Modes		CCM only
Transport Streams		Only Single Transport Stream supported
Spectral Mask		20%, 25%, or 35% (per DVB-S, DSNG, S2) See Figure 8-1 and Table 8-1.
M&C/Remote Port		RS-232 and RS-485 2W/4W with Comtech EF Data protocol 10/100 Base-T Ethernet with HTTP, SNMP or Telnet
Physical (PL) Layer Scrambling		User specified value (one) of n = 0 to 262,141, per EN 302 307.
Pilot Insertion		Selection for On or Off
Reflash		Ethernet port
Frequency Reference		Selectable
Internal Reference		10 MHz for data and IF, stability ± 1.5 ppm
External Clock		For data interfaces only, not IF. Clock Input depends upon data interface module.
External Ref		1, 2, 5, 10 or 20 MHz for IF, internally phase locked. Input is 50 or 75Ω compatible with 0.5 to 4.0 Up-p sine or square wave. Requires high stability source.

Description	Requirements
1:1 Redundancy	Built in controller for operation with optional CRS-170A for L-Band and CRS-180 for 70/140 MHz
Fault	Form C, see connector pinout information and notes
Configuration	Non-volatile for 1-year minimum and returns upon power up.
External Tx Carrier Off	TTL low signal – path bypasses microprocessor (Alarm Conn)
Agency Approval	Safety, conducted and radiated emissions and Immunity sufficient for CE certification

8.2 Environmental and Physical

Description	Requirements
Temperature: Operating Storage	 0 to 50ºC (32 to 122ºF) -20 to 70ºC (-4 to 158ºF)
Humidity: Operating Storage	 95% maximum, non-condensing 99% maximum, non-condensing
Power Supply Input	100-240AC 50/60Hz, auto-ranging
Power Supply Input	-48VDC
Fuse	AC, T2.00A, 5x20 mm.250VAC time lag DC, T6.25A, 6.3x32mm.(3AG), 250VAC time lag
Power Consumption	< 75 W, 55W typical
AC Power Cord Retainer	Standard
Modular design	Simplex or Duplex
Dimensional Envelope, 1RU	1.72H x 19.00W x 18.65D inches (4.37H x 48.26W x 47.37D cm)
Weight	15lbs (6.8 kg)
Keypad and Display	2 lines x 24-character display with up, down, left, right, Clear, and Enter keys.

8.3 70/140 MHz Modulator

Description	Requirements
Frequency	52 to 88 MHz or 104 to 176 MHz in 100Hz steps. Bandwidth of transmitted spectrum is within IF frequency range.
Impedance	75 Ω or 50 Ω, programmable
Connector	BNC Female
Return Loss	18 dB
Output Power	0 to -20 dBm in 0.1 dB steps. Carrier is not interrupted when changing between output power levels or removing data connections.
Output Power Accuracy	± 0.5 dB at 25°C
Output Power Stability	Within ± 0.5 dB of 25C value over all specified environments
Carrier Mute	55 dB below main carrier output
Harmonics and Spurious	-55 dBc/4 kHz over operating frequency range (excludes spectral mask area) and is with a modulated carrier -55 dBc/4 kHz 10 to 52 MHz, 176 to 250 MHz
Integrated Phase Noise	Continuous component < 1 degrees RMS double-sided, 100 Hz to 10 MHz
Spectral Inversion	Normal or Inverted
Quadrature Phase Error	< 2°
Quadrature Amplitude Imbalance	0.2 dB maximum
Carrier Null	35 dB below an unmodulated carrier
Combined Amplitude Imbalance and Quadrature Phase Error	Single sideband test with suppressed sideband 35 dB minimum below unmodulated carrier

8.4 L-Band Modulator

Description	Requirements
Frequency	950 to 1950 MHz in 100Hz steps. Bandwidth of transmitted spectrum is within IF frequency range.
Impedance	50 Ω
Connector	Type N Male
Return Loss	15 dB
Output Power	-5 to -25 dBm in 0.1 dB steps. Carrier is not interrupted when changing between output power levels or removing data connections.
Output Power Accuracy	± 0.5 dB at 25°C
Output Power Stability	Within ± 0.5 dB of 25C value over all specified environments
Carrier Mute	55 dB below main carrier output
Harmonics and Spurious	-55 dBc/4 kHz over operating frequency range (excludes spectral mask area) and is with a modulated carrier -55 dBc/4 kHz 250 to 950 MHz, 1950 to 2500 MHz
Integrated Phase Noise	Continuous component < 1 degrees RMS double-sided, 100 Hz to 10 MHz
Spectral Inversion	Normal or Inverted
Quadrature Phase Error	< 2°
Quadrature Amplitude Imbalance	0.2 dB maximum
Carrier Null	35 dB below an unmodulated carrier
Combined Amplitude Imbalance and Quadrature Phase Error	Single sideband test with suppressed sideband 35 dB minimum below unmodulated carrier

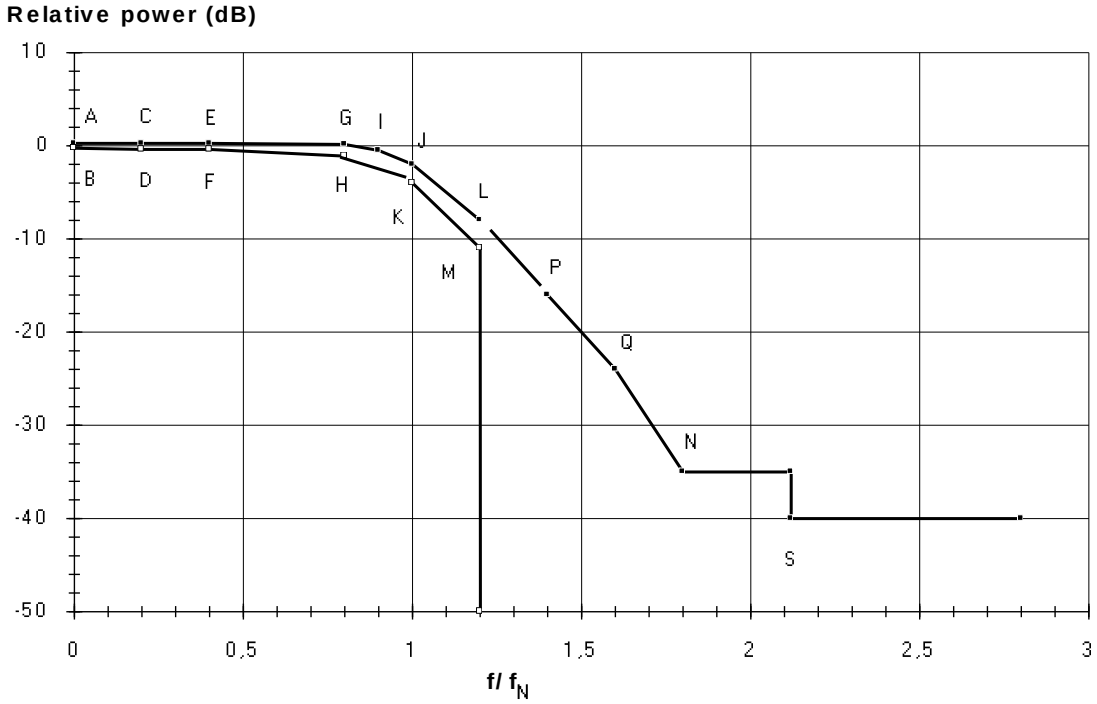


Figure 8-1. Spectral Mask

Table 8-1. Definition of Points For Spectral Mask

Point	Frequency for α=0,35	Frequency for α=0,25	Frequency for α=0,20	Relative power (dB)	Group delay
A	0,0 f_N	0,0 f_N	0,0 f_N	+0,25	+0,07/f_N
B	0,0 f_N	0,0 f_N	0,0 f_N	-0,25	-0,07/f_N
C	0,2 f_N	0,2 f_N	0,2 f_N	+0,25	+0,07/f_N
D	0,2 f_N	0,2 f_N	0,2 f_N	-0,40	-0,07/f_N
E	0,4 f_N	0,4 f_N	0,4 f_N	+0,25	+0,07/f_N
F	0,4 f_N	0,4 f_N	0,4 f_N	-0,40	-0,07/f_N
G	0,8 f_N	0,86f_N	0,89 f_N	+0,15	+0,07/f_N
H	0,8 f_N	0,86 f_N	0,89 f_N	-1,10	-0,07/f_N
I	0,9 f_N	0,93 f_N	0,94 f_N	-0,50	+0,07/f_N
J	1,0 f_N	1,0 f_N	1,0 f_N	-2,00	+0,07/f_N
K	1,0 f_N	1,0 f_N	1,0 f_N	-4,00	-0,07/f_N
L	1,2 f_N	1,13 f_N	1,11 f_N	-8,00	-
M	1,2 f_N	1,13 f_N	1,11 f_N	-11,00	-
N	1,8 f_N	1,60 f_N	1,5 f_N	-35,00	-
P	1,4 f_N	1,30 f_N	1,23 f_N	-16,00	-
Q	1,6 f_N	1,45 f_N	1,4 f_N	-24,00	-
S	2,12 f_N	1,83 f_N	1,7 f_N	-40,00	-

8.5 70/140 MHz Demodulator

Description	Requirements
Frequency Range	52 to 88 and 104 to 176 MHz in 100 Hz steps
Impedance/Connector	50 Ω or optional 75 Ω/BNC Female
Return Loss	15 dB
Input Power, Minimum	-58 + 10xLog(Symbol Rate in MHz) dBm, -58 dBm at 1 Msps, -41.5 dBm at 45 Msps. See Figure 8-2.
AGC Range	45 dB above minimum
Max Composite Level	+20 dBc composite to desired up to +10 dBm
Acquisition Range	± 100 kHz programmable in 1 kHz steps
Acquisition Time	Typical < 5 seconds, DVB-S and DVB-DSNG Typical < 10 seconds, DVB-S2 Pilots On.
Adaptive Equalizer	Up to 3 dB tilt
BER Performance	See Table 8-2 to Table 8-5
IQ Test Point	Accessible from rear panel Alarm connector

8.6 L-Band Demodulator

Description	Requirements
Frequency Range	950 MHz to 1950 MHz in 100 Hz steps
Impedance/Connector	50 Ω/Type N Female
Return Loss	10 dB
Input Power, Minimum	-58 + 10xLog(Symbol Rate in MHz) dBm, -58 dBm at 1 Msps, -41.5 dBm at 45 Msps
AGC Range	45 dB above minimum
Max Composite Level	+30 dBc composite to desired up to +10 dBm
Acquisition Range	± 100 kHz programmable in 1 kHz steps
Acquisition Time	Typical < 5 seconds, DVB-S and DVB-DSNG Typical < 10 seconds, DVB-S2 Pilots On
Adaptive Equalizer	Up to 3 dB tilt
BER Performance	See Table 8-2 to Table 8-5
IQ Test Point	Accessible from rear panel Alarm connector

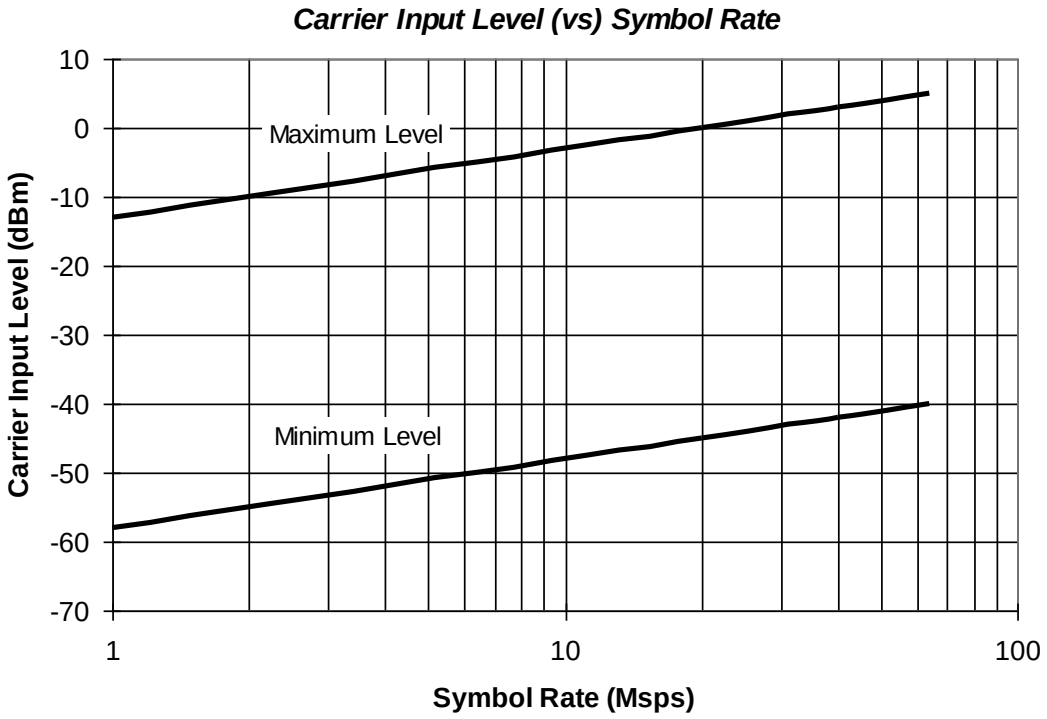


Figure 8-2. Demodulator Input Level

Table 8-2. Eb/No Performance at Quasi Error Free PER = 10^{-7} with AWGN for DVB-S2 Operations

FECFRAME = 64,800 or 16,200 Bits and no pilot

Modulation DVB-S2	Code Rate	Spectral Efficiency FECFrame = 64,800 bits	Spectral Efficiency FECFrame = 16,200 bits	Specified Es/No (dB) See Notes	Eb/No (dB) See Notes	Remarks
QPSK	1/4	0.490243	0.365324	-1.85	1.25	Information
	1/3	0.656448	0.629060	-0.74	1.09	Information
	2/5	0.789412	0.760928	0.20	1.23	Information
	1/2	0.988858	0.848840	1.50	1.55	
	3/5	1.188304	1.156532	2.73	1.98	
	2/3	1.322253	1.288400	3.60	2.39	
	3/4	1.487473	1.420269	4.53	2.81	
	4/5	1.587196	1.508181	5.18	3.17	
	5/6	1.654663	1.596093	5.68	3.49	
	8/9	1.766451	1.727961	6.70	4.23	
	9/10	1.788612	NA	6.92	4.39	
8-PSK	3/5	1.779991	1.725319	6.20	3.70	
	2/3	1.980636	1.922040	7.32	4.35	
	3/4	2.228124	2.118761	8.61	5.13	
	5/6	2.478562	2.381056	10.15	6.21	
	8/9	2.646012	2.577778	11.49	7.26	
	9/10	2.679207	NA	11.78	7.50	
16-APSK	2/3	2.637201	2.548792	9.97	5.76	
	3/4	2.966728	2.809662	11.21	6.49	
	4/5	3.165623	2.983575	12.03	7.03	
	5/6	3.300184	3.157488	12.61	7.42	
	8/9	3.523143	3.418357	13.89	8.42	
	9/10	3.567342	NA	14.13	8.61	
32-APSK	3/4	3.703295	3.493093	13.73	8.04	
	4/5	3.951571	3.709309	14.64	8.67	
	5/6	4.119540	3.925526	15.28	9.13	
	8/9	4.397854	4.249850	16.69	10.26	
	9/10	4.453027	NA	17.05	10.56	

Notes:
1. Eb/No = Es/No – 10 Log (Spectral Efficiency).
2. BER $\approx 10^{-9}$ at PER = 10^{-7}
3. Performance with FECFRAME = 16,200 Bits and no pilot is typically 0.2 to 0.3 dB higher.

Table 8-3. Eb/No Performance for DVB-S QPSK Operations

BER	Eb/No (dB)				
	1/2	2/3	3/4	5/6	7/8
10^{-6}	3.7	4.4	5.0	5.6	5.9
10^{-8}	4.0	4.7	5.3	5.9	6.3
10^{-11}	4.5	5.1	5.8	6.4	6.9

Table 8-4. Eb/No Performance for DSNG 8-PSK Operations

BER	Eb/No (dB)		
	2/3	5/6	8/9
10^{-4}	6.0	7.5	8.5
10^{-6}	6.3	7.9	8.8
10^{-8}	6.6	8.3	9.1
10^{-10}	6.9	8.8	9.4

Table 8-5. Eb/No Performance for DSNG 16-QAM Operations

BER	Eb/No (dB)	
	3/4	7/8
10^{-4}	8.1	10.0
10^{-6}	8.3	10.2
10^{-8}	8.6	10.4
10^{-10}	8.9	10.6

8.7 Test Functions

Description	Requirements
Data Test Pattern	2047 and 2^23-1 compatible with BERT on Tx data tributaries on applicable data interfaces
CW	Generates a narrow carrier at the programmed frequency at the programmed power level. Used in testing.
SSB Carrier	Provides desired sideband, suppressed carrier and suppressed sideband.
Loopback Modes	- Modulator to Demodulator - I/O Loopback where applicable - Digital Loopback where applicable

8.8 Monitor Functions

Description	Requirements
Status Items – Available Via Front Panel	Fault Log with fault type and time stamp
Receive Signal Level	Report within ± 5 dB, typical
Es/No	Report within ± 0.5 dB, typical
Eb/No	Report within ± 0.5 dB, typical

8.9 Remote Port Operation

Description	Requirements
Comtech EF Data Remote Port	See remote port chapter.
Ethernet Telnet	Ethernet transport of standard Remote Control commands.
Ethernet SNMP	See SNMP Chapter
Ethernet HTTP	Support all control and monitor parameters.

8.10 Data Rate Range

Symbol Rate and Data Rate Range for DVB-S2, DVB-S and DVB-DSNG. There is some round off in the data rate ranges in the last digit. The first table is for the standard FEC frame and the second table is for the short frame. DVB recommends turning the Pilot ON for 8PSK and higher modulation orders, particularly when phase noise is present. These modes may need Pilot ON may need the Pilot ON for low C/N operation: 8PSK 1/2, 16APSK 2/3 and 3/4, and 32APSK 3/4 to assist carrier recovery. QPSK 1/4, 1/3, and 2/5 data is for information only.

188 Byte Format

Modulation	FEC Code	Inner Code Rate	Symbol Rate (Msps)		Spectral Efficiency Pilot OFF	Data Rate (Mbps) Pilot OFF		Spectral Efficiency Pilot ON	Data Rate (Mbps) Pilot ON	
			Min	Max		Min	Max		Min	Max
DVB-S2 - Standard FEC Frame = 64,800 Bits										
QPSK	LDPC+BCH	1/4	1	45	0.490243	0.490243	22.060942	0.478577	0.478577	21.535965
		1/3			0.656448	0.656448	29.540166	0.640827	0.640827	28.837209
		2/5			0.789412	0.789412	35.523546	0.770627	0.770627	34.678204
		1/2			0.988858	0.988858	44.498615	0.965327	0.965327	43.439697
		3/5			1.188304	1.188304	53.473684	1.160026	1.160026	52.201190
		2/3			1.322253	1.322253	59.501385	1.290788	1.290788	58.085452
		3/4			1.487473	1.487473	66.936288	1.452076	1.452076	65.343429
		4/5			1.587196	1.587196	71.423823	1.549426	1.549426	69.724175
		5/6			1.654663	1.654663	74.459834	1.615288	1.615288	72.687939
		8/9			1.766451	1.766451	79.490305	1.724416	1.724416	77.598702
		9/10			1.788612	1.788612	80.487535	1.746049	1.746049	78.572201
8PSK	LDPC+BCH	3/5	1	45	1.779991	1.779991	80.099585	1.739569	1.739569	78.280616
		2/3			1.980636	1.980636	89.128631	1.935658	1.935658	87.104623
		3/4			2.228124	2.228124	100.265560	2.177525	2.177525	97.988646
		5/6			2.478562	2.478562	111.535270	2.422276	2.422276	109.002433
		8/9			2.646012	2.646012	119.070539	2.585924	2.585924	116.366586
		9/10			2.679207	2.679207	120.564315	2.618365	2.618365	117.826440
16APSK	LDPC+BCH	2/3	1	35	2.637201	2.637201	92.302026	2.574613	2.574613	90.111471
		3/4			2.966728	2.966728	103.835482	2.896320	2.896320	101.371209
		4/5			3.165623	3.165623	110.796808	3.090495	3.090495	108.167326
		5/6			3.300184	3.300184	115.506446	3.221863	3.221863	112.765192
		8/9			3.523143	3.523143	123.310006	3.439530	3.439530	120.383555
		9/10			3.567342	3.567342	124.856967	3.482680	3.482680	121.893803
32APSK	LDPC+BCH	3/4	1	28	3.703295	3.703295	103.692261	3.623332	3.623332	101.453291
		4/5			3.951571	3.951571	110.643985	3.866247	3.866247	108.254911
		5/6			4.119540	4.119540	115.347126	4.030589	4.030589	112.856500
		8/9			4.397854	4.397854	123.139923	4.302894	4.302894	120.481032
		9/10			4.453027	4.453027	124.684751	4.356875	4.356875	121.992503
DVB-S & DVB-DSNG FEC Frame Does Not Apply										
QPSK	Conv+RS	1/2	1	45	0.921569	0.921569	41.470588	-	-	-
		2/3			1.228758	1.228758	55.294118	-	-	-
		3/4			1.382353	1.382353	62.205882	-	-	-
		5/6			1.535948	1.535948	69.117647	-	-	-
		7/8			1.612745	1.612745	72.573529	-	-	-
8-PSK	Conv+RS	2/3	1	45	1.843137	1.843137	82.941176	-	-	-
		5/6			2.303922	2.303922	103.676471	-	-	-
		8/9			2.457516	2.457516	110.588235	-	-	-
16-QAM	Conv+RS	3/4	1	45	2.764706	2.764706	124.411765	-	-	-
		7/8			3.225490	3.225490	145.147059	-	-	-

188 Byte Format

Modulation	FEC Code	Inner Code Rate	Symbol Rate (Msps)		Spectral Efficiency Pilot OFF	Data Rate (Mbps) Pilot OFF		Spectral Efficiency Pilot ON	Data Rate (Mbps) Pilot ON	
			Min	Max		Min	Max		Min	Max
DVB-S2 - Short FEC Frame = 16,200 Bits										
QPSK	LDPC+BCH	1/4	1	45	0.365324	0.365324	16.439560	0.357467	0.357467	16.086022
		1/3			0.629060	0.629060	28.307692	0.615532	0.615532	27.698925
		2/5			0.760928	0.760928	34.241758	0.744564	0.744564	33.505376
		1/2			0.848840	0.848840	38.197802	0.830585	0.830585	37.376344
		3/5			1.156532	1.156532	52.043956	1.131661	1.131661	50.924731
		2/3			1.288400	1.288400	57.978022	1.260693	1.260693	56.731183
		3/4			1.420269	1.420269	63.912088	1.389725	1.389725	62.537634
		4/5			1.508181	1.508181	67.868132	1.475747	1.475747	66.408602
		5/6			1.596093	1.596093	71.824176	1.561768	1.561768	70.279570
		8/9			1.727961	1.727961	77.758242	1.690800	1.690800	76.086022
		9/10			NA	NA	NA	NA	NA	NA
8PSK	LDPC+BCH	3/5	1	45	1.725319	1.725319	77.639344	1.692033	1.692033	76.141479
		2/3			1.922040	1.922040	86.491803	1.884959	1.884959	84.823151
		3/4			2.118761	2.118761	95.344262	2.077885	2.077885	93.504823
		5/6			2.381056	2.381056	107.147541	2.335120	2.335120	105.080386
		8/9			2.577778	2.577778	116.000000	2.528046	2.528046	113.762058
		9/10			NA	NA	NA	NA	NA	NA
16APSK	LDPC+BCH	2/3	1	35	2.548792	2.548792	89.207729	2.505223	2.505223	87.682811
		3/4			2.809662	2.809662	98.338164	2.761633	2.761633	96.657170
		4/5			2.983575	2.983575	104.425121	2.932574	2.932574	102.640076
		5/6			3.157488	3.157488	110.512077	3.103514	3.103514	108.622982
		8/9			3.418357	3.418357	119.642512	3.359924	3.359924	117.597341
		9/10			NA	NA	NA	NA	NA	NA
32APSK	LDPC+BCH	3/4	1	28	3.493093	3.493093	97.806607	3.419165	3.419165	95.736626
		4/5			3.709309	3.709309	103.860661	3.630805	3.630805	101.662551
		5/6			3.925526	3.925526	109.914715	3.842446	3.842446	107.588477
		8/9			4.249850	4.249850	118.995796	4.159906	4.159906	116.477366
		9/10			NA	NA	NA	NA	NA	NA

The tables are based on a 188-byte transport stream packet. When a 204-byte frame size is selected, the data rate increases by 204/188.

Chapter 9. SNMP INTERFACE

9.1 SNMP Interface

The *Simple Network Management Protocol* (SNMP) is an application-layer protocol designed to facilitate the exchange of management information between network devices. The CDM-710 SNMP agent supports both SNMPv1 and v2c.

For proper SNMP operation, the CDM-710 MIB files must be used with the associated version of the CDM-710 modem M&C Software. Refer to the CDM-710 SW Release Notes for information on the required FW/SW compatibility.

9.2 Management Information Base (MIB) Files

MIB files are used for SNMP remote management and consist of Object Identifiers (OIDs). Each OID is a node that provides remote management of a particular function. A MIB file is a tree of nodes that is unique to a particular device. There are seven MIB files associated with the CDM-710:

MIB File/Name	Description
Fw12051-2-.mib **ComtechEFData MIB file**	**ComtechEFData MIB file gives the root tree for ALL Comtech EF Data products and consists of only the following OID:** **Name: comtechEFData** **Type: MODULE-IDENTITY** **OID: 1.3.6.1.4.1.6247** **Full path: iso(1).org(3).dod(6).internet(1).private(4).enterprises(1).comtechEFData(6247)** **Module: ComtechEFData**
Fw12051-3-.mib **CDM-710 Common MIB file**	**CDM-710 High Speed modem family common components.**
Fw12051-4-.mib **CDM-710-Modulator MIB file**	**CDM-710 High Speed modem family Modulator components.**
Fw12051-5-.mib **CDM-710-ASI MIB file**	**CDM-710 High Speed modem family ASI interface components.**
Fw12051-6-.mib **CDM-710-REDUNDANCY MIB file**	**CDM-710 High Speed modem family 1:1 Redundancy components.**
Fw12051-7-.mib **CDM-710- Traps MIB file**	**CDM-710 High Speed modem family Trap MIB file is provided for SNMPv1 traps**
Fw12051-8-.mib **CDM-710- Gigabit Ethernet Interface MIB file**	**CDM-710 High Speed modem family Gigabit Ethernet MIB file is provided for SNMPv1 traps**

These MIB files should be compiled in a MIB Browser or SNMP Network Monitoring System server.

Note: The CDM-710 SNMP agent supports both SNMPv1 and v2c. The CDM-710 Traps file only needs to be compiled if SNMPv1 traps are to be used.

9.3 SNMP Community Strings

The CDM-710 uses community strings as a password scheme that provides authentication before gaining access to the CDM-710 agent's MIBs.

In SNMP v1/v2c, the community string is sent unencrypted in the SNMP packets. Caution must be taken by the network administrator to ensure that SNMP packets travel only over a secure and private network if security is a concern. A packet sniffer can easily obtain the community string by viewing the SNMP traffic on the network.

The community string is entered into the MIB Browser or Network Node Management software and is used to authenticate users and determine access privileges to the SNMP agent.

The user defines three Community Strings for SNMP access:

Read Community	default = **public**
Write Community	default = **private**
Trap Community	default = **comtech**

9.4 SNMP Traps

The CDM-710 has the ability to send out SNMP traps when certain events occur in the modem. For example, the CDM-710 also sends out traps when an alarm or a fault occurs in the modem. These include unit faults, TX faults, and RX faults. A trap is sent both when a fault occurs and is cleared.

9.5 Common Private MIB

The CDM-710 SNMP agent also implements 4 private MIBs. The CDM-710 Common MIB holds all unit parameters not associated with Modulator, Demodulator, FEC, or Interface boards. For detailed OID information please refer to the actual MIB file.

9.5.1 System Information Group

This group provides Serial Number and Model Number information as well as an interface table that defines the exact hardware configuration of the unit.

9.5.2 Remote Serial Group

This group provides the parameters of the modem's legacy Serial interface. This includes the Local/Remote State, Physical Interface (RS-232 or RS-485), Address and baud rate selections. In addition, this group provides address selection for the 1:1 redundancy controller.

9.5.3 Remote Ethernet Group

This group provides the parameters of the modem's Ethernet interface. This includes the IP Address and Mask, IP Gateway, and MAC Address.

9.5.4 Ethernet SNMP Group

This group provides the parameters necessary to configure and operate the SNMP interface. This includes the System Name, Administrator and Location as well as the Community Strings.

9.5.5 Interface FEC Group

This group provides information regarding unit's two FEC Slots and the capabilities of the cards loaded in those slots.

9.5.6 Modem Reference Group

This group provides the parameters for selection of the modem's frequency reference.

9.5.7 Monitor Group

This group provides access to the units current Alarm/Fault Status as well as a table to access the Stored Alarms/Events.

9.5.8 Test Group

This group provides access to the units test modes.

9.5.9 Save/Load Group

This group provides control of the unit's configuration Store and Load capabilities.

9.5.10 Utilities Group

This group provides access to the unit's Real-Time clock (Time and Date), Internal Reference Adjustment, Circuit ID, and Front Panel Display Brightness Control.

9.5.10.1 Firmware Group

This group provides a table of firmware numbers, Revision Numbers, and Release Dates for all the software/firmware within the unit.

9.6 Modulator Private MIB

The CDM-710 Modem MIB holds all unit parameters associated with the Modulator. For detailed OID information please refer to the actual MIB file.

9.7 ASI Private MIB

The CDM-710 ASI MIB holds all unit parameters associated with the ASI interface board. For detailed OID information please refer to the actual MIB file.

9.8 Redundancy-Switch Private MIB

The CDM-710 Modem MIB holds all unit parameters associated with 1:1 Redundancy operations. For detailed OID information please refer to the actual MIB file.

9.9 Gigabit Ethernet MIB

The CDM-710 Modem MIB holds all unit parameters associated with the Gigabit Ethernet Interface. For detailed information, refer to the actual MIB file.

9.10 HSSI MIB

SNMP for the HSSI interface is not supported at this time.

Notes:

Chapter 10. CDI-40 ASI Data Interface

10.1 Introduction

This data interface is a plug-in module that inserts into the rear of the modem chassis. It provides physical and electrical connection between the external terrestrial device and the internal circuitry of the modulator or demodulator. By convention, a modem is **D**ata **C**ommunications **E**quipment (DCE) where transmit data enters the data interface and receive data exits it. The plug-in interface has full duplex capability for the ASI interface. In addition, the module is automatically configured for simplex-transmit or simplex-receive operation when the module is plugged into a simplex chassis configured for modulator only or demodulator only operation. The module will operate when plugged into either Slot 1 or Slot 2 of the modem. (Slot 1 is located near the center of the rear panel, and Slot 2 is next to the outside edge.)

The ASI Interface combines two electrical and physical interfaces into a single assembly. The ASI section provides DVB compliant interface with BNC connectors.

Operation for either ASI is selected by programming the unit from the front panel keypad/display or from the remote communications ports. Refer to Figure 10-1 through Figure 10-5 for card diagrams. There are two ASI Interface Cards:

ASI Interface Usage By Application	
PL/10881-3	Standard non-redundant applications: • **Tx only 1:1 redundancy.** Rx output (J2 and J3) is the standard ASI level • **Full duplex 1:N redundancy.** Rx output (J2 and J3) is the standard ASI level
PL/10881-4	Standard non-redundant applications (excluding J3): • **Tx only, Rx only or full duplex (Tx and Rx) 1:1 redundancy** (see Figure 10-5). ♦ Rx output J2 is standard ASI level ♦ Rx output J3 is higher so the standard level is delivered after a 3 dB combiner (see Figure 10-5). • **Full duplex 1:N redundancy (excluding J3).**

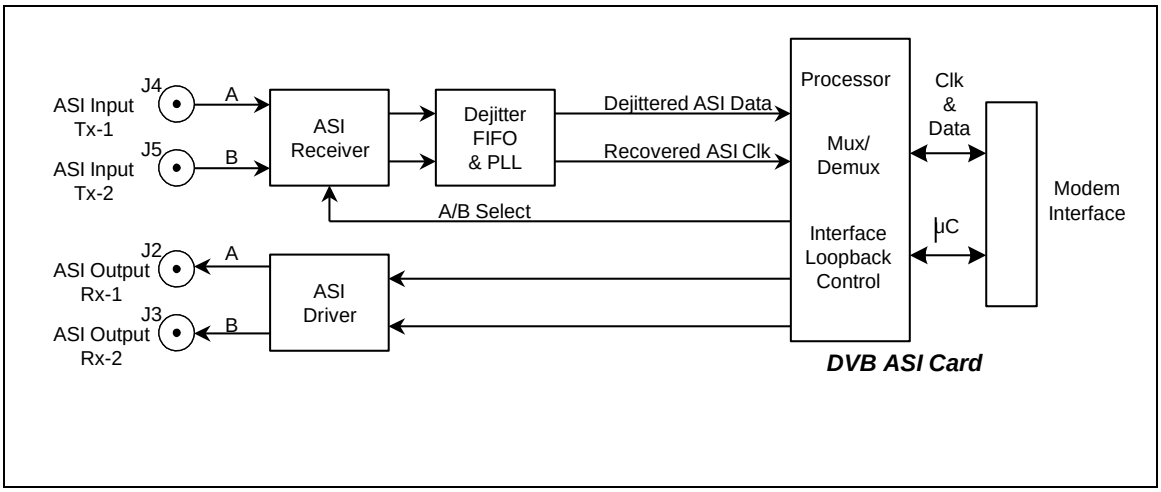


Figure 10-1. ASI Interface Block Diagram

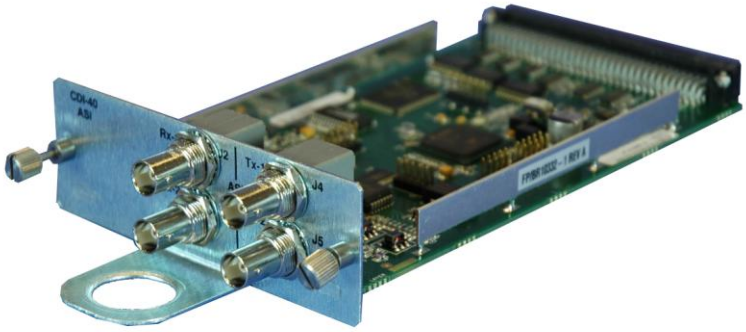


Figure 10-2. ASI Interface (PL/10881-3) For <u>non</u>-1:1 Applications or Tx Only 1:1

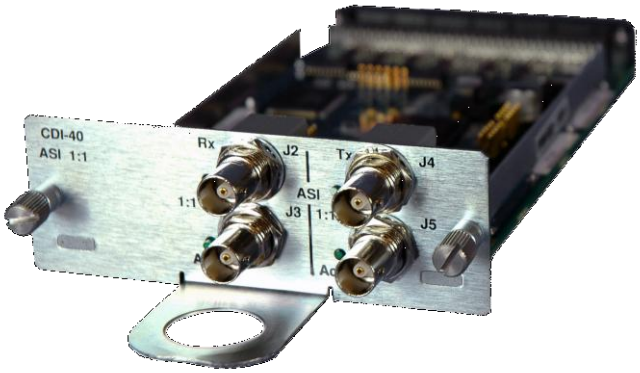


Figure 10-3. ASI Interface (PL/10881-4) For 1:1 Applications

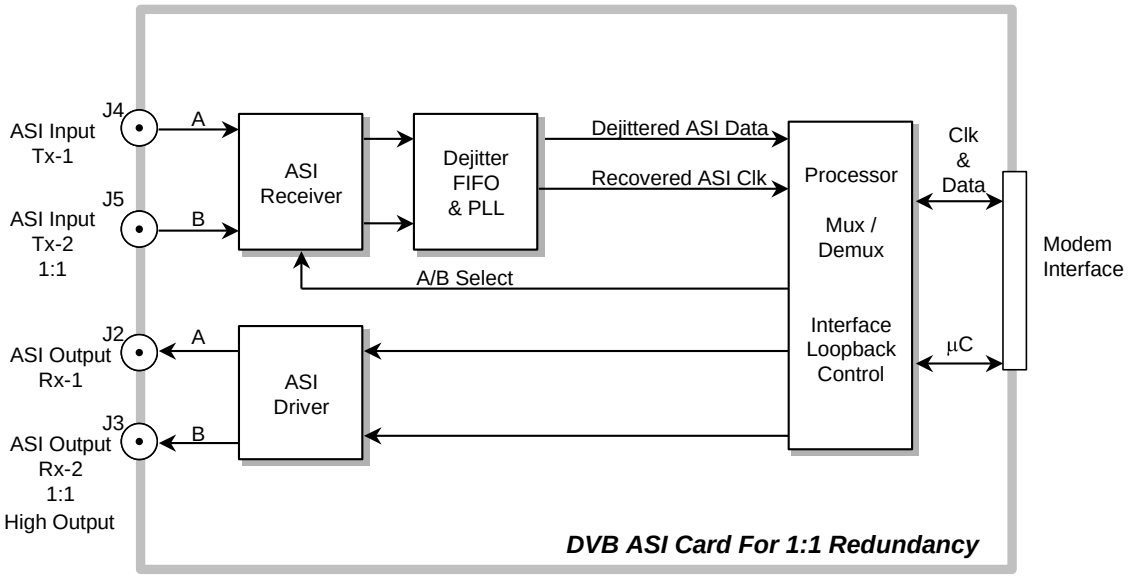


Figure 10-4. ASI Interface Diagram (Later PL/10881-4)

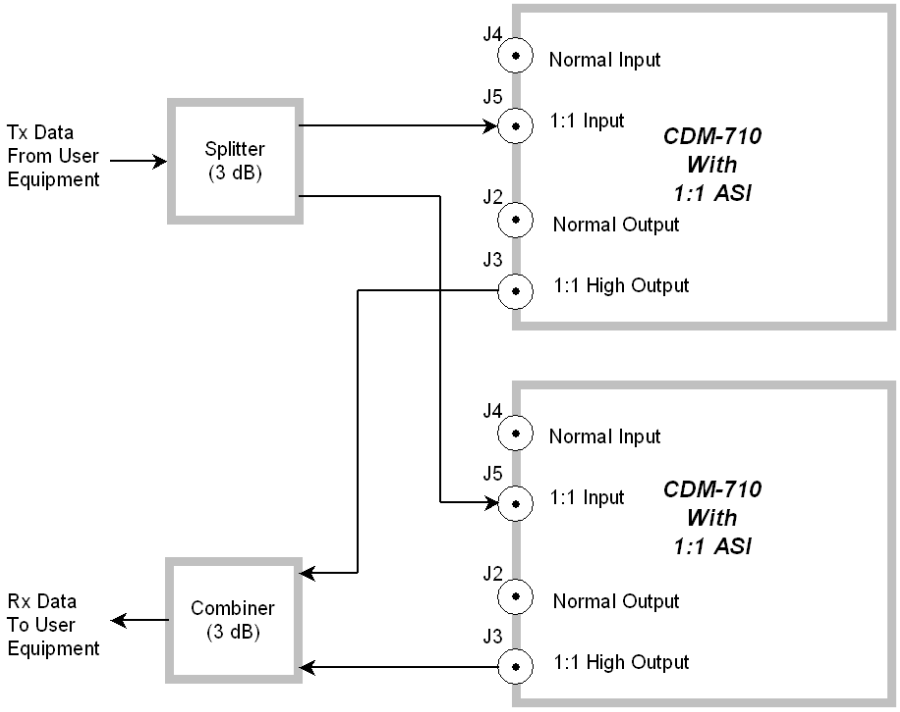


Figure 10-5. Typical ASI 1:1 Application (See CRS-170A or CRS-180 Manual)

10.2 General Specifications

The interface operates to the specifications described in Table 10-1.

Table 10-1. Interface Specifications

General Specifications	
Data Framing Formats	ASI: 188 or 204 byte packets per ETS 300 421.
Test Pattern	Tx only, 2047 or 2^{23}-1 pattern compatible with typical BER tester
Hot Pluggable	No
ASI Specifications	
Data Rate	Up to155 Mbps
Tx Clock Rate Acquisition	Programmed data rate ± 100 ppm
ASI Transport	The transport rate is 270 Mbps for all data rates
Impedance	75Ω
Return Loss	13 dB over 5 to 270 MHz
Connectors	BNC Female
Electrical Properties	Per EN 500083-9
Packet Types	Burst or distributed
Signal Types	Serial data
Voltage Level Rx Out	800 mV ± 10% into 75Ω, (J2, J3 of PL/10881-3 or J2 of PL/10881-4). J3 of PL/10881-4 is higher for 1:1 applications for 800 mV typical after 3 dB combiner (Figure 10-5).
ASI Data Loop 3 dB Frequency, Tx Only	Wide: 2 Hz Narrow: 0.5 Hz
Jitter Tolerance	Meets ITU-T G.823 (3/93) and ITU-T G.824 (3/93)
Jitter Transfer	≤ 0.5 dB peaking up to cutoff frequency. -20 dB per decade beyond cutoff.
Cable Length, Typical	30 meters (100 feet), RG59 40 meters (140 feet), Belden 8281
Tx Input Selection	Two inputs with selection to control, which is active
Loss Of Tx Input Data	Null packets are formed and transmitted. Loss of Tx Input is selectable as a fault or alarm.
Monitor & Control	
Controlled Functions	Interface I/O Loopback, Digital Loopback Data Rate Loss of Data, Mask as Fault or Alarm Variable ASI Mode
Monitored Functions	Loss of Tx Data: The modulator indicates a loss of sync (framed modes) and transmits Null Packets in the data portion of the frame. Tx Clock PLL Program Error Data Violations (Tx) FIFO Faults
ASI Input Select	Input J4 or Input J5
ASI Data Loop BW Selection	Wide and Narrow (Tx Input Data)

PCR Jitter (RX Output)	Less than 100ns after settling Settling to < 500ns, 20 seconds Peak PCR jitter < 1000ns typical during settling

10.3 Input/Output Data Formats

The ASI interface operates at a 270 Mbps transport rate for all data rates. The required encoding of this transport is defined in EN 80053-9 and the Cypress Hotlink IC data sheets. See applicable specifications section. The description that follows, applies to baseband data and not the data transformed to the 270 Mbps physical transport layer.

There are two general modes of operation. There are three standard frame formats (Table 10-2) supported.

Note: The Tx interface correlates from sync word or sync signal.

ASI Sync modes:

188 Mode:	The unit looks for a DVB/MPEG-2 frame consisting of 1 sync byte (0x47) and 187 bytes of data. The frame structure is acquired by the interface to create a satellite frame of 204 bytes by adding 16 bytes of Reed-Solomon check bytes. The demodulator removes the 16 check bytes and the 188-byte frame is returned to the terrestrial circuit.
204 Mode:	The unit expects a DVB/MPEG-2 frame consisting of 1 sync byte (0x47), 187 bytes of data and 16 bytes of filler.

For ASI operation data is either constant packet arrival or constant burst arrival at the equivalent serial data rate. See Table 10-2 for input/output formats.

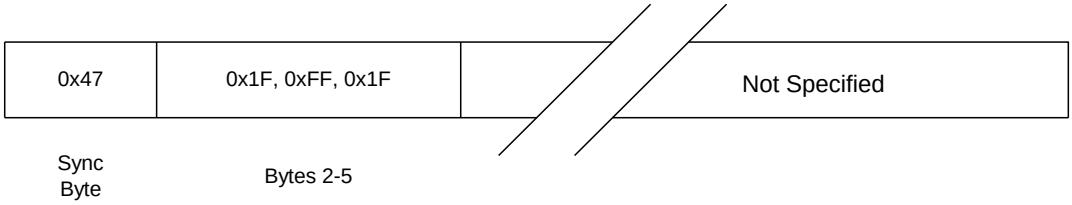
Table 10-2. MPEG-2 Input/Output Data Formats

Data Format	Description
DATA	Payload data is byte serial with MSB first. For 188 the format, the payload is 187 bytes in length, preceded by a sync word.
TRANSPORT RATE (ASI)	270 Mbps for all data rates.

10.3.1 MPEG-2 Null Packet

When the data input to the ASI interface is disconnected or not synchronized the modulator sends MPEG-2 null packets in accordance with ISO/IEC DIS 13818-1, Coding Of Moving Pictures And Associated Audio.

If the interface is in Test mode with the patterns turned ON, the modulator sends pseudo random pattern over the link in the 187 bytes following the sync byte whether Tx data into the modem is present or not.



10.4 Connector Pinouts

10.4.1 ASI Connector Pinout

The ASI interface is as follows:

PL/10881-3		
Connector	**Description**	**Signal Direction**
J2, J3	Rx Data, BNC Female	Output
J4, J5	Tx Data, BNC female	Input

PL/10881-4		
Connector	**Description**	**Signal Direction**
J2,	Rx Data, BNC Female	Output
J3	Rx Data, BNC Female, 1:1 Redundant (High-Level)	Output
J4, J5	Tx Data, BNC female	Input

10.5 ASI Interface Defaults

Default settings for the interface are listed in the following table:

Interface Defaults	
Mode	1, ASI active
Active Tx Input	J4
Data or Clock	Normal
ASI Frame Format	188
Loss of Data	Alarm
Loop Bandwidth	Wide

Chapter 11. CDI-70 1000 Base-T (GbE) INTERFACE

11.1 Introduction

The CDI-70 Gigabit Base-T Ethernet Interface or GbE performs a Motion Picture Expert Group (MPEG-2) packet decapsulation operation on ingress **I**nternet **P**rotocol (IP) packets received from the **L**ocal **A**rea **N**etwork (LAN). MPEG-2 packets are extracted from the active (of up to two multicast) connection and forwards the extracted MPEG-2 packets to **W**ide **A**rea **N**etwork (WAN) (satellite connection). In addition, an MPEG-over-IP transmit function is performed, in which MPEG-2 packets are received from the WAN and are encapsulated in IP packets and transmitted to the LAN (egress).

The GbE Interface is shown in Figure 11-1. **M**onitor and **C**ontrol (M&C) information is not supported on the GbE Interface but available through the 10/100 Base-T remote port of the modem. The GbE Interface supports data rates from 1.5Mbps to either 80.376 Mbps with SMPTE 2022 (formerly Pro-MPEG COP3) FEC enabled or 124 Mbps with SMPT 2022 / Pro-MPEG COP3 FEC disabled. The user interface to the GbE card is a single IEEE 802.3ab 1000 Base-T copper compliant female RJ-45 connector wired as described in Table 11-1

Figure 11-1. 1000 Base-T Ethernet (GbE) Interface

11.2 Physical Description

The GbE is implemented on a 3.95 x 7.022 inch (10.03 x 17.83 cm) PCB. Connectivity to the CDM-710 will be implemented with a 96-pin DIN receptacle, and the LAN interface consists of an RJ-45 connector with link status and link activity **L**ight-**E**mitting **D**iode (LED).

11.3 General Specifications

Table 11-1. Interface Specifications

General Specifications	
Data Framing Formats	10/100/1000BaseT interface: RFC 894 “Ethernet”
Connectors	RJ-45 female, 100Ω
Electrical Properties	Per IEEE 802.3ab
Packet Types	IPV4, RFC 894
Signal Types	Serial data
Voltage Level	Per IEEE- 802.3ab
Ingress PDV (packet delay variation) tolerance	60 ms to either end
Flow Control	None
Cable Length, Maximum	100 meters CAT-5 cable, patch cords and connecting hardware, per ISO/IEC 11801:1995 and ANSI/EIA/TIA-568-A (1995)
Hot Pluggable (cable)	Yes
Hot Pluggable (card)	No
LEDs	Link Status, link activity
Data Rate	1.5 Mbps to 80.376 Mbps (COP3 FEC enabled) 1.5 Mbps to 124 Mbps (COP3 FEC disabled)
FEC Method	SMPTE 2022 / Pro-MPEG COP3 Annex A, column FEC
Fec Streams	0 or 1; user slectable, column offset supported (Pro-MPEG COP3 Annex A)
MPEG-2 TS	7 cells per media packet
MPEG-2 Cell Size	188 bytes
Ingress Redundancy	Dual multicast streams
Egress Redundancy	Not supported

Monitor & Control	
1000Base-T Link Statistics	Ingress good octets Ingress bad octets Ingress unicast packets Ingress broadcast packets Ingress multicast packets Ingress pause packets Ingress undersize packets Ingress fragments Ingress oversize packets Ingress jabber Ingress RX errors Ingress Frame Check Sequence Errors Egress octets Egress unicast packets Egress broadcast packets Egress multicast packets
WAN Port Statistics	Egress octets Egress unicast packets Egress broadcast packets Egress multicast packets Media packets received Recovered media packets Unrecoverable media packets UDP checksum violations Non-compliant packets Packets dripped Null packets due to underrun Null packets due to out-of-sync condition Overrun events Underrun events Out-of-sync events Ingress octets Ingress unicast Ingress broadcast packets Ingress multicast packets

Monitor & Control (Continued)	
Management Port Statistics	Ingress good octets Ingress bad octets Ingress unicast packets Ingress broadcast packets Ingress multicast packets Ingress pause packets Ingress undersize packets Ingress fragments Ingress oversize packets Ingress jabber Ingress RX errors Ingress Frame Check Sequence Errors Egress octets Egress unicast packets Egress broadcast packets Egress multicast packets
Controlled Functions	Data Rate Loss of data: Mask as Fault or Alarm Ingress buffer violation timeout (100ms. to 1s.) Management IP Address and Mask Ingress Multicast Group Address 1 Ingress Multicast Group Address 2 Ingress Multicast Source Address 1 Ingress Multicast Source Address 2 Tx data rate Tx Enable/Disable Ingress UDP port base number Ingress FEC enable/disable Egress Multicast Group Address Egress (to LAN) Enable/Disable Egress UDP destination port base number Egress UDP source port base number Egress FEC enable/disable Egress Tx FEC Configuration (L, D)
Monitored Functions	Loss of Tx Data (Data Connector Removed): Indicates a loss of signal and transmits (to WAN) MPEG null TX clock PLL program error Buffer status 10/100/1000Base-T Link Status
Supported Protocols	ICMP RFC-792 IGMP V3 RFC-3376

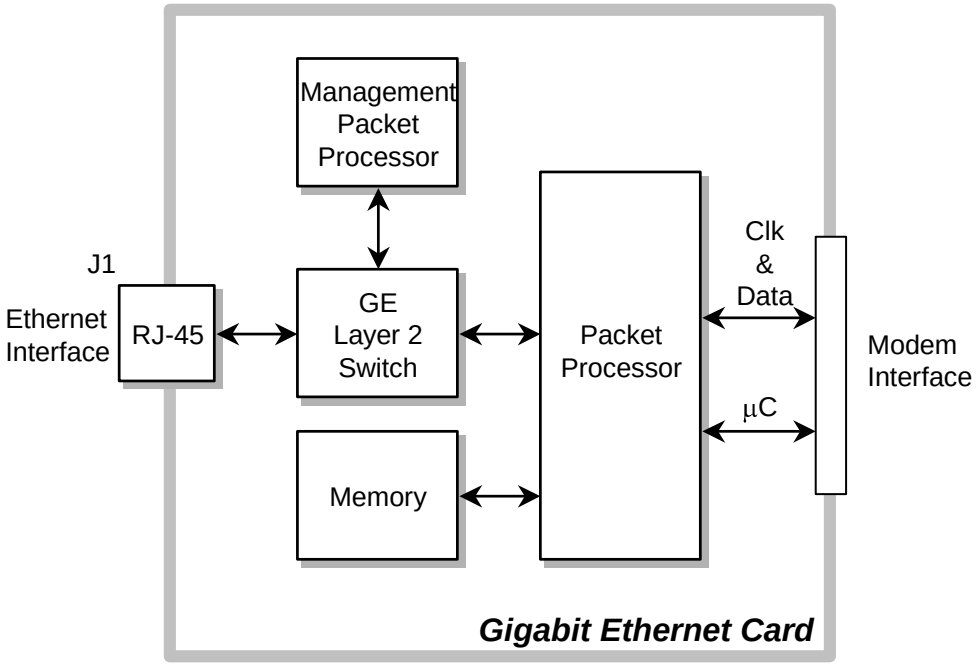


Figure 11-2. GbE Interface Option Board – Phase 1

11.4 Connector Pinout

The LAN interface is comprised of one IEEE 802.3ab 1000Base-T copper interface via a single female RJ-45 connector wired:

Table 11-2. Connector Pinout

Pin #	Description	Direction
1	BI_DA+	bidirectional
2	BI_DA-	bidirectional
3	BI_DB+	bidirectional
4	BI_DC+	bidirectional
5	BI_DC-	bidirectional
6	BI_DB-	bidirectional
7	BI_DD+	bidirectional
8	BI_DD-	bidirectional

11.5 GBEI Software Upload Procedure

The GBEI interface board contains its own processor and memory. On occasion, CEFD may release new software to fix anomalies or add functionality to this interface board. This section will define how to perform this upgrade process. The CDI-70 GBEI interface board uses 'flash memory' technology internally, and new firmware can be uploaded to the unit from an external PC, as follows:

Go online to: **www.comtechefdata.com**
Click on: **Support**
Click on: **Downloads**
Click on: **Flash upgrades**

This makes software upgrading very simple, and updates can now be sent via the Internet, E-mail, or on disk. The upgrade can be performed without opening the unit, by simply connecting the GBEI 10/100/1000 Ethernet port to the Ethernet port of a computer.

1. Identify the reflashable product, firmware number, and version for download.

The current base GBEI version can be viewed at the top level menu of the front panel display (press "CLR" button several times to view). Also, you can find the firmware information within the **<Util > <Firmware > <Info> <Image#1, Image#2> <Interfaces> <GBEI>** menu tree.

2. Create a temporary directory (folder) on your PC.

Windows: Select File > New > Folder > and rename the New Folder to "**temp**" or another convenient and unused name. Assuming "**temp**" works, you should now have a "**c:\temp**" folder created.

Note: The **c:** is the drive letter used in this example. Any valid writable drive letter can be used.

CMD Prompt: At the command prompt (**c:**\>) type "**MD temp**" without quotes (MD stands for make directory). This is the same as creating a new folder from Windows. You should now have a "**c:\temp**" subdirectory created where **c:** is the drive letter used in the example.

3. Download the correct firmware file to this temporary folder.

Access the download server with the flash firmware data files link, **http://206.223.8.10/linksite/flashupgrades/CDM710_710L-MODEM/GBEI/**

About Firmware Numbers, File Versions, and Formats:

The flashable files on the download server are organized by product first, then by firmware number, (make sure you know the correct firmware number; see step 1 version, if applicable, and release date. The base modem bulk firmware will be **FW12547***_*_* (where the asterisks show revision, version and date).

The current version firmware release is provided. If applicable, one version prior to the current release is also available. Be sure to identify and download the desired version.

The downloadable files are stored in two formats: *.exe (self extracting) and *.zip (compressed). Some firewalls will not allow the downloading of *.exe files. In this case, download the *.zip file instead.

For additional help with "zipped" file types, refer to "pkzip for windows", "winzip", or "zip central" help files. Pkzip for DOS is not supported due to file naming conventions.

4. Unzip the files in the temporary folder on your PC.

At least 3 files should be extracted:

a. **FW12547**x.bin, where "x" is the version (bulk image file).
b. **FW12547**x.txt, where "x" is the version (history notes).
c. README.TXT installation notes

5. Connect the client PC to the CDI-70 (GBEI) 10/100/1000 Ethernet connector via a hub or a switch, or directly to a PC with a crossover cable.

Verify the communication and connection by issuing a "ping" command to the modem. You can find the management IP address of the GBEI interface using the front panel with the **<Config> <Intfc1> <Gigabit Ethernet> <Man>** menus.

To PING and FTP from DOS, press the “Start” button on the Windows toolbar, and select the “Run...” option. From Win95 or Win98, type, “command”. From WinNT, Win2K or WinXP, type “cmd”. You can also use the “DOS Prompt” or “Command Prompt” icons in the Start Menu. Now change to the temporary directory you created earlier with “cd c:\temp”. A quick “dir” will show the downloaded files.

6. Initiate an FTP session with the modem. The example is with a DOS window.

a. From the PC, type "ftp xxx.xxx.xxx.xxx" where "xxx.xxx.xxx.xxx" is the management IP address of the CDI-70 (GBEI).

b. Press <Enter> twice to bypass the user name and password to complete login.

c. Verify your FTP transfer is binary by typing "bin".

d. Type "prompt" then type "hash" to facilitate the file transfers.

7. Transfer the files.

Type "put **FW12547***.bin bulk:" to begin the file transfers. The destination "bulk:" must be all lower-case.

It will take approximately ten minutes to transfer the file – wait for this transfer to take place before proceeding to the next step.

Do NOT interrupt the transfer process. If the transfer process is interrupted, the GbEI may have to be returned to the manufacturer.

8. Verify the file transfer.

a. The PC should report that the file transfer has occurred.

b. Terminate the FTP session by typing "**bye**" and closing the DOS window.

c. Verify that the new file loaded using the procedure in Step 1.

9. After waiting at least 5 minutes you must cycle power on the modem for the new GBEI firmware to run.

11.6 CDI-70 1000 Base-T Ethernet (GbE) Interface Card Removal and Installation

WARNING

Ensure the unit is in a Power Off mode. Serious injury or damage to the equipment could result.

Figure 11-3. CDI-70 1000 Base-T Ethernet (GbE) Interface Card

IMPORTANT

CDI-70 Interface Card can be located in Slot 1 or Slot 2.

Removal of the CDI-70 Interface Card:

Steps	Procedures
1	Disconnect the RJ-45 cable from the interface card.
2	Remove the two screws securing the interface card.
3	Pull out the interface card.

Installation of the CDI-70 Interface Card:

Steps	Procedures
1	Insert the CDI-70 Interface Card into the desired slot.
2	Ensure that the interface card is secured to the internal card.
3	Secure the CDI-70 using two screws.
4	Connect the RJ-45 cable to the interface card.

Notes:

Chapter 12. CDI-60 HSSI Interface

12.1 Introduction

This data interface is a plug-in module that inserts into the rear of the modem chassis. It provides physical and electrical connection between the external terrestrial device and the internal circuitry of the modulator or demodulator. By convention, a modem is **D**ata **C**ommunications **E**quipment (DCE) where Tx data enters the data interface and Rx data exits it. The plug-in interface has full duplex capability.

In addition, the module is automatically configured for simplex-transmit or simplex-receive operation when the module is plugged into a simplex chassis configured for modulator only or demodulator only operation. Slot 1 of the modem is filled with a data interface card first, and Slot 2 is assigned a blank panel or another interface depending upon configurations allowed at time of order. (Slot 1 is located near the center of the rear panel, and Slot 2 is next to the outside edge.)

The CDI-60 is a HSSI Card data interface module that plugs into the rear of the modem. Figure 12.1 is a block diagram of the interface. The HSSI interface provides:

- A single HSSI interface
- Supports 188 byte MPEG-2 transport stream only
- DCE Connection
  - RT is derived from the received satellite clock and is provided to the DTE as a receive data clock.
  - ST is equivalent to the modem transmit rate and is sourced to the terrestrial interface for use as a reference by the DTE.
  - TT is treated as an incoming Transmit Clock. TT must be equal to the transmit data rate. The precision of TT must be </= 100ppm.

Figure 12-2 shows a picture of the CDI-60 HSSI interface and the SCSI-2 connector that serves as the data port. A summary of specifications for the interface is provided in Table 12-1 and the connector pinout is shown in Table 12-2.

When a HSSI card is installed in Slot 1, Slot 2 is a blank panel.

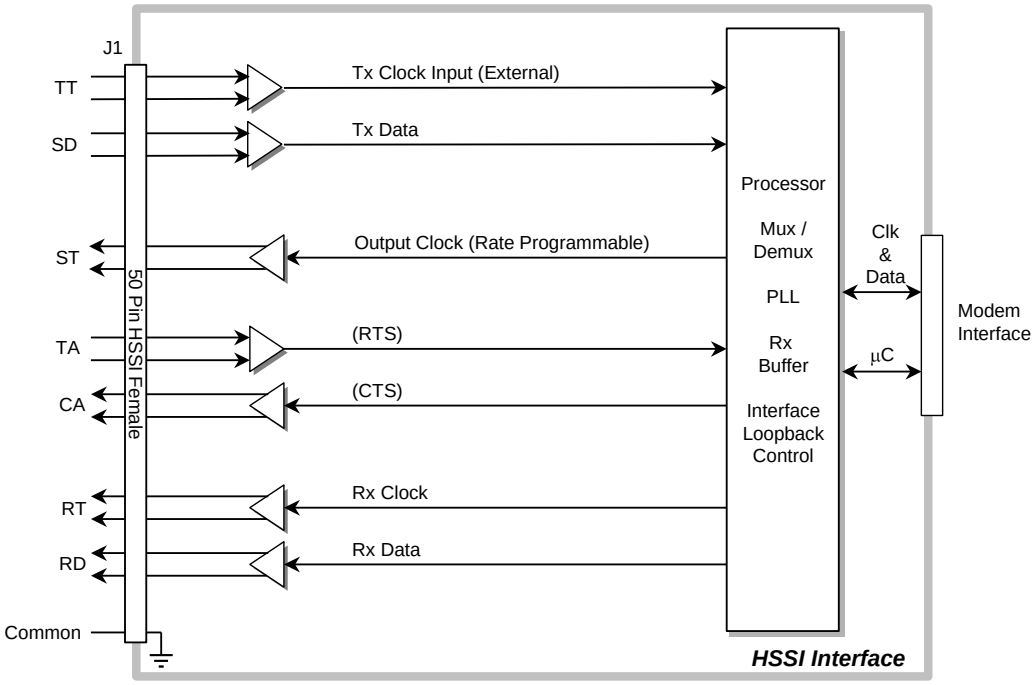


Figure 12-1. HSSI Interface Block Diagram

Figure 12-2. HSSI Interface

12.2 Physical Description

The HSSI Interface is implemented on a 3.95 x 7.022 inch (10.03 x 17.83 cm) PCB. Connection to the modem is provided when the 96-pin DIN connector is engaged into the modem slot. The HSSI interface consists of a 50-pin SCSI connector and an activity Light-Emitting Diode (LED) that is lit when the interface is enabled.

12.3 General Specifications

Table 12-1. Interface Specifications

Item	Requirement
Data Rate Range	1 to 70 Mbps
Interfaces Per Card	One HSSI
Signals Supported	ST, TT (or external) , SD, TA, CA, RT, RD, SG
Connector	DCE, 50-pin mini-D female per EIA-613 (HSSI)
Electrical	Per EIA-612 (10KH ECL compatible).
Electrical Typical	Differential output voltage: $\geq$ 590 mV pp into 110Ω load Differential Input voltage: 150 to 1000 mV pp with 110Ω load
Minimum Buffer Size	5.0 mS smallest buffer setting, 0.1 mS step size, 32 mS maximum size
Impedance Tx: Rx:	110Ω for TT, SD, TA ST, CA, RT, RD will drive 110Ω and meet HSSI voltage levels
Signal Characteristics	The A terminal is negative with respect to the B terminal for a binary 0 (Space or OFF) state. The A terminal is positive with respect to the B Terminal for a binary 1 (Mark or ON) state.
Clock / Data Relationship	The data transitions occur during the OFF to ON transition of the clock. Data is stable during the ON to Off transition of the clock.
Tx Clock Modes	TT (Input clock) continuous. ST (output clock) is continuous output, programmable in 1 bps steps and matches the transmit bit rate.
Rx Clock Modes	RT (output clock) is continuous from satellite, ST (internal clock), continuous from TX rate.
Gap Clock (See Figure 12-3)	Not allowed – Send ST to external equipment DTE so it will return a continuous clock
Tx / Rx Clock	Asymmetrical clocking with Rx Doppler buffer disabled
Acquisition Range	Programmed Tx data rate ± 100 ppm
TA / CA Default: Selection:	CA looped to TA CA is asserted when there is no modem fault
Supported Frame Types	188 byte MPEG-2 transport stream

Item	Requirement
Test	I/O Loopback not provided
Operation	Simplex (Tx only or Rx only) or full duplex
Signal Sense	Programmable Normal or Inverted for TT and TD, RT and RD
Cards Per Modem	The interface operates in Slot 1.
Cable Length to 52 Mbps	2 m (6 ft) nominal, up to 15 m (49 ft) maximum – Note higher data rates usually require shorter cable lengths.
LED	Green LED's indicate channel is enabled

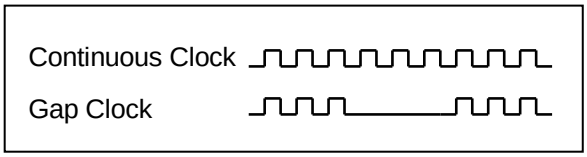


Figure 12-3. Continuous and Gap Clock at TT

12.4 Connector Pinout

The HSSI interface has a 50 pin female SCSI-2 connector (mini-D) with the pinout shown in Table 12-2.

Table 12-2. Connector Pinout

HSSI/EIA-613 Interface Connector Pinout					
Signal Function	**HSSI Signal**	**EIA-613 Circuit**	**Pin # (+,-)**	**Circuit Direction**	**Comment**
Signal Ground	SG	102	1, 26		Ground
Receive Timing	RT	115	2, 27	From DCE	
DCE Available	CA	107	3, 28	From DCE	
Receive Data	RD	104	4, 29	From DCE	
Loopback circuit C	LC	undefined	5, 30	From DCE	Not used
Send Timing	ST	114	6, 31	From DCE	
Signal Ground	SG	102	7, 32		Ground
DTE Available	TA	108/2	8, 33	to DCE	
Terminal Timing	TT	113	9, 34	to DCE	
Loopback circuit A	LA	143	10, 35	to DCE	Not used
Send Data	SD	103	11, 36	to DCE	
Loopback Circuit B	LB	144	12, 37	to DCE	Not used
Signal Ground	SG	102	13, 38		Ground
Not used		undefined	14, 39		Not used
TX DVALID		undefined	15, 40		Not used
reserved (to DCE)			16, 41		Not used
reserved (to DCE)			17, 42		Not used
reserved (to DCE)			18, 43		Not used
Signal Ground	SG	102	19, 44		Ground
		undefined	20		Not used
		undefined	45		Not used
		undefined	21		Not used
reserved (to DTE)			46		Not used
		undefined	22, 47	from DCE	Not used
		undefined	23, 48	from DCE	Not used
Test Mode	TM	142	24, 49	from DCE	Not used
Signal Ground	SG	102	25, 50		Ground

Notes:

Chapter 13. WEB SERVER PAGES

13.1 Web Server Usage

The embedded Web Server application provides the user with an easy to use interface to configure and monitor all aspects of the CDM-710 Modem. The web page is available via the management Ethernet port of the CDM-710, J4, only. These web pages have been designed for optimal performance when using Microsoft's Internet Explorer 5.5 or higher.

HTTP Login Access Levels are defined as follows:

User Interface	User Login Access Level		
	Admin User	Read/Write User	Read Only User
Web	Full Access to all Web Pages	No Access to Admin Web pages	No Access to Admin Web pages
		Full Access for all other Web Pages	View Only Access for all other Web Pages, able to reset Statistics

Modem Default Name/Passwords are:

- Admin comtech/comtech
- Read/Write opcenter/1234
- Read Only monitor/1234

13.1.1 Web Server Menu Tree

Table 13-1. CDM-710 Web Server Menu Tree

Level 1	Level 2
Home	Home
	Contact
	Support
Admin	Access
	Remote
Config Mdm	Interface
	Modem
	Modem Utilities
Stats	Modem Status
	Events & Statistics
Maintenance	Unit Info

13.2 Web Server Login

13.2.1 Locating IP Address via Front Panel

The IP Address can be found by following the pathway detailed in *5.3.1.1 Config: Remote Control: Local Remote.*

IMPORTANT

Ethernet option must be selected or entering the correct Username and Password will cause the Login Window, Figure 13-1, to return the user to a blank window.

13.2.2 Login Prompt

By typing http://xxx.xxx.xxx.xxx" (where xxx.xxx.xxx.xxx = modem IP address) on your browser, the Login prompt will appear:

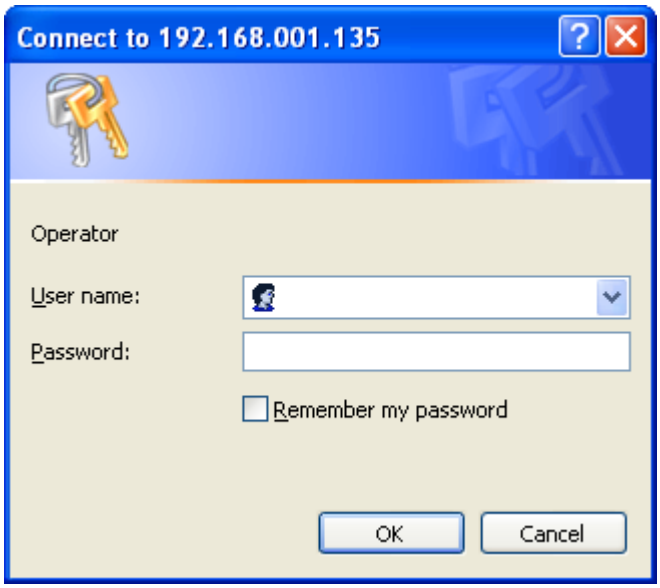


Figure 13-1. Web Interface – Login Window

Note: O**nly one remote method can be in control of either Ethernet or Serial while the other can be used for query.**

13.3 Home Pages

13.3.1 Home Page

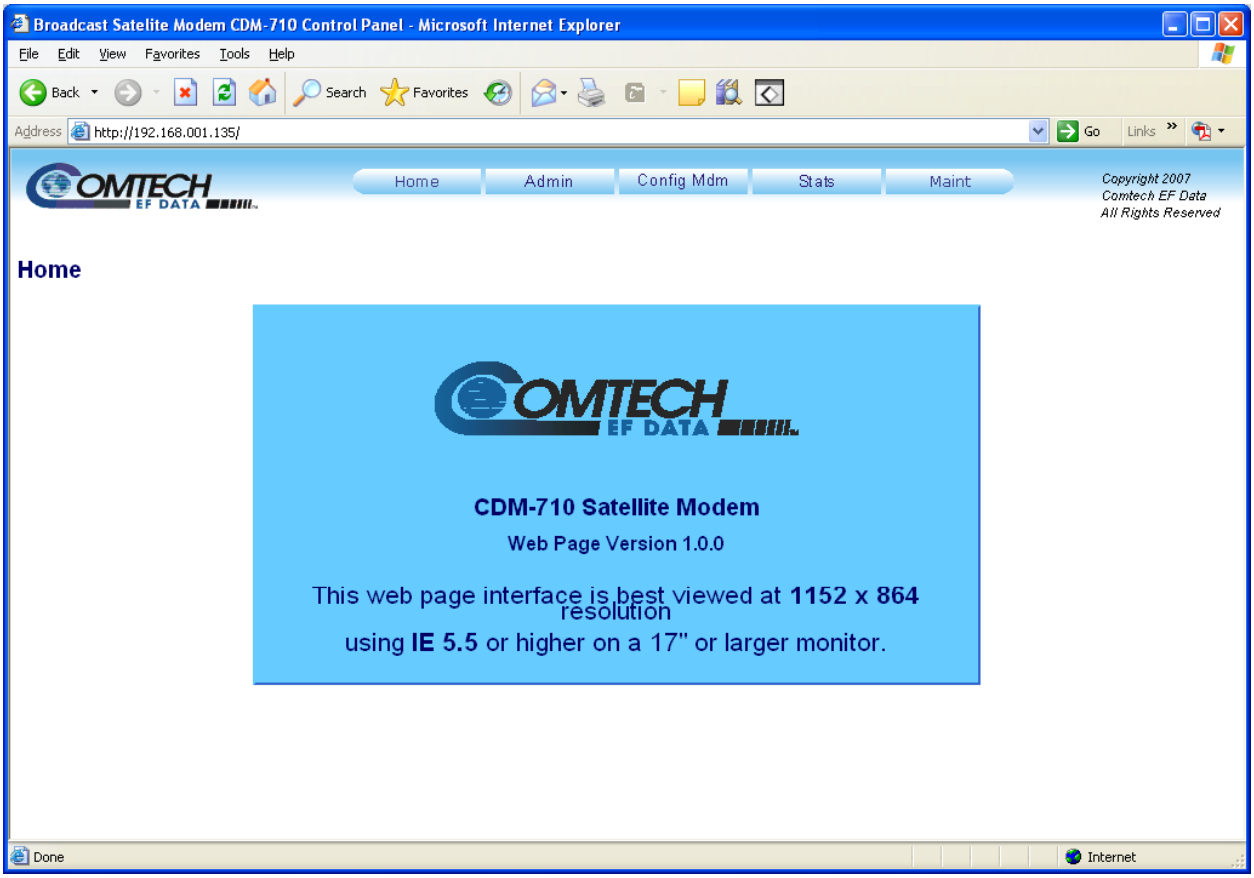


Figure 13-2. Web Interface – Home Page

Welcome to the CDM-710 Modem Web Interface. The following sections will describe the functionality that is unique to the Web Interface. Please refer to ***Appendix A Remote Specifications*** in this manual for a complete and detailed description of each configuration parameter.

13.3.2 Contact Information

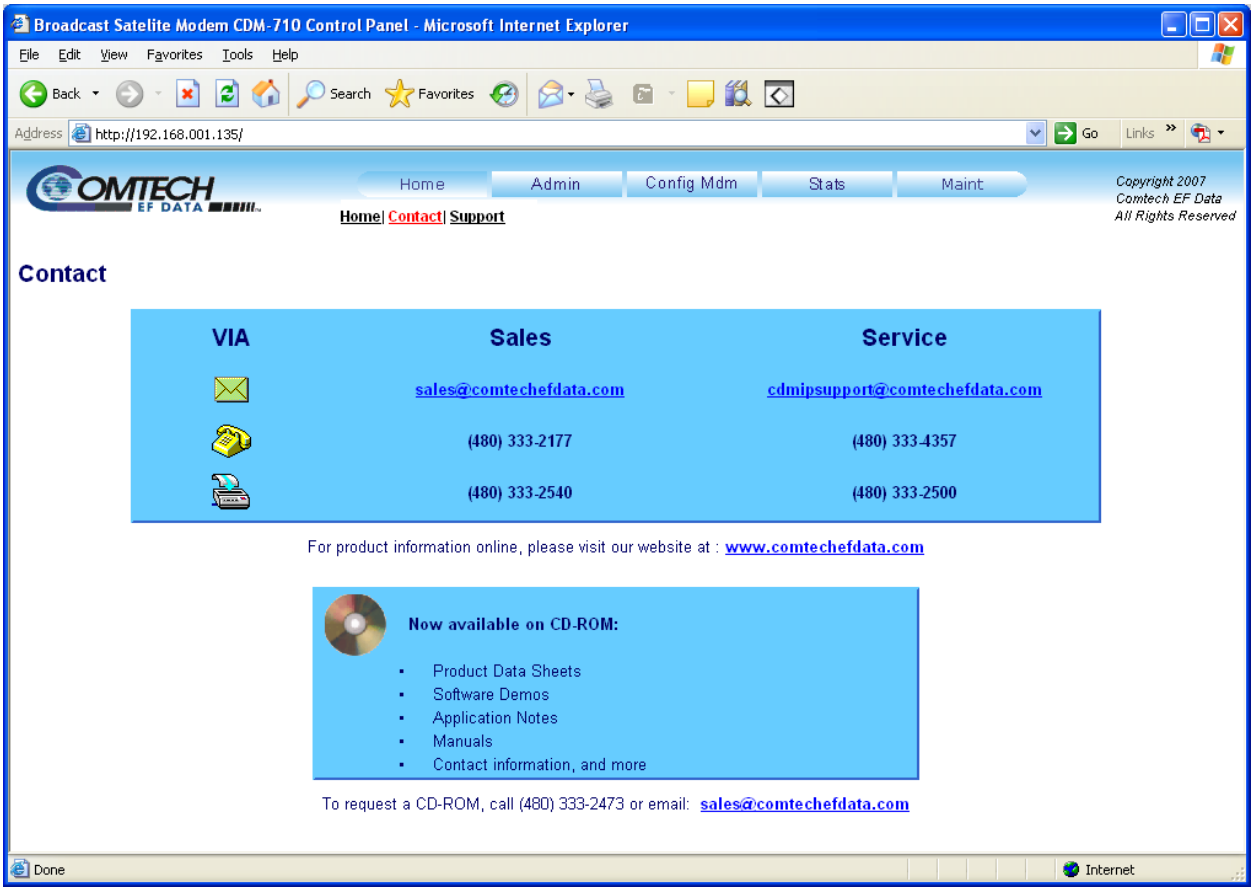


Figure 13-3. Web Interface – Contact page

This page provides basic contact information to reach Comtech EF Data Sales and Customer Support via phone or automated e-mail links.

13.3.3 Support

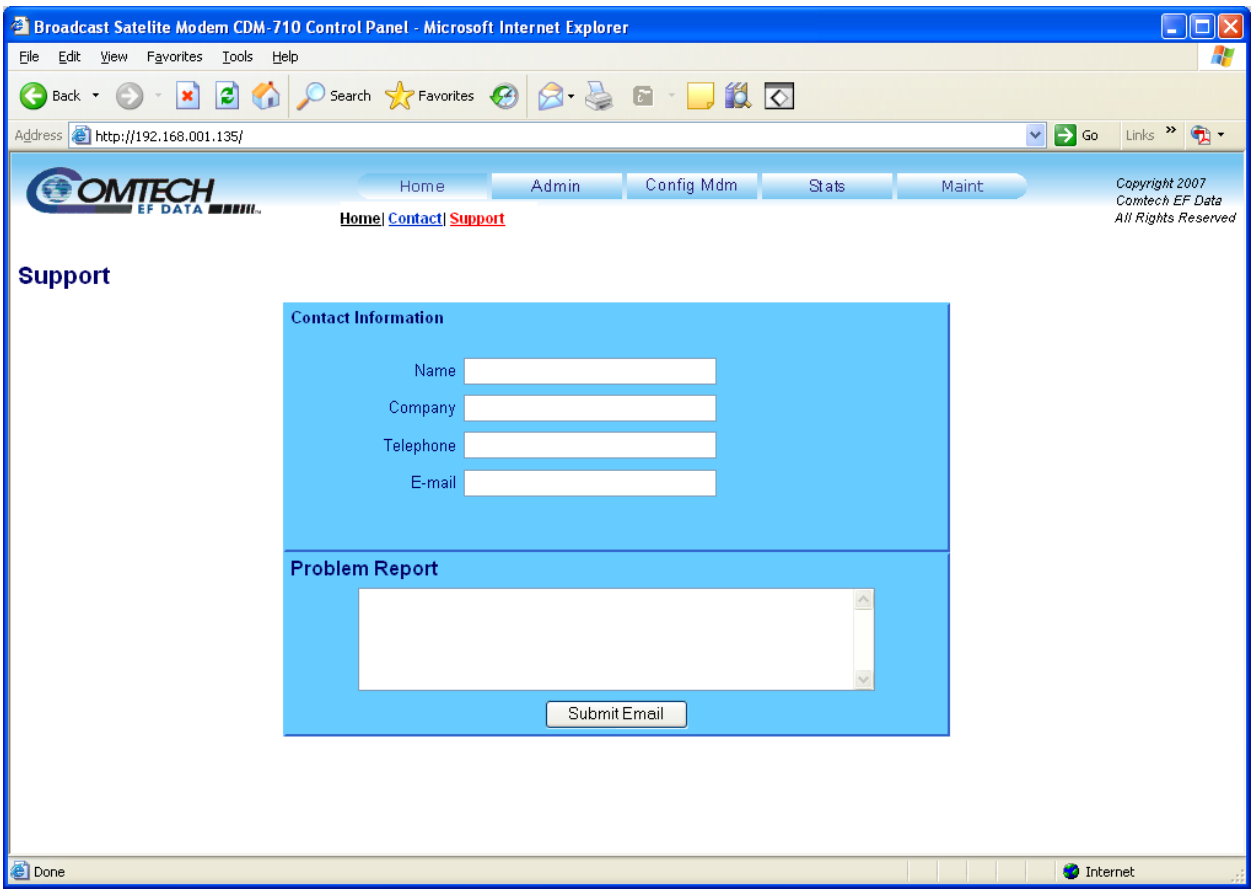


Figure 13-4. Web Interface – Customer Support page

Notes on SMTP – SMTP can be used to send an email to Comtech EF Data Modem Support cdmipsupport@comtechefdata.com from the Support Web Page. The Support Web Page allows you to compose an email message for questions or problems with the Modem. The user can also select to automatically attach the Modem parameter file (which will contain the modem's serial number and configuration information) in order to facilitate troubleshooting or to resolve configuration issues. The problem report area of the display allows up to 2,000 characters maximum.

The Modem uses SMTP (Simple Mail Transport Protocol) to send email and will require the modem's administrator to specify the SMTP server, domain name and destination name on the Administration Screen for SMTP to operate.

13.3.3.1 SMTP Configuration Page

The SMTP Configuration page is activated from the *Administration* page and contains the following options/fields:

Menu Options/Fields	Entry	Description
SMTP Server IP Address	**I**	The mail server address from where you want to send the email.
SMTP Domain	**D**	Set to the domain of the email server (usually found to the right of the @ symbol in an email address).
SMTP Destination Name	**N**	Set the email recipient names (usually found to the left of the @ symbol in an email address).

NOTE

SMTP can be used to send an email to Comtech EF Data Modem Support cdmipsupport@comtechefdata.com using the Support Web Page by connecting to the modem with a Web Browser. The Support Web Page allows you to compose an email message for questions or problems with the Modem. The user can also select to automatically attach the modem parameter file in order to facilitate troubleshooting or to resolve configuration issues.

Notes:

Appendix A. REMOTE CONTROL

A.1 Introduction

This section describes the protocol and message command set for remote monitor and control of the CDM-710 Satellite Modulator.

The electrical interface is either an RS-485 multi-drop bus (for the control of many devices) or an RS-232 connection (for the control of a single device), and data is transmitted in asynchronous serial form, using ASCII characters. Control and status information is transmitted in packets, of variable length, in accordance with the structure and protocol defined in later sections.

A.2 RS-485

For applications where multiple devices are to be monitored and controlled, a full-duplex (or 4-wire) RS-485 is preferred. Half-duplex (2-wire) RS-485 is possible, but is not preferred.

In full-duplex RS-485 communication there are two separate, isolated, independent, differential-mode twisted pairs, each handling serial data in different directions. It is assumed that there is a 'controller' device (a PC or dumb terminal), which transmits data, in a broadcast mode, via one of the pairs. Many 'target' devices are connected to this pair, which all simultaneously receive data from the controller. The controller is the only device with a line-driver connected to this pair - the target devices only have line-receivers connected.

In the other direction, on the other pair, each target has a tri-stateable line driver connected, and the controller has a line-receiver connected. All the line drivers are held in high-impedance mode until one (and only one) target transmits back to the controller.

Each target has a unique address, and each time the controller transmits, in a framed 'packet' of data, the address of the intended recipient target is included. All of the targets receive the packet, but only one (the intended) will reply. The target enables its output line driver, and transmits its return data packet back to the controller, in the other direction, on the physically separate pair.

RS 485 (full duplex) summary:

- Two differential pairs - one pair for controller to target, one pair for target to controller.
- Controller-to-target pair has one line driver (controller), and all targets have line-receivers.
- Target-to-controller pair has one line receiver (controller), and all targets have tri-state drivers.

A.3 RS-232

This a much simpler configuration in which the controller device is connected directly to the target via a two-wire-plus-ground connection. Controller-to-target data is carried, via RS-232 electrical levels, on one conductor, and target-to-controller data is carried in the other direction on the other conductor.

A.4 Basic Protocol

Whether in RS-232 or RS-485 mode, all data is transmitted as asynchronous serial characters, suitable for transmission and reception by a UART. In this case, the asynchronous character formats is 8N1. The baud rate may vary between 1200 and 57,600 baud.

All data is transmitted in framed packets. The controller is assumed to be a PC or ASCII dumb terminal, which is in charge of the process of monitor and control. The controller is the only device which is permitted to initiate, at will, the transmission of data. Targets are only permitted to transmit when they have been specifically instructed to do so by the controller.

All bytes within a packet are printable ASCII characters, less than ASCII code 127. In this context, the Carriage Return and Line Feed characters are considered printable.

All messages from controller to target require a response (with one exception). This will be either to return data which has been requested by the controller, or to acknowledge reception of an instruction to change the configuration of the target. The exception to this is when the controller broadcasts a message (such as Set time/date) using Address 0, when the target is set to RS-485 mode.

A.5 Packet Structure

Controller-to-target:

Start of Packet	Target Address	Address De-limiter	Instruction Code	Code Qualifier	Optional Arguments	End of Packet
< ASCII code 60 (1 character)	 (4 characters)	/ ASCII code 47 (1 character)	 (3 characters)	= or ? ASCII code 61 or 63 (1 character)	 (n characters)	Carriage Return ASCII code 13 (1 character)

Example: <0135/TFQ=0070.2345{CR}

Target-to-controller:

Start of Packet	Target Address	Address De-limiter	Instruction Code	Code Qualifier	Optional Arguments	End of Packet
> ASCII code 62 (1 character)	 (4 characters)	/ ASCII code 47 (1 character)	 (3 characters)	=, ?, !, or * ASCII code 61, 63, 33 or 42 (1 character)	 (From 0 to n characters)	Carriage Return, Line Feed ASCII code 13,10 (2 characters)

Example: >0654/TFQ=0070.2345{CR}{LF}

Each of the components of the packet is now explained.

A.5.1 Start Of Packet

Controller to Target: This is the character '<' (ASCII code 60)

Target to Controller: This is the character '>' (ASCII code 62)
Because this is used to provide a reliable indication of the start of packet, these two characters may not appear anywhere else within the body of the message.

A.5.2 Address

Up to 9999 devices can be uniquely addressed. In RS-232 applications this value is set to 0. In RS-485 applications, the permissible range of values is 1 to 9999. It is programmed into a target unit using the front panel keypad.

The controller sends a packet with the address of a target - the destination of the packet. When the target responds, the address used is the same address, to indicate to the controller the source of the packet. The controller does not have its own address.

A.5.3 Instruction Code

This is a three-character alphabetic sequence which identifies the subject of the message. Wherever possible, the instruction codes have been chosen to have some significance. For example TFQ for transmit frequency, etc. This aids in the readability of the message, should it be displayed in its raw ASCII form. Only upper case alphabetic characters may be used (A-Z, ASCII codes 65 - 90).

A.5.4 Instruction Code Qualifier

This is a single character which further qualifies the preceding instruction code.

Code Qualifiers obey the following rules:

1) From Controller to Target, the only permitted values are:
   = (ASCII code 61)
   ? (ASCII code 63)

They have these meanings:

The '=' code (controller to target) is used as the assignment operator, and is used to indicate that the parameter defined by the preceding byte should be set to the value of the argument(s) which follow it.

For example, in a message from controller to target, TFQ=0070.0000 would mean 'set the transmit frequency to 70 MHz'

The '?' code (controller to target) is used as the query operator, and is used to indicate that the target should return the current value of the parameter defined by the preceding byte.

For example, in a message from controller to target, TFQ? would mean 'return the current value of the transmit frequency'

2) From Target to Controller, the only permitted values are:
   = (ASCII code 61)
   ? (ASCII code 63)
   ! (ASCII code 33)
   * (ASCII code 42)
   # (ASCII code 35)
   ~ (ASCII Code 126)

They have these meanings:

The '=' code (target to controller) is used in two ways:

First, if the controller has sent a query code to a target (for example TFQ?, meaning 'what's the Transmit frequency?'), the target would respond with TFQ=xxxx.xxxx, where xxxx.xxxx represents the frequency in question.

Second, if the controller sends an instruction to set a parameter to a particular value, then, providing the value sent in the argument is valid, the target will acknowledge the message by replying with TFQ= (with no message arguments).

The ? code (target to controller) is only used as follows:
If the controller sends an instruction to set a parameter to a particular value, then, if the value sent in the argument is not valid, the target will acknowledge the message by replying (for example) with TFQ? (with no message arguments). This indicates that there was an error in the message sent by the controller.

The * code (target to controller) is only used as follows:
If the controller sends an instruction to set a parameter to a particular value, then, if the value sent in the argument is valid, BUT the modulator will not permit that particular parameter to be changed at that time, the target will acknowledge the message by replying (for example) with TFQ* (with no message arguments).

The ! code (target to controller) is only used as follows:
If the controller sends an instruction code which the target does not recognize, the target will acknowledge the message by echoing the invalid instruction, followed by the ! character with. Example: XYZ!

The # code (target to controller) is only used as follows:
If the controller sends a correctly formatted command, BUT the modulator is not in remote mode, it will not allow reconfiguration, and will respond with TFQ#.

A.5.5 Message Arguments

Arguments are not required for all messages. Arguments are ASCII codes for the characters 0 to 9 (ASCII 48 to 57), period (ASCII 46) and comma (ASCII 44).

A.5.6 End Of Packet

Controller to Target: This is the 'Carriage Return' character (ASCII code 13)

Target to Controller: This is the two-character sequence 'Carriage Return', 'Line Feed'. (ASCII code 13, and code 10.) Both indicate the valid termination of a packet

A.6 Remote Specification Table of Contents

Modulator

Priority System = TMM (Highest priority), TMD, TCR, and TSR (Lowest Priority). Any change to a higher priority parameter can override any of the parameters of lower priority.

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Tx Mode	TMM=	1 byte	Tx Mode, where: 0=DVB-S 1=DVB-S2 2=DVB-DSNG Example: TMM=0 (which is DVB-S mode) *NOTE: Please refer to Chapter 8 for available code rates, modulation types, and symbol rates for each mode.	TMM= TMM? TMM* TMM#	TMM?	TMM=x
Tx Modulation Type	TMD=	1 byte	Tx Modulation type, where: 0=QPSK 1=8PSK 2=16QAM 3=16APSK 4=32APSK Example: TMD=1 (which is 8PSK) *NOTE: Please refer to Chapter 8 for available modulation types for each mode.	TMD= TMD? TMD* TMD#	TMD?	TMD=x

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Tx FEC Code Rate	TCR=	1 byte	Tx Modulation Type, where: 0 = Rate 3/4 1 = Rate 7/8 2 = Rate 3/5 3 = Rate 4/5 4 = Rate 5/6 5 = Rate 8/9 6 = Rate 9/10 7 = Rate 2/3 8 = Rate 1/2 Depending on FEC type, not all of these selections will be valid. Example: TCR=0 (which is Rate 3/4) *NOTE: Please refer to Chapter 8 for a list of available code rates for each mode.	TCR= TCR? TCR* TCR#	TCR?	TCR=x
Tx Symbol Rate	TSR=	9 bytes	Tx Symbol Rate, where: s=Symbol Rate in Msps Example: TSR=20.000000 (20 Msps.)	TSR= TSR? TSR* TSR#	TSR?	TSR=ss.ssssss
Tx Frequency	TFQ=	9 bytes	Tx Frequency (in MHz) 52 to 88 MHz, and 104 to 176 MHz (70/140 Modulator) 950 to 1950 MHz (L-Band Modulator) Resolution=100Hz. Example: TFQ=0950.0000	TFQ= TFQ? TFQ* TFQ#	TFQ?	TFQ=xxxx.xxxx

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Tx Power Level	TPL=	5 bytes	Tx Output power level, where: s=sign (+ / -) xx.x = Tx Output power level, +05.0 and –20.0 dBm. L-Band: -25.0 to –05.0 dBm 70/140 MHz: -20.0 to +00.0 dBm Note: Beyond –20 dBm is beyond the specification. Example: TPL = -13.4	TPL= TPL? TPL* TPL#	TPL?	TPL=sxx.x
Tx Carrier State	TXO=	1 byte	Tx Carrier State, where: 0=OFF due to front panel or remote control command 1=ON Example: TXO=1 (Tx Carrier ON)	TXO= TXO? TXO* TXO#	TXO?	TXO=x
Tx Output Impendance	IMP=	1 byte	Tx output impedance, where: 0=50 Ohm 1=75 Ohm Example: IMP=0 (Set impedance to 50 Ohms) * NOTE: Setting Tx Impedence is only possible on 70/140 Mhz units.	IMP= IMP? IMP* IMP#	IMP?	IMP=x
Tx Data Rate	N/A	10 bytes	Composite Tx Data rate, in kbps. Resolution=1 bps. Example: TDR=002047.999 (which is 2047.999 kbps)	N/A	TDR?	TDR=xxxxxx.xxx

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Tx FEC Type	N/A	1 byte	Tx FEC coding type, where: 0=Viterbi + Reed-Solomon 1=LDPC (FEC is dependent on the TX Mode Type.) Example: TFT=1 (which is LDPC coding)	N/A	TFT?	TFT=x
Tx Interface Enable	TIE=	2 bytes	Interface Slot Enable/Disable, where: s=Defines which interface slot (1 or 2) x=Tx Interface Status, where: 0=Disabled 1=Enabled Ex: TIE =11 (Enables transmit interface)	TIE= TIE? TIE* TIE#	TIE?s	TIE=sx
Tx Alpha Rolloff	TAR=	1 byte	Tx Alpha Rolloff, where: 0 = 20% 1 = 25% 2 = 35% Example: TAR=0 (which is a Tx Alpha Rolloff of 20%)	TAR= TAR? TAR* TAR#	TAR?	TAR=x
Tx Gold Code Sequence Index	TGS=	6 bytes	Tx Gold Code Sequence Index: xxxxxx = Gold Code Sequence index (0 to 262141) Example: TGS=189063 *NOTE: Only valid in DVB-S2 mode.	TGS= TGS? TGS* TGS#	TGS?	TGS=xxxxxx

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Tx Frame Size	TFS=	1 byte	Tx Frame Size Long/Short selection, where: 0=Short, 1=Long Example: TFS =0 (which is Short Frame Size) *NOTE: Setting only valid in DVB-S2 mode.	TFS = TFS? TFS * TFS #	TFS?	TFS =x
Tx Pilot On/Off	TPI=	1 byte	Tx Pilot On/Off selection, where: 0=Off, 1=On Example: TPI=0 (which is Pilot Off) *NOTE: Only valid in DVB-S2 mode.	TPI= TPI? TPI* TPI#	TPI?	TPI=x
Tx Location of the Pilot	TLP=	1 byte	Tx Pilot On/Off selection, where: 0=Average, 1=Peak Example: TLP=0 (which is Pilot Average) *NOTE: Only valid in DVB-S2 mode.	TLP= TLP? TLP* TLP#	TLP?	TLP=x
Tx Spectrum Invert	TSI=	1 byte	Tx Spectrum Invert selection, where: 0=Normal 1=Tx Spectrum Inverted Example: TSI=0 (which is normal)	TSI= TSI? TSI* TSI#	TSI?	TSI=x

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Tx ASI Bandwidth	TAB=	2 bytes	Tx ASI Bandwidth, where: s=Defines which interface slot (1 or 2) x=Defines ASI Bandwidth, where: 0=Wide 1=Narrow Example: TAB=11 (selects Narrow bandwidth)	TAB= TAB? TAB* TAB#	TAB?s	TAB=sx
Tx Interface Port	TIP=	2 bytes	Indicates which port on the interface is to be used (ASI card only), in the form: sp Where: s = interface slot (1 to 2) p = interface port/channel (1 to 4) 1 = J4 2 = J5 Example: TIP=11 (selects port J4 on interface slot 1)	TIP= TIP? TIP* TIP#	TIP?s	TIP=sp
Tx Data Invert	TDI=	2 bytes	Invert Transmit Data, where: s=Defines which interface slot (1 or 2) x=Invert Transmit Data, where: 0=Normal 1=Inverted (Note: Command valid Only with HSSI) Example: TDI = 111 (selects Inverted TX Data)	TDI = TDI? TDI * TDI #	TDI?sc	TDI =sx (see description of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Tx Clock Invert	TCI=	2 bytes	Command or Query. Invert Transmit Clock, where: s=Defines which interface slot (1 or 2) x=Invert Transmit Clock, where: 0=Normal 1=Inverted (Note: Command valid Only with HSSI) Example: TCI = 11 (selects Inverted TX Clock, Slot 1)	TCI = TCI? TCI * TCI #	TCI?s	TCI =sx (see description of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Transmit & Receive Configuration	TRC=	69 bytes	Global configuration, in the form: aaaa.aaaabcc.ccccccdefghhhhhhiii.ijkllll.llllmnn.nnnnnnopqrssssstuvv where: aaaa.aaaa = Tx Frequency (in MHz) same as TFQ b = Tx Mode same as TMM cc.cccccc = Tx Symbol Rate same as TSR d = Tx FEC Type same as TFT ** e = Tx Modulation type same as TMD f = Tx FEC Rate same as TCR g = Tx Spectrum Inversion same as TSI hhhhhh = Tx Gold Code Sequence same as TGS iii.i = Tx Power Level same as TPL j = Tx Carrier State same as TXO k = Tx Alpha Roll-off same as TAR llll.llll = Rx Frequency (in MHz) same as RFQ m = Rx Mode same as RMM nn.nnnnnn = Rx Symbol Rate same as RSR o = Rx FEC Type same as RFT ** p = Rx Modulation type same as RMD q = Rx FEC Rate same as RCR x = spare ssssss = Rx Gold Code Sequence same as RGS t = Rx Alpha Roll-off same as RAR u = Unit test Mode same as TST** vv = Unit Alarm Mask same as MSK ** Read-only	TRC= TRC? TRC* TRC#	TRC?	TRC= aaaa.aaaabcc.ccccccdefghhhhhhiii.ijkllll.llllmnn.nnnnnnopqxssssssstuvv Returns current transmit and receive configuration. **Notes:** Unit returns ‘x’s for Rx parameters if unit is modulator. Unit returns ‘x’s for Tx parameters if unit is demodulator. If Rx is in DVB-S2 mode, the Rx Modulation Type and Rx FEC Rate is ignored because these are automatically detected.

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
ASI Tx Frame Size	ATF=	2 bytes	Indicates whether the ASI Tx Frame Size is 188 or 204 bytes (ASI card only), in the form: sf Where: s = interface slot (1 or 2) f = frame size 0 = 188 bytes 1 = 204 bytes Example: ATF=11 (sets interface slot 1 to 204 byte frame size)	ATF= ATF? ATF* ATF#	ATF?s	ATF=sf
Clear All Stored Events	CAE=	None	Forces the software to clear the software events log. Example: CAE= Note: This command takes no arguments	CAE= CAE? CAE* CAE#	N/A	N/A
Circuit ID String	CID=	24 bytes	Sets or queries the user-defined Circuit ID string, which is a fixed length of 24 characters. Valid characters include: Space ( ) * + – , . / 0 9 and A thru Z	CID= CID? CID* CID#	CID?	CID=xxxxxxxxxxxxxxxx xxxxxxxx
Configuration Load	CLD=	1 byte	Retrieves a previously stored configuration from the specified configuration location (0 to 9). Example: CLD=4 (retrieve configuration from location 4)	CLD= CLD? CLD* CLD#	N/A	N/A
Configuration Save	CST=	1 byte	Stores the current configuration in the specified configuration location (0 to 9). Example: CST=4 (store the current configuration in location 4)	CST= CST? CST* CST#	N/A	N/A
Real-time Clock Date	DAY=	6 bytes	A date in the form ddmmyy, where dd = day of the month (01 to 31), mm = month (01 to 12) yy = year (00 to 99) Example: DAY=240457 (April 24, 2057)	DAY= DAY? DAY* DAY#	DAY?	DAY=ddmmyy

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Equipment ID	N/A	23 bytes	Unit returns equipment identification and configuration, where: **aaa = defines the modulator model number (710)** **b = Modulator configuration**: 1=70/140 Mhz, 2=L-Band **c = Tx Symbol Rate S/W option:** 0 = 15.0 Msps, 1 = 22.5 Msps, 2 = 30.0 Msps, 3 = 37.5 Msps (S1 and DSNG only), 4 = 45.0 Msps (S1 and DSNG only) **d = S/W option Tx 8PSK:** 0=Not installed, 1=Installed **e = S/W option Tx 16-QAM:** 0=Not installed, 1=Installed **f = S/W option Tx 16APSK:** 0=Not installed, 1=Installed **g = S/W option Tx 32APSK:** 0=Not installed, 1=Installed **h = S/W option Tx DVB-S1:** 0=Not installed, 1=Installed **i = S/W option Tx DVB-DSNG:** 0=Not installed, 1=Installed **j = S/W option Tx DVB-S2:** 0=Not installed, 1=Installed **k = Demodulator configuration:** 0=None, 1=70/140 Mhz, 2=L-Band **l = Rx Symbol Rate S/W option:** 0=15.0 Msps, 1 = 22.5 Msps, 2 = 30.0 Msps, 3 = 37.5 Msps (S1 & DSNG only), 4 = 45.0 Msps (S1 & DSNG only) **m = S/W option Rx 8PSK:** 0=Not installed, 1=Installed **n = S/W option Rx 16-QAM:** 0=Not installed, 1=Installed **o = S/W option Rx 16APSK:** 0=Not installed, 1=Installed **p = S/W option Rx 32APSK:** 0=Not installed, 1=Installed **q = S/W option Rx DVB-S1:** 0=Not installed, 1=Installed **r = S/W option Rx DVB-DSNG:**0=Not installed, 1=Installed **s = S/W option Rx DVB-S2:** 0=Not installed, 1=Installed **t = Interface slot #1:** 0 = None, 1 = ASI, 2 = Gigabit Ethernet Interface, 3 = HSSI **u = Interface slot #2:** 0 = None, 1 = ASI, 2 = Gigabit Ethernet Interface, 3 = HSSI	EID=EID? EID* EID#	EID?	EID= aaabcdefghijklmnopqrstu Note: Unit returns 'Not Installed' for Rx options if unit is modulator only. Unit returns 'Not Installed' for Tx options if unit is demodulator only.

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
External Reference Frequency	ERF=	1 byte	External Reference Frequency, where: 0=Internal 1=External 1 MHz 2=External 2 MHz 3=External 5 MHz 4=External 10 MHz 5=External 20 MHz Example: ERF=0 (External reference not used - uses internal)	ERF= ERF? ERF* ERF#	ERF?	ERF=x
Faults and Status	N/A	4 bytes	Unit returns the current fault and status codes for the Unit (hardware), Tx Traffic and Rx Traffic, in the form abcd, where: a = Unit Faults: 0=No faults 1=Framer FPGA Load 2=Power supply fault, +1.5 Volts, Framer Card 3=Power supply fault, +1.5 Volts, Interface #1 4=Power supply fault, +1.5 Volts, Interface #2 5=Power supply fault, +3.3 Volts, Framer Card 6=Power supply fault, +5.0 Volts, Framer Card 7=Power supply fault, +12.0 Volts, Framer Card 8=Power supply fault, -12.0 Volts, Framer Card 9=Power supply faulit, +18.0 Volts, Framer Card A=FLASH Checksum B=FEC1 Load C=FEC2 Load D=Interface #1 Load E=Interface #2 Load F=192 MHz PLL G=External Reference H=Framer Card Temperature I=Modem Temperature J=Cooling Fans K=Interface #1 Removed L=Interface #2 Removed	N/A	FLT?	FLT=abcd d=Change in fault status since last poll. **Note:** Each section has faults listed in order of priority. For each section, only the highest priority fault is returned. There maybe multiple faults for each section, but only the highest fault is returned.

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
			b = Tx Traffic Status: 0=No faults 1= +1.5V Power Supply Unit (Modulator Card) 2= FPGA Failed to Load (Modulator Card) 3= Symbol Rate PLL Clock 4= Tx Synthesizer Unlocked 5= Tx Digital Clock Manager Unlocked 6= I & Q Baseband Channels are Inactive 7= FPGA Temperature (Modulator Card) 8= Nyquist Filter Clipping 9= ASI Port Transmit FIFO Empty (Interface 1) A= ASI Port Transmit FIFO Empty (Interface 2) B= ASI Port Transmit FIFO Full (Interface 1) C= ASI Port Transmit FIFO Full (Interface 2) D= ASI Port Transmit Data Loss (Interface 1) E= ASI Port Transmit Data Loss (Interface 2) F= ASI Frame Not Synchronized (Interface 1) G= ASI Frame Not Synchronized (Interface 2) H= HSSI TX Clock Failure (Interface 1) I= HSSI TX Clock Failure (Interface 2) J= GBEI Card Datarate > 200 PPM K= GBEI Card Datarate < 200 PPM L= GBEI No PHY Link M= Encoder FIFO Empty N= Encoder FIFO Full O= ASI Tx Input Datarate Offset > +110PPM (Interface 1) P= ASI Tx Input Datarate Offset > +110PPM (Interface 2) Q= ASI Tx Input Datarate Offset < -110PPM (Interface 1) R= ASI Tx Input Datarate Offset < -110PPM (Interface 2) S= SERDES Parity Errors c=Rx Traffic Status 0=No faults			

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Firmware Revisions	N/A	1 byte	Query the version information of the system. Where: i = Bulk Image number (1 or 2) a = Firmware Image b = Firmware Revision c = Firmware Date Example: FRW?1	FRW? FRW* FRW#	FRW?i	FRW={CR}Boot:{CR}a,b,c{CR}Bulki:{CR}a,b,c{CR}a,b,c…
Gigabit FEC Enable	GFE=	2 bytes	Enables the Gigabit FEC mode. s=Slot (1, 2) n=Enable/Disable 0=Disabled 1=Enabled	GFE= GFE# GFE? GFE*	GFE?s	GFE=sn
Gigabit FEC Base Port	GFP=	6 bytes	Gigabit FEC Base Port number s=Slot (1, 2) n=Port Number (0 – 65535)	GFP= GFP# GFP? GFP*	GFP?s	GFP=snnnnn
Gigabit Management IP Address and Subnet	GIP=	19 bytes	Gigabit Management IP address and subnet mask. s=Slot (1, 2) i=IP Address n=Netmask	GIP= GIP# GIP? GIP*	GIP?s	GIP=siii.iii.iii.iii.nn
Gigabit Multicast Address	GMI=	17 bytes	Gigabit Multicast Address s=Slot (1, 2) m=Multicast Stream (1, 2) i=IP Address	GMI= GMI# GMI? GMI*	GMI?sm	GMI=smiii.iii.iii.iii
Gigabit Active Stream	N/A	2 bytes	Gigabit Active Stream s=Slot (1, 2) m=Stream (1, 2)	GSA= GSA# GSA? GSA*	GSA?s	GSA=sm
Gigabit Source IP Address	GSI=	17 bytes	Gigabit Source IP Address s=Slot (1, 2) m=Multicast Stream (1, 2) i=IP Address	GSI= GSI# GSI? GSI*	GSI?sm	GSI =smiii.iii.iii.iii

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Gigabit Primary Stream	GSP=	2 bytes	Gigabit Primary Stream s=Slot (1, 2) m=Multicast Stream (1, 2)	GSP= GSP# GSP? GSP*	GSP?s	GSP=sm
Gigabit Stream Mode	GSM=	2 bytes	Gigabit Stream Mode s=Slot (1, 2) m=Mode 1=Single Stream 2=Dual Stream (Redundancy Mode)	GSM= GSM# GSM? GSM*	GSM?s	GSM=sm
Gigabit Stream Timeout	GTO=	3 bytes	Gigabit Stream Timeout (Only used when in Dual Stream Mode). s=Slot (1, 2) t=Timeout in 100 mS intervals (0 – 10)	GTO= GTO# GTO? GTO*	GTO?s	GTO=stt
Gigabit Stream Timeout Mode	GTM=	2 bytes	Gigabit Stream Timeout Mode (Only used when in Dual Stream Mode) s=Slot (1, 2) m=Mode 0 = Non-revertive 1 = Revertive ***When in redundancy mode (GSM = 1), this parameter controls whether the Gigabit Interface switches back and forth between the two input streams for a valid MPEG stream. Revertive means the interface will switch back and forth between the two streams. Non-revertive is a latching scheme where the interface will only switch to the secondary stream.	GTM= GTM# GTM? GTM*	GTM?s	GTM=sm
Initialize Events Pointer	IEP=	None	Resets internal pointer to allow RNE? queries to start at the beginning of the stored events log.	IEP= IEP#	N/A	N/A
Boot Image	IMG=	1 byte	Boot image selection, where n is the image number: 1=Image #1 2=Image #2 Example: IMG=1 (Selects Image #1 for booting.)	IMG= IMG? IMG* IMG#	IMG?	IMG=n

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
IP Address	IPA=	18 bytes	Used to set the IP address and network prefix for the 10/100 BaseTx Ethernet management port, in the format: xxx.xxx.xxx.xxx.yy, where: xxx.xxx.xxx.xxx is the IP address, and yy is the network prefix (00..31) Example: IPA=010.006.030.001.24	IPA= IPA? IPA* IPA#	IPA?	IPA= xxx.xxx.xxx.xxx.yy
Gateway Address	IPG=	15 bytes	Used to set the Gateway IP addess for the 10/100 Base Tx Ethernet management port, in the format: xxx.xxx.xxx.xxx, where: xxx.xxx.xxx.xxx is the IP address Example: IPG = 010.006.030.001	IPG= IPG? IPG* IPG#	IPG?	IPG = xxx.xxx.xxx.xxx
Interface Type	N/A	2 bytes	Interface Type, where: s=Defines which interface slot (1 or 2) x=Defines the interface type, where: 0=ASI 1=Gigabit Ethernet 2=HSSI Example: ITF?1	ITF= ITF? ITF* ITF#	ITF?s	ITF=sx
Local/Remote Status	LRS=	1 byte	Local/Remote status, where: 0=Local 1=Serial 2=Reserved 3=Ethernet Example: LRS=1 (which is remote Serial)	LRS= LRS? LRS* LRS#	LRS?	LRS=x
Unit MAC Address	N/A	12 bytes	MAC address of the unit, reported in hexadecimal. Example: MAC=0006B000D2A7 (The MAC address of the unit is 00:06:B0:00:D2:A7)	MAC= MAC? MAC* MAC#	MAC?	MAC=AABBCCDDEEFF

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Unit Alarm Mask	MSK=	2 bytes	Alarm mask conditions, in form ab, where: a=Tx AIS (0 = Alarm, 1 =Fault, 2 = Masked) b=Spare Example: MSK = 00	MSK= MSK? MSK* MSK#	MSK?	MSK=ab
Number of Unread stored Events	N/A	3 bytes	Unit returns the Number of stored Events, which remain Unread, in the form xxx. Note: This means unread over the remote control. Example: NUE=126	N/A	NUE?	NUE=xxx
Soft Reboot	RBT=	1 byte	Soft Reboot. 1= Reboot System	RBT= RBT? RBT* RBT#	N/A	RBT=x
Enable Redundancy Switch Mode	ESW=	1 byte, value of 0 or 1	Set redundancy mode, where : 0 = Disable 1 = Enable Example: ESW=1 (Enable redundancy mode)	ESW= ESW? ESW* ESW#	ESW?	ESW=x
Redundancy State	RED=	1 byte, value of 0 or 1	Unit returns the redundancy state of the unit, where: 0 = Offline 1 = Online *** This command can be used to force the unit offline, this is done by sending RED=0. This is only valid if redundancy mode is enabled. If redundancy is not enabled, then RED=0 will return an error. The unit cannot be forced online. *** If the unit is not in redundancy mode, then the unit will always be online. Example: RED=0 (force unit offline)	RED= RED? RED* RED#	RED?	RED=x (see description of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Retrieve next 5 unread Stored Events	N/A	75 bytes	Unit returns the oldest 5 Stored Events which have not yet been read over the remote control. Reply format: {CR}Sub-body{CR}Sub-body{CR}Sub-body{CR}Sub-body{CR}Sub-body, where Sub-body= ABCddmmyyhhmmss, A being the fault/clear indicator. F=Fault C=Clear I=Info B being the fault type where: 1=Unit 2=Rx Traffic 3=Tx Traffic 4=Log C is Fault Code numbers, as in FLT? or Info Code, which is: 0=Power Off 1=Power On 2=Log Cleared 3=Global Config Change 4=Redundancy Config Change If there are less than 5 events to be retrieved, the remaining positions are padded with zeros. If there are no new events, the response is RNE*.	N/A	RNE?	RNE={CR}ABCddmmyyhhmmss{CR}ABCddmmyyhhmmss{CR}ABCddmmyyhhmmss{CR}ABCddmmyyhhmmss{CR}ABCddmmyyhhmmss
Serial Number	N/A	9 bytes	Used to query the unit 9-digit serial number. Unit returns its S/N in the form xxxxxxxxx. Example: SNO=176500143	N/A	SNO?	SNO=xxxxxxxxx
Software Revision	N/A	5 bytes	Unit returns the value of the internal software revision installed in the unit, in the form: Boot:X.X.X Bulk1:Y.Y.Y Bulk2: Z.Z.Z Example: SWR=Boot:1.0.3 Bulk1:1.0.1 Bulk2:1.0.0	N/A	SWR?	SWR=Boot:X.X.X Bulk1:Y.Y.Y Bulk2:Z.Z.Z

Demodulator

Priority System = RMM (Highest priority), RMD, RCR, and RSR (Lowest Priority). Any change to a higher priority parameter can override any of the parameters of lower priority.

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Rx Mode	RMM=	1 byte	Rx Mode, where: 0=DVB-S 1=DVB-S2 2=DVB-DSNG Example: RMM=0 (which is DVB-S mode) *NOTE: Please refer to Ch.8 for available code rates, modulation types, and symbol rates for each mode.	RMM= RMM? RMM* RMM#	RMM?	RMM=x
Rx Modulation Type	RMD=	1 byte	Rx Modulation type, where: 0=QPSK 1=8PSK 2=16QAM 3=16APSK 4=32APSK Example: RMD=1 (which is 8PSK) *NOTE: Please refer to Ch.8 for available modulation types for each mode. If the demodulator is set to DVB-S2 mode, this command is query-only because the demodulation type is automatically detected, but if the unit is not locked, the query returns 'x'.	RMD= RMD? RMD* RMD#	RMD?	RMD=x

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Rx FEC Code Rate	RCR=	1 byte	Rx Modulation Type, where: 0 = Rate 3/4 1 = Rate 7/8 2 = Rate 3/5 3 = Rate 4/5 4 = Rate 5/6 5 = Rate 8/9 6 = Rate 9/10 7 = Rate 2/3 8 = Rate 1/2 Example: RCR=0 (which is Rate 3/4) *NOTE: Please refer to Ch.8 for a list of available code rates for each mode. If the demodulator is set to DVB-S2 mode, this command is query-only because the code rate is automatically detected, but if the unit is not locked, the query returns 'x'.	RCR= RCR? RCR* RCR#	RCR?	RCR=x
Rx Symbol Rate	RSR=	9 bytes	Rx Symbol Rate, where: s=Symbol Rate in Msps Example: RSR=20.000000 (20 Msps.) *NOTE: Please refer to Ch. 8 for available symbol rates for each mode.	RSR= RSR? RSR* RSR#	RSR?	RSR=ss.ssssss
Rx Frequency	RFQ=	9 bytes	Rx Frequency (in MHz) 52 to 88 MHz, and 104 to 176 MHz (70/140 Modulator) 950 to 1950 MHz (L-Band Modulator) Resolution=100Hz. Example: RFQ=0950.0000	RFQ= RFQ? RFQ* RFQ#	RFQ?	RFQ=xxxx.xxxx

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Rx Frequency Offset	N/A	5 bytes	Query only. Unit returns the value of the measured frequency offset of the carrier being demodulated. Values range from ± 0 to ± 100 kHz, 100 Hz resolution. Returns 999999 if the demodulator is unlocked. Example: RFO=+002.3 (which is + 2.3 kHz)	N/A	RFO?	RFO=sxxx.x
Rx Demod Acquisition Sweep Width	RSW=	3 bytes	Command or Query. Rx ± acquisition sweep range of demodulator, in kHz, ranging from ± 1 to ± 100 kHz. Example: RSW=009 (selects ± 9 kHz)	RSW= RSW? RSW* RSW#	RSW?	RSW=xxx (see description of arguments)
Demodulator Lock Status	N/A	1 byte	Demodulator Lock Status, where: 0 = Demodulator Unlocked 1 = Demodulator Locked Example: DLK=1 (Demodulator Locked)	DLK= DLK? DLK* DLK#	DLK?	DLK=x
Rx Signal Level	N/A	3 bytes	Query Only. Unit returns the value of the Rx signal level, in dBm, between +3.0 and –99.0 dBm, where; xxx is the Rx signal level. Examples: RSL=+03 RSL=-41	N/A	RSL?	RSL=xxx
Rx Data Rate	N/A	10 bytes	Composite Rx Data rate, in kbps. Resolution=1 bps. Example: RDR=002047.999 (which is 2047.999 kbps)	N/A	RDR?	RDR=xxxxxx.xxx

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Rx FEC Type	N/A	1 byte	Rx FEC coding type, where: 0=Viterbi + Reed-Solomon 1=LDPC (FEC is dependent on the RX Mode Type.) Example: RFT=1 (which is LDPC coding)	N/A	RFT?	RFT=x
Rx Interface Enable	RIE=	2 bytes	Interface Slot Enable/Disable, where: s=Defines which interface slot (1 or 2) x=Rx Interface Status, where: 0=Disabled 1=Enabled Ex: RIE =11 (Enables receive interface)	RIE= RIE? RIE* RIE#	RIE?s	RIE=sx
Rx Alpha Rolloff	RAR=	1 byte	Rx Alpha Rolloff, where: 0 = 20% 1 = 25% 2 = 35% Example: RAR=0 (which is a Rx Alpha Rolloff of 20%)	RAR= RAR? RAR* RAR#	RAR?	RAR=x
Rx Gold Code Sequence Index	RGS=	6 bytes	Rx Gold Code Sequence Index: xxxxxx = Gold Code Sequence index (0 to 262141) Example: RGS=189063 *NOTE: Only valid in DVB-S2 mode.	RGS= RGS? RGS* RGS#	RGS?	RGS=xxxxxx

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Rx Frame Size	N/A	1 byte	Rx Frame Size Long/Short selection, where: 0=Short, 1=Long Example: RFS =0 (which is Short Frame Size) *NOTE: Setting only valid in DVB-S2 mode. If the unit is not locked, the query returns 'x'.	RFS = RFS? RFS * RFS #	RFS?	RFS =x
Rx Pilot On/Off	N/A	1 byte	Rx Pilot On/Off selection, where: 0=Off, 1=On Example: RPI=0 (which is Pilot Off) *NOTE: Only valid in DVB-S2 mode. This is automatically detected on demod acquisition, but if the unit is not locked, the query returns 'x'.	RPI= RPI? RPI* RPI#	RPI?	RPI=x
Rx Data Invert	RDI=	2 bytes	Invert Receive Data, where: s=Defines which interface slot (1 or 2) x=Invert Receive Data, where: 0=Normal 1=Inverted (Note: Command valid Only with HSSI.) Example: RDI = 111 (selects Inverted RX Data)	RDI = RDI? RDI* RDI#	RDI?sc	RDI =sx (see description of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Rx Clock Invert	RCI=	2 bytes	Command or Query. Invert Receive Clock, where: s=Defines which interface slot (1 or 2) x=Invert Receive Clock, where: 0=Normal 1=Inverted (Note: Command valid Only with HSSI) Example: RCI = 11 (selects Inverted RX Clock, Slot 1)	RCI = RCI? RCI * RCI #	RCI?s	RCI =sx (see description of arguments)
Rx Clock Source	RCK=	2 bytes	Command or Query. Rx Clock Source (For Data Rate Accuracy), where: s=Defines which interface slot (1 or 2) x=Rx Clock Source, where: 0=Rx Satellite 1=Tx-Terrestrial 2=External Reference Clock 3=Internal (HSSI Only) Example: RCK=11 (selects Tx-Terrestrial)	RCK= RCK? RCK* RCK#	RCK?s	RCK=sx (see description of arguments)
Enable/Disable Adaptive Equalizer	AEQ=	1 byte	Adaptive Equalizer status, where: 0=Disable 1=Enable Example: AEQ=1 (which is Enable)	AEQ= AEQ? AEQ* AEQ#	AEQ?	AEQ=x
Eb/No Alarm Point	EBA=	4 bytes	Command or Query. Eb/No alarm point in dB, with a range between 0.1 and 16 dB. Resolution=0.1 dB Example: EBA=12.3	EBA= EBA? EBA* EBA#	EBA?	EBA=xx.x (see description of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Rx Buffer Size	RBS=	5 bytes	Command or Query. Rx Buffer Size (in milliseconds), where: s=Defines which interface slot (1 or 2) xx.x= Rx Buffer Size, HSSI = 5.0 to 32.0 ms, in 0.1 ms steps GBEI = N/A ASI = N/A Example: RBS=130.0 (selects 30.0 ms on interface 1)	RBS= RBS? RBS* RBS#	RBS?s	RBS=sxx.x (see description of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Transmit & Receive Configuration	TRC=	69 bytes	Global configuration, in the form: aaaa.aaaabcc.ccccccdefghhhhhhiii.ijkllll.llllmnn.nnnnnnopqrssssstuvv where: aaaa.aaaa = Tx Frequency (in MHz) same as TFQ b = Tx Mode same as TMM cc.cccccc = Tx Symbol Rate same as TSR d = Tx FEC Type same as TFT ** e = Tx Modulation type same as TMD f = Tx FEC Rate same as TCR g = Tx Spectrum Inversion same as TSI hhhhhh = Tx Gold Code Sequence same as TGS iii.i = Tx Power Level same as TPL j = Tx Carrier State same as TXO k = Tx Alpha Roll-off same as TAR llll.llll = Rx Frequency (in MHz) same as RFQ m = Rx Mode same as RMM nn.nnnnnn = Rx Symbol Rate same as RSR o = Rx FEC Type same as RFT ** p = Rx Modulation type same as RMD q = Rx FEC Rate same as RCR x = spare byte ssssss = Rx Gold Code Sequence same as RGS t = Rx Alpha Roll-off same as RAR u = Unit test Mode same as TST** vv = Unit Alarm Mask same as MSK ** Read-only	TRC= TRC? TRC* TRC#	TRC?	TRC= aaaa.aaaabcc.ccccccdefghhhhhhiii.ijkllll.llllmnn.nnnnnnopqxssssssstuvv Returns current transmit and receive configuration. **Notes:** Unit returns ‘x’s for Rx parameters if unit is modulator. Unit returns ‘x’s for Tx parameters if unit is demodulator. If Rx is in DVB-S2 mode, the Rx Modulation Type and Rx FEC Rate is ignored because these are automatically detected.

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Rx Eb/No	N/A	4 bytes	Query only. Unit returns the value of Eb/No (when in DVB-S or DVB-DSNG mode), between 0 and 16 dB, resolution 0.1 dB. Returns 99.9 if demod is unlocked. Example EBN=12.3 (which is Eb/No = 12.3 dB) For values greater than 16.0 dB, the reply will be: EBN=+016	N/A	EBN?	EBN=xxxx
Rx Es/No	N/A	4 bytes	Query only. Unit returns the value of EsNo (when in DVB-S2 mode), between 0 and 16 dB, resolution 0.1 dB. Returns 99.9 if demod is unlocked. Example ESN=12.3 (which is Es/No = 12.3 dB) For values greater than 22.0 dB, the reply will be: ESN=+022	N/A	ESN?	ESN=xxxx
Rx PER	N/A	7 bytes	Query only. Units returns the value of the estimated PER in the form ab x 10^{-c} . First three bytes are the value. Last two bytes are the exponent. Returns 0.0E+00 if the demodulator is unlocked. Example: PER=4.8E-03 (which is PER = 4.8 x 10^{-3})	N/A	PER?	PER=a.bEscc
Rx BER	N/A	7 bytes	Query only. Units returns the value of the estimated BER in the form ab x 10^{-c} . First three bytes are the value. Last two bytes are the exponent. Returns 0.0E+00 if the demodulator is unlocked. Example: BER=4.8E-03 (which is BER = 4.8 x 10^{-3})	N/A	BER?	BER=a.bEscc

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Rx Link Margin	N/A	4 bytes	Query only. Unit returns the value of the Link Margin. Returns 00.0 if demod is unlocked. Example LNK=12.3	N/A	LNK?	LNK=xxxx
ASI Rx Frame Size	ARF=	2 bytes	Indicates whether the ASI Rx Frame Size is 188 or 204 bytes (ASI card only), in the form: sf Where: s = interface slot (1 or 2) f = frame size 0 = 188 bytes 1 = 204 bytes Example: ARF=11 (sets interface slot 1 to 204 byte frame size)	ARF= ARF? ARF* ARF#	ARF?s	ARF=sf
Clear All Stored Events	CAE=	None	Forces the software to clear the software events log. Example: CAE= Note: This command takes no arguments	CAE= CAE? CAE* CAE#	N/A	N/A
Circuit ID String	CID=	24 bytes	Sets or queries the user-defined Circuit ID string, which is a fixed length of 24 characters. Valid characters include: Space ( ) * + – , . / 0 9 and A thru Z	CID= CID? CID* CID#	CID?	CID=xxxxxxxxxxxxxxxx xxxxxxxx
Configuration Load	CLD=	1 byte	Retrieves a previously stored configuration from the specified configuration location (0 to 9). Example: CLD=4 (retrieve configuration from location 4)	CLD= CLD? CLD* CLD#	N/A	N/A
Configuration Save	CST=	1 byte	Stores the current configuration in the specified configuration location (0 to 9). Example: CST=4 (store the current configuration in location 4)	CST= CST? CST* CST#	N/A	N/A

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Real-time Clock Date	DAY=	6 bytes	A date in the form ddmmyy, where dd = day of the month (01 to 31), mm = month (01 to 12) yy = year (00 to 99) Example: DAY=240457 (April 24, 2057)	DAY= DAY? DAY* DAY#	DAY?	DAY=ddmmyy

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Equipment ID	N/A	23 bytes	Unit returns equipment identification and configuration, where: **aaa = defines the modulator model number (710)** **b = Modulator configuration**: 0 = None, 1=70/140 Mhz, 2=L-Band **c = Tx Symbol Rate S/W option:** 0 = 15.0 Msps, 1 = 22.5 Msps, 2 = 30.0 Msps, 3 = 37.5 Msps (S1 and DSNG only), 4 = 45.0 Msps (S1 and DSNG only) **d = S/W option Tx 8PSK:** 0=Not installed, 1=Installed **e = S/W option Tx 16-QAM:** 0=Not installed, 1=Installed **f = S/W option Tx 16APSK:** 0=Not installed, 1=Installed **g = S/W option Tx 32APSK:** 0=Not installed, 1=Installed **h = S/W option Tx DVB-S1:** 0=Not installed, 1=Installed **i = S/W option Tx DVB-DSNG:** 0=Not installed, 1=Installed **j = S/W option Tx DVB-S2:** 0=Not installed, 1=Installed **k = Demodulator configuration:** 0=None, 1=70/140 Mhz, 2=L-Band **l = Rx Symbol Rate S/W option:** 0=15.0 Msps, 1 = 22.5 Msps, 2 = 30.0 Msps, 3 = 37.5 Msps (S1 & DSNG only), 4 = 45.0 Msps (S1 & DSNG only) **m = S/W option Rx 8PSK:** 0=Not installed, 1=Installed **n = S/W option Rx 16-QAM:** 0=Not installed, 1=Installed **o = S/W option Rx 16APSK:** 0=Not installed, 1=Installed **p = S/W option Rx 32APSK:** 0=Not installed, 1=Installed **q = S/W option Rx DVB-S1:** 0=Not installed, 1=Installed **r = S/W option Rx DVB-DSNG:**0=Not installed, 1=Installed **s = S/W option Rx DVB-S2:** 0=Not installed, 1=Installed **t = Interface slot #1:** 0 = None, 1 = ASI, 2 = Gigabit Ethernet Interface, 3 = HSSI **u = Interface slot #2:** 0 = None, 1 = ASI, 2 = Gigabit Ethernet Interface, 3 = HSSI	EID= EID? EID* EID#	EID?	EID= aaabcdefghijklmnopqrstu Note: Unit returns 'Not Installed' for Rx options if unit is modulator only. Unit returns 'Not Installed' for Tx options if unit is demodulator only.

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
External Reference Frequency	ERF=	1 byte	External Reference Frequency, where: 0=Internal 1=External 1 MHz 2=External 2 MHz 3=External 5 MHz 4=External 10 MHz 5=External 20 MHz Example: ERF=0 (External reference not used - uses internal)	ERF= ERF? ERF* ERF#	ERF?	ERF=x
Faults and Status	N/A	5 bytes	Unit returns the current fault and status codes for the Unit (hardware), Tx Traffic and Rx Traffic, in the form abcd, where: a = Unit Faults: 0=No faults 1=Framer FPGA Load 2=Power supply fault, +1.5 Volts, Framer Card 3=Power supply fault, +1.5 Volts, Interface #1 4=Power supply fault, +1.5 Volts, Interface #2 5=Power supply fault, +3.3 Volts, Framer Card 6=Power supply fault, +5.0 Volts, Framer Card 7=Power supply fault, +12.0 Volts, Framer Card 8=Power supply fault, -12.0 Volts, Framer Card 9=Power supply faulit, +18.0 Volts, Framer Card A=FLASH Checksum B=FEC1 Load C=FEC2 Load D=Interface #1 Load E=Interface #2 Load F=192 MHz PLL G=External Reference H=Framer Card Temperature I=Modem Temperature J=Cooling Fans K=Interface #1 Removed L=Interface #2 Removed	N/A	FLT?	FLT=abcd d=Change in fault status since last poll. **Note:** Each section has faults listed in order of priority. For each section, only the highest priority fault is returned. There maybe multiple faults for each section, but only the highest fault is returned.

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
			b = Tx Traffic Status: 0=No faults			

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
			c=Rx Traffic Status 0=No faults 1=+1.5V Demod Power Supply Unit (Demodulator Card) 2=FPGA Load (Demodulator Card) 3=Demod Unlocked 4=DSNG Sync Error 5=FPGA Temperature (Demodulator Card) 6=BER Limit Exceeded 7=AGC Level Out of Range 8=Eb/No Limit Exceeded 9=Demodulator Synth 1 PLL A=Demodulator Synth 2 PLL B= SERDES Demod to Framer C= SERDES Framer to FEC1 D= SERDES Framer to FEC2 E= Demod FAST options not installed. F= MPEG transport stream error. G=ASI Rx PLL Empty (Interface 1) H=ASI Rx PLL Full (Interface 1) I=ASI Rx PLL Lower Limit Reached (Interface 1) J=ASI Rx PLL Upper Limit Reached (Interface 1) K=ASI Rx PLL Empty (Interface 2) L=ASI Rx PLL Full (Interface 2) M=ASI Rx PLL Lower Limit Reached (Interface 2) N=ASI Rx PLL Upper Limit Reached (Interface 2) O=Rx DCM Unlocked P=ASI Rx SERDES Error (Interface 1) Q=ASI Rx SERDES DCM Unlocked (Interface 1) R=ASI Rx SERDES Error (Interface 2) S=ASI Rx SERDES DCM Unlocked (Interface 2) T=HSSI Rx Buffer Underrun (Interface 1) U=HSSI Rx Buffer Overflow (Interface 1) V=HSSI Rx Buffer Underrun (Interface 2) W=HSSI Rx Buffer Overflow (Interface 2) X=Framer SERDES Rx Fault (Interface 1) Y=Framer SERDES Rx Fault (Interface 2) Z=Rx Clock Source Fault (Interface 1) [=Rx Clock Source Fault (Interface 2)			
			d=New Faults 0=No new faults 1=New faults, since last check			

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Firmware Revisions	N/A	1 byte	Query the version information of the system. Where: i = Bulk Image number (1 or 2) a = Firmware Image b = Firmware Revision c = Firmware Date Example: FRW?1	FRW? FRW* FRW#	FRW?i	FRW={CR}Boot:{CR}a,b,c{CR}Bulki:{CR}a,b,c{CR}a,b,c…
Gigabit Egress FEC Enable	GEF=	2 bytes	Gigabit Egress FEC Enable/Disable. s=Slot (1, 2) n=Enable / Disable, where 0 = Disabled 1 = Enabled	GEF= GEF# GEF? GEF*	GEF?s	GEF=sn
Gigabit Egress Multicast Group Address	GEG=	16 bytes	Gigabit Egress Multicast Group Address. The multicast stream egressing from the gigabit interface will have this ip address as the source IP address. s=Slot (1, 2) i=IP Address	GEG= GEG# GEG? GEG*	GEG?s	GEG=siii.iii.iii.iii
Gigabit Egress Port Numbers	GEP=	11 bytes	Gigabit Egress Port Numbers s=Slot (1, 2) nnnnn = Source Port Number (0 – 65535) ppppp = Destination Port Number (0 – 65535) *** Note: Both Source Port and Destination Port must be valid for set command to take effect.	GEP= GEP# GEP? GEP*	GEP?s	GEP=snnnnnppppp
Gigabit Egress FEC Matrix	GFM=	6 bytes	Gigabit Egress FEC Matrix. s=Slot (1, 2) ll = Length, two digit number (leading zero) between 1 and 20. dd = Depth, two digit number (leading zero) between 4 and 20. **(Length x Depth, must be less than or equal to 100)	GFM= GFM # GFM? GFM*	GFM?s	GFM=sll,dd

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Gigabit Management IP Address and Subnet	GIP=	19 bytes	Gigabit Management IP address and subnet mask. s=Slot (1, 2) i=IP Address n=Netmask	GIP= GIP# GIP? GIP*	GIP?s	GIP=siii.iii.iii.iii.nn
Initialize Events Pointer	IEP=	None	Resets internal pointer to allow RNE? queries to start at the beginning of the stored events log.	IEP= IEP#	N/A	N/A
Boot Image	IMG=	1 byte	Boot image selection, where n is the image number: 1=Image #1 2=Image #2 Example: IMG=1 (Selects Image #1 for booting.)	IMG= IMG? IMG* IMG#	IMG?	IMG=n
IP Address	IPA=	18 bytes	Used to set the IP address and network prefix for the 10/100 BaseTx Ethernet management port, in the format: xxx.xxx.xxx.xxx.yy, where: xxx.xxx.xxx.xxx is the IP address, and yy is the network prefix (00..31) Example: IPA=010.006.030.001.24	IPA= IPA? IPA* IPA#	IPA?	IPA= xxx.xxx.xxx.xxx.yy
Gateway Address	IPG=	15 bytes	Used to set the Gateway IP addess for the 10/100 Base Tx Ethernet management port, in the format: xxx.xxx.xxx.xxx, where: xxx.xxx.xxx.xxx is the IP address Example: IPG = 010.006.030.001	IPG= IPG? IPG* IPG#	IPG?	IPG = xxx.xxx.xxx.xxx
Interface Type	N/A	2 bytes	Interface Type, where: s=Defines which interface slot (1 or 2) x=Defines the interface type, where: 0=ASI 1=Gigabit Ethernet 2=HSSI Example: ITF?1	ITF= ITF? ITF* ITF#	ITF?s	ITF=sx

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Local/Remote Status	LRS=	1 byte	Local/Remote status, where: 0=Local 1=Serial 2=Reserved 3=Ethernet Example: LRS=1 (which is remote Serial)	LRS= LRS? LRS* LRS#	LRS?	LRS=x
Unit MAC Address	N/A	12 bytes	MAC address of the unit, reported in hexadecimal. Example: MAC=0006B000D2A7 (The MAC address of the unit is 00:06:B0:00:D2:A7)	MAC= MAC? MAC* MAC#	MAC?	MAC=AABBCCDDEEFF
Unit Alarm Mask	MSK=	2 bytes	Alarm mask conditions, in form ab, where: a=Tx AIS (0 = Alarm, 1 =Fault, 2 = Masked) b=Spare Example: MSK = 00	MSK= MSK? MSK* MSK#	MSK?	MSK=ab
Number of Unread stored Events	N/A	3 bytes	Unit returns the Number of stored Events, which remain Unread, in the form xxx. Note: This means unread over the remote control. Example: NUE=126	N/A	NUE?	NUE=xxx
Soft Reboot	RBT=	1 byte	Soft Reboot. 1= Reboot System	RBT= RBT? RBT* RBT#	N/A	RBT=x
Enable Redundancy Switch Mode	ESW=	1 byte, value of 0 or 1	Set redundancy mode, where : 0 = Disable 1 = Enable Example: ESW=1 (Enable redundancy mode)	ESW= ESW? ESW* ESW#	ESW?	ESW=x

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Redundancy State	RED=	1 byte, value of 0 or 1	Unit returns the redundancy state of the unit, where: 0 = Offline 1 = Online *** This command can be used to force the unit offline, this is done by sending RED=0. This is only valid if redundancy mode is enabled. If redundancy is not enabled, then RED=0 will return an error. The unit cannot be forced online. *** If the unit is not in redundancy mode, then the unit will always be online. Example: RED=0 (force unit offline)	RED= RED? RED* RED#	RED?	RED=x (see description of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Retrieve next 5 unread Stored Events	N/A	75 bytes	Unit returns the oldest 5 Stored Events which have not yet been read over the remote control. Reply format: {CR}Sub-body{CR}Sub-body{CR}Sub-body{CR}Sub-body{CR}Sub-body, where Sub-body= ABCddmmyyhhmmss, A being the fault/clear indicator. F=Fault C=Clear I=Info B being the fault type where: 1=Unit 2=Rx Traffic 3=Tx Traffic 4=Log C is Fault Code numbers, as in FLT? or Info Code, which is: 0=Power Off 1=Power On 2=Log Cleared 3=Global Config Change 4=Redundancy Config Change If there are less than 5 events to be retrieved, the remaining positions are padded with zeros. If there are no new events, the response is RNE*.	N/A	RNE?	RNE={CR}ABCddmmyyhhmmss{CR}ABCddmmyyhhmmss{CR}ABCddmmyyhhmmss{CR}ABCddmmyyhhmmss{CR}ABCddmmyyhhmmss
Serial Number	N/A	9 bytes	Used to query the unit 9-digit serial number. Unit returns its S/N in the form xxxxxxxxx. Example: SNO=176500143	N/A	SNO?	SNO=xxxxxxxxx
Software Revision	N/A	5 bytes	Unit returns the value of the internal software revision installed in the unit, in the form: Boot:X.X.X Bulk1:Y.Y.Y Bulk2: Z.Z.Z Example: SWR=Boot:1.0.3 Bulk1:1.0.1 Bulk2:1.0.0	N/A	SWR?	SWR=Boot:X.X.X Bulk1:Y.Y.Y Bulk2:Z.Z.Z

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Real-time Clock Time	TIM=	6 bytes	A time in the form hhmmss, indicating the time from midnight, where: hh = hours (00 to 23) mm = minutes (00 to 59) ss = seconds (00 to 59) Example: TIM=231259 (23 hours:12 minutes:59 seconds)	TIM= TIM? TIM* TIM#	TIM?	TIM=hhmmss
Temperature	N/A	3 bytes	Unit returns the value of the internal temperature, in the form of sxxx (degrees C). Where s is the sign and and xxx is the number of degrees. Example: TMP=+026	N/A	TMP?	TMP=sxxx

Modem

Priority System = TMM (Highest priority), TMD, TCR, and TSR (Lowest Priority). Any change to a higher priority parameter can override any of the parameters of lower priority.

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Tx Mode	TMM=	1 byte	Tx Mode, where: 0=DVB-S 1=DVB-S2 2=DVB-DSNG Example: TMM=0 (which is DVB-S mode) *NOTE: Please refer to Chapter 8 for available code rates, modulation types, and symbol rates for each mode.	TMM= TMM? TMM* TMM#	TMM?	TMM=x
Tx Modulation Type	TMD=	1 byte	Tx Modulation type, where: 0=QPSK 1=8PSK 2=16QAM 3=16APSK 4=32APSK Example: TMD=1 (which is 8PSK) *NOTE: Please refer to Chapter 8 for available modulation types for each mode.	TMD= TMD? TMD* TMD#	TMD?	TMD=x

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Tx FEC Code Rate	TCR=	1 byte	Tx Modulation Type, where: 0 = Rate 3/4 1 = Rate 7/8 2 = Rate 3/5 3 = Rate 4/5 4 = Rate 5/6 5 = Rate 8/9 6 = Rate 9/10 7 = Rate 2/3 8 = Rate 1/2 Depending on FEC type, not all of these selections will be valid. Example: TCR=0 (which is Rate 3/4) *NOTE: Please refer to Chapter 8 for a list of available code rates for each mode.	TCR= TCR? TCR* TCR#	TCR?	TCR=x
Tx Symbol Rate	TSR=	9 bytes	Tx Symbol Rate, where: s=Symbol Rate in Msps Example: TSR=20.000000 (20 Msps.)	TSR= TSR? TSR* TSR#	TSR?	TSR=ss.ssssss
Tx Frequency	TFQ=	9 bytes	Tx Frequency (in MHz) 52 to 88 MHz, and 104 to 176 MHz (70/140 Modulator) 950 to 1950 MHz (L-Band Modulator) Resolution=100Hz. Example: TFQ=0950.0000	TFQ= TFQ? TFQ* TFQ#	TFQ?	TFQ=xxxx.xxxx

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Tx Power Level	TPL=	5 bytes	Tx Output power level, where: s=sign (+ / -) xx.x = Tx Output power level, +05.0 and –20.0 dBm. L-Band: -25.0 to –05.0 dBm 70/140 MHz: -20.0 to +00.0 dBm Note: Beyond –20 dBm is beyond the specification. Example: TPL = -13.4	TPL= TPL? TPL* TPL#	TPL?	TPL=sxx.x
Tx Carrier State	TXO=	1 byte	Tx Carrier State, where: 0=OFF due to front panel or remote control command 1=ON Example: TXO=1 (Tx Carrier ON)	TXO= TXO? TXO* TXO#	TXO?	TXO=x
Tx Output Impendance	IMP=	1 byte	Tx output impedance, where: 0=50 Ohm 1=75 Ohm Example: IMP=0 (Set impedance to 50 Ohms) * NOTE: Setting Tx Impedence is only possible on 70/140 Mhz units.	IMP= IMP? IMP* IMP#	IMP?	IMP=x
Tx Data Rate	N/A	10 bytes	Composite Tx Data rate, in kbps. Resolution=1 bps. Example: TDR=002047.999 (which is 2047.999 kbps)	N/A	TDR?	TDR=xxxxxx.xxx

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Tx FEC Type	N/A	1 byte	Tx FEC coding type, where: 0=Viterbi + Reed-Solomon 1=LDPC (FEC is dependent on the TX Mode Type.) Example: TFT=1 (which is LDPC coding)	N/A	TFT?	TFT=x
Tx Interface Enable	TIE=	2 bytes	Interface Slot Enable/Disable, where: s=Defines which interface slot (1 or 2) x=Tx Interface Status, where: 0=Disabled 1=Enabled Ex: TIE =11 (Enables transmit interface)	TIE= TIE? TIE* TIE#	TIE?s	TIE=sx
Tx Alpha Rolloff	TAR=	1 byte	Tx Alpha Rolloff, where: 0 = 20% 1 = 25% 2 = 35% Example: TAR=0 (which is a Tx Alpha Rolloff of 20%)	TAR= TAR? TAR* TAR#	TAR?	TAR=x
Tx Gold Code Sequence Index	TGS=	6 bytes	Tx Gold Code Sequence Index: xxxxxx = Gold Code Sequence index (0 to 262141) Example: TGS=189063 *NOTE: Only valid in DVB-S2 mode.	TGS= TGS? TGS* TGS#	TGS?	TGS=xxxxxx

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Tx Frame Size	TFS=	1 byte	Tx Frame Size Long/Short selection, where: 0=Short, 1=Long Example: TFS =0 (which is Short Frame Size) *NOTE: Setting only valid in DVB-S2 mode.	TFS = TFS? TFS * TFS #	TFS?	TFS =x
Tx Pilot On/Off	TPI=	1 byte	Tx Pilot On/Off selection, where: 0=Off, 1=On Example: TPI=0 (which is Pilot Off) *NOTE: Only valid in DVB-S2 mode.	TPI= TPI? TPI* TPI#	TPI?	TPI=x
Tx Location of Pilot	TLP=	1 byte	Tx Pilot On/Off selection, where: 0=average, 1=Peak Example: TLP=0 (which is Pilot Average) *NOTE: Only valid in DVB-S2 mode.	TLP= TLP? TLP* TLP#	TLP?	TLP=x
Tx Spectrum Invert	TSI=	1 byte	Tx Spectrum Invert selection, where: 0=Normal 1=Tx Spectrum Inverted Example: TSI=0 (which is normal)	TSI= TSI? TSI* TSI#	TSI?	TSI=x

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Tx ASI Bandwidth	TAB=	2 bytes	Tx ASI Bandwidth, where: s=Defines which interface slot (1 or 2) x=Defines ASI Bandwidth, where: 0=Wide 1=Narrow Example: TAB=11 (selects Narrow bandwidth)	TAB= TAB? TAB* TAB#	TAB?s	TAB=sx
Tx Interface Port	TIP=	2 bytes	Indicates which port on the interface is to be used (ASI card only), in the form: sp Where: s = interface slot (1 to 2) p = interface port/channel (1 to 4) 1 = J4 2 = J5 Example: TIP=11 (selects port J4 on interface slot 1)	TIP= TIP? TIP* TIP#	TIP?s	TIP=sp
Tx Data Invert	TDI=	2 bytes	Invert Transmit Data, where: s=Defines which interface slot (1 or 2) x=Invert Transmit Data, where: 0=Normal 1=Inverted (Note: Command valid Only with HSSI) Example: TDI = 111 (selects Inverted TX Data)	TDI = TDI? TDI * TDI #	TDI?sc	TDI =sx (see description of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Tx Clock Invert	TCI=	2 bytes	Command or Query. Invert Transmit Clock, where: s=Defines which interface slot (1 or 2) x=Invert Transmit Clock, where: 0=Normal 1=Inverted (Note: Command valid Only with HSSI) Example: TCI = 11 (selects Inverted TX Clock, Slot 1)	TCI = TCI? TCI * TCI #	TCI?s	TCI =sx (see description of arguments)

Priority System = RMM (Highest priority), RMD, RCR, and RSR (Lowest Priority). Any change to a higher priority parameter can override any of the parameters of lower priority.

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Rx Mode	RMM=	1 byte	Rx Mode, where: 0=DVB-S 1=DVB-S2 2=DVB-DSNG Example: RMM=0 (which is DVB-S mode) *NOTE: Please refer to Ch.8 for available code rates, modulation types, and symbol rates for each mode.	RMM= RMM? RMM* RMM#	RMM?	RMM=x
Rx Modulation Type	RMD=	1 byte	Rx Modulation type, where: 0=QPSK 1=8PSK 2=16QAM 3=16APSK 4=32APSK Example: RMD=1 (which is 8PSK) *NOTE: Please refer to Ch.8 for available modulation types for each mode.	RMD= RMD? RMD* RMD#	RMD?	RMD=x

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Rx FEC Code Rate	RCR=	1 byte	Rx Modulation Type, where: 0 = Rate 3/4 1 = Rate 7/8 2 = Rate 3/5 3 = Rate 4/5 4 = Rate 5/6 5 = Rate 8/9 6 = Rate 9/10 7 = Rate 2/3 8 = Rate 1/2 Example: RCR=0 (which is Rate 3/4) *NOTE: Please refer to Ch.8 for a list of available code rates for each mode.	RCR= RCR? RCR* RCR#	RCR?	RCR=x
Rx Symbol Rate	RSR=	9 bytes	Rx Symbol Rate, where: s=Symbol Rate in Msps Example: RSR=20.000000 (20 Msps.) *NOTE: Please refer to Ch. 8 for available symbol rates for each mode.	RSR= RSR? RSR* RSR#	RSR?	RSR=ss.ssssss
Rx Frequency	RFQ=	9 bytes	Rx Frequency (in MHz) 52 to 88 MHz, and 104 to 176 MHz (70/140 Modulator) 950 to 1950 MHz (L-Band Modulator) Resolution=100Hz. Example: RFQ=0950.0000	RFQ= RFQ? RFQ* RFQ#	RFQ?	RFQ=xxxx.xxxx

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Rx Frequency Offset	N/A	5 bytes	Query only. Unit returns the value of the measured frequency offset of the carrier being demodulated. Values range from ± 0 to ± 100 kHz, 100 Hz resolution. Returns 999999 if the demodulator is unlocked. Example: RFO=+002.3 (which is + 2.3 kHz)	N/A	RFO?	RFO=sxxx.x
Rx Demod Acquisition Sweep Width	RSW=	3 bytes	Command or Query. Rx ± acquisition sweep range of demodulator, in kHz, ranging from ± 1 to ± 100 kHz. Example: RSW=009 (selects ± 9 kHz)	RSW= RSW? RSW* RSW#	RSW?	RSW=xxx (see description of arguments)
Demodulator Lock Status	N/A	1 byte	Demodulator Lock Status, where: 0 = Demodulator Unlocked 1 = Demodulator Locked Example: DLK=1 (Demodulator Locked)	DLK= DLK? DLK* DLK#	DLK?	DLK=x
Rx Signal Level	N/A	3 bytes	Query Only. Unit returns the value of the Rx signal level, in dBm, between +3.0 and –99.0 dBm, where; xxx is the Rx signal level. Examples: RSL=+03 RSL=-41	N/A	RSL?	RSL=xxx
Rx Data Rate	N/A	10 bytes	Composite Rx Data rate, in kbps. Resolution=1 bps. Example: RDR=002047.999 (which is 2047.999 kbps)	N/A	RDR?	RDR=xxxxxx.xxx

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Rx FEC Type	N/A	1 byte	Rx FEC coding type, where: 0=Viterbi + Reed-Solomon 1=LDPC (FEC is dependent on the RX Mode Type.) Example: RFT=1 (which is LDPC coding)	N/A	RFT?	RFT=x
Rx Interface Enable	RIE=	2 bytes	Interface Slot Enable/Disable, where: s=Defines which interface slot (1 or 2) x=Rx Interface Status, where: 0=Disabled 1=Enabled Ex: RIE =11 (Enables receive interface)	RIE= RIE? RIE* RIE#	RIE?s	RIE=sx
Rx Alpha Rolloff	RAR=	1 byte	Rx Alpha Rolloff, where: 0 = 20% 1 = 25% 2 = 35% Example: RAR=0 (which is a Rx Alpha Rolloff of 20%)	RAR= RAR? RAR* RAR#	RAR?	RAR=x
Rx Gold Code Sequence Index	RGS=	6 bytes	Rx Gold Code Sequence Index: xxxxxx = Gold Code Sequence index (0 to 262141) Example: RGS=189063 *NOTE: Only valid in DVB-S2 mode.	RGS= RGS? RGS* RGS#	RGS?	RGS=xxxxxx

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Rx Frame Size	N/A	1 byte	Rx Frame Size Long/Short selection, where: 0=Short, 1=Long Example: RFS =0 (which is Short Frame Size) *NOTE: Setting only valid in DVB-S2 mode.	RFS = RFS? RFS * RFS #	RFS?	RFS =x
Rx Pilot On/Off	N/A	1 byte	Rx Pilot On/Off selection, where: 0=Off, 1=On Example: RPI=0 (which is Pilot Off) *NOTE: Only valid in DVB-S2 mode. This is automatically detected on demod acquisition.	RPI= RPI? RPI* RPI#	RPI?	RPI=x
Rx Data Invert	RDI=	2 bytes	Invert Receive Data, where: s=Defines which interface slot (1 or 2) x=Invert Receive Data, where: 0=Normal 1=Inverted (Note: Command valid Only with HSSI) Example: RDI = 111 (selects Inverted RX Data)	RDI = RDI? RDI* RDI#	RDI?sc	RDI =sx (see description of arguments)
Rx Clock Invert	RCI=	2 bytes	Command or Query. Invert Receive Clock, where: s=Defines which interface slot (1 or 2) x=Invert Receive Clock, where: 0=Normal 1=Inverted (Note: Command valid Only with HSSI) Example: RCI = 11 (selects Inverted RX Clock, Slot 1)	RCI = RCI? RCI * RCI #	RCI?s	RCI =sx (see description of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Enable/Disable Adaptive Equalizer	AEQ=	1 byte	Adaptive Equalizer status, where: 0=Disable 1=Enable Example: AEQ=1 (which is Enable)	AEQ= AEQ? AEQ* AEQ#	AEQ?	AEQ=x
Eb/No Alarm Point	EBA=	4 bytes	Command or Query. Eb/No alarm point in dB, with a range between 0.1 and 16 dB. Resolution=0.1 dB Example: EBA=12.3	EBA= EBA? EBA* EBA#	EBA?	EBA=xx.x (see description of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Transmit & Receive Configuration	TRC=	69 bytes	Global configuration, in the form: aaaa.aaaabcc.ccccccdefghhhhhhiii.ijkllll.llllmnn.nnnnnnopqrssssstuvv where: aaaa.aaaa = Tx Frequency (in MHz) same as TFQ b = Tx Mode same as TMM cc.cccccc = Tx Symbol Rate same as TSR d = Tx FEC Type same as TFT ** e = Tx Modulation type same as TMD f = Tx FEC Rate same as TCR g = Tx Spectrum Inversion same as TSI hhhhhh = Tx Gold Code Sequence same as TGS iii.i = Tx Power Level same as TPL j = Tx Carrier State same as TXO k = Tx Alpha Roll-off same as TAR llll.llll = Rx Frequency (in MHz) same as RFQ m = Rx Mode same as RMM nn.nnnnnn = Rx Symbol Rate same as RSR o = Rx FEC Type same as RFT ** p = Rx Modulation type same as RMD q = Rx FEC Rate same as RCR x = spare byte ssssss = Rx Gold Code Sequence same as RGS t = Rx Alpha Roll-off same as RAR u = Unit test Mode same as TST** vv = Unit Alarm Mask same as MSK ** Read-only	TRC= TRC? TRC* TRC#	TRC?	TRC= aaaa.aaaabcc.ccccccdefghhhhhhiii.ijkllll.llllmnn.nnnnnnopqxssssssstuvv Returns current transmit and receive configuration. **Notes:** Unit returns ‘x’s for Rx parameters if unit is modulator. Unit returns ‘x’s for Tx parameters if unit is demodulator. If Rx is in DVB-S2 mode, the Rx Modulation Type and Rx FEC Rate is ignored because these are automatically detected.

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Rx Eb/No	N/A	4 bytes	Query only. Unit returns the value of Eb/No (when in DVB-S or DVB-DSNG mode), between 0 and 16 dB, resolution 0.1 dB. Returns 99.9 if demod is unlocked. Example EBN=12.3 (which is Eb/No = 12.3 dB) For values greater than 16.0 dB, the reply will be: EBN=+016	N/A	EBN?	EBN=xxxx
Rx Es/No	N/A	4 bytes	Query only. Unit returns the value of EsNo (when in DVB-S2 mode), between 0 and 16 dB, resolution 0.1 dB. Returns 99.9 if demod is unlocked. Example ESN=12.3 (which is Es/No = 12.3 dB) For values greater than 22.0 dB, the reply will be: ESN=+022	N/A	ESN?	ESN=xxxx
Rx PER	N/A	7 bytes	Query only. Units returns the value of the estimated PER in the form ab x 10^{-c} . First three bytes are the value. Last two bytes are the exponent. Returns 0.0E+00 if the demodulator is unlocked. Example: PER=4.8E-03 (which is PER = 4.8 x 10^{-3})	N/A	PER?	PER=a.bEscc
Rx BER	N/A	7 bytes	Query only. Units returns the value of the estimated BER in the form ab x 10^{-c}. First three bytes are the value. Last two bytes are the exponent. Returns 0.0E+00 if the demodulator is unlocked. Example: BER=4.8E-03 (which is BER = 4.8 x 10^{-3})	N/A	BER?	BER=a.bEscc

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Rx Link Margin	N/A	4 bytes	Query only. Unit returns the value of the Link Margin. Returns 00.0 if demod is unlocked. Example LNK=12.3	N/A	LNK?	LNK=xxxx
ASI Rx Frame Size	ARF=	2 bytes	Indicates whether the ASI Rx Frame Size is 188 or 204 bytes (ASI card only), in the form: sf Where: s = interface slot (1 or 2) f = frame size 0 = 188 bytes 1 = 204 bytes Example: ARF=11 (sets interface slot 1 to 204 byte frame size)	ARF= ARF? ARF* ARF#	ARF?s	ARF=sf
ASI Tx Frame Size	ATF=	2 bytes	Indicates whether the ASI Tx Frame Size is 188 or 204 bytes (ASI card only), in the form: sf Where: s = interface slot (1 or 2) f = frame size 0 = 188 bytes 1 = 204 bytes Example: ATF=11 (sets interface slot 1 to 204 byte frame size)	ATF= ATF? ATF* ATF#	ATF?s	ATF=sf
Clear All Stored Events	CAE=	None	Forces the software to clear the software events log. Example: CAE= Note: This command takes no arguments	CAE= CAE? CAE* CAE#	N/A	N/A
Circuit ID String	CID=	24 bytes	Sets or queries the user-defined Circuit ID string, which is a fixed length of 24 characters. Valid characters include: Space ( ) * + – , . / 0 9 and A thru Z	CID= CID? CID* CID#	CID?	CID=xxxxxxxxxxxxxxxx xxxxxxxx

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Configuration Load	CLD=	1 byte	Retrieves a previously stored configuration from the specified configuration location (0 to 9). Example: CLD=4 (retrieve modulator configuration from location 4)	CLD= CLD? CLD* CLD#	N/A	N/A
Configuration Save	CST=	1 byte	Stores the current modulator configuration in the specified configuration location (0 to 9). Example: CST=4 (store the current configuration in location 4)	CST= CST? CST* CST#	N/A	N/A
Real-time Clock Date	DAY=	6 bytes	A date in the form ddmmyy, where dd = day of the month (01 to 31), mm = month (01 to 12) yy = year (00 to 99) Example: DAY=240457 (April 24, 2057)	DAY= DAY? DAY* DAY#	DAY?	DAY=ddmmyy

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Equipment ID	N/A	23 bytes	Unit returns equipment identification and configuration, where: **aaa = defines the modulator model number (710)** **b = Modulator configuration**: 0=None, 1=70/140 Mhz, 2=L-Band **c = Tx Symbol Rate S/W option:** 0 = 15.0 Msps, 1 = 22.5 Msps, 2 = 30.0 Msps, 3 = 37.5 Msps (S1 and DSNG only), 4 = 45.0 Msps (S1 and DSNG only) **d = S/W option Tx 8PSK:** 0=Not installed, 1=Installed **e = S/W option Tx 16-QAM:** 0=Not installed, 1=Installed **f = S/W option Tx 16APSK:** 0=Not installed, 1=Installed **g = S/W option Tx 32APSK:** 0=Not installed, 1=Installed **h = S/W option Tx DVB-S1:** 0=Not installed, 1=Installed **i = S/W option Tx DVB-DSNG:** 0=Not installed, 1=Installed **j = S/W option Tx DVB-S2:** 0=Not installed, 1=Installed **k = Demodulator configuration:** 0=None, 1=70/140 Mhz, 2=L-Band **l = Rx Symbol Rate S/W option:** 0=15.0 Msps, 1 = 22.5 Msps, 2 = 30.0 Msps, 3 = 37.5 Msps (S1 & DSNG only), 4 = 45.0 Msps (S1 & DSNG only) **m = S/W option Rx 8PSK:** 0=Not installed, 1=Installed **n = S/W option Rx 16-QAM:** 0=Not installed, 1=Installed **o = S/W option Rx 16APSK:** 0=Not installed, 1=Installed **p = S/W option Rx 32APSK:** 0=Not installed, 1=Installed **q = S/W option Rx DVB-S1:** 0=Not installed, 1=Installed **r = S/W option Rx DVB-DSNG:**0=Not installed, 1=Installed **s = S/W option Rx DVB-S2:** 0=Not installed, 1=Installed **t = Interface slot #1:** 0 = None, 1 = ASI, 2 = Gigabit Ethernet Interface, 3 = HSSI **u = Interface slot #2:** 0 = None, 1 = ASI, 2 = Gigabit Ethernet Interface, 3 = HSSI	EID= EID? EID* EID#	EID?	EID= aaabcdefghijklmnopqrstu

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
External Reference Frequency	ERF=	1 byte	External Reference Frequency, where: 0=Internal 1=External 1 MHz 2=External 2 MHz 3=External 5 MHz 4=External 10 MHz 5=External 20 MHz Example: ERF=0 (External reference not used - uses internal)	ERF= ERF? ERF* ERF#	ERF?	ERF=x
Faults and Status	N/A	5 bytes	Unit returns the current fault and status codes for the Unit (hardware), Tx Traffic and Rx Traffic, in the form abcd, where: a = Unit Faults: 0=No faults 1=Framer FPGA Load 2=Power supply fault, +1.5 Volts, Framer Card 3=Power supply fault, +1.5 Volts, Interface #1 4=Power supply fault, +1.5 Volts, Interface #2 5=Power supply fault, +3.3 Volts, Framer Card 6=Power supply fault, +5.0 Volts, Framer Card 7=Power supply fault, +12.0 Volts, Framer Card 8=Power supply fault, -12.0 Volts, Framer Card 9=Power supply faulit, +18.0 Volts, Framer Card A=FLASH Checksum B=FEC1 Load C=FEC2 Load D=Interface #1 Load E=Interface #2 Load F=192 MHz PLL G=External Reference H=Framer Card Temperature I=Modem Temperature J=Cooling Fans K=Interface #1 Removed L=Interface #2 Removed	N/A	FLT?	FLT=abcd d=Change in fault status since last poll. **Note:** Each section has faults listed in order of priority. For each section, only the highest priority fault is returned. There maybe multiple faults for each section, but only the highest fault is returned.

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
			b = Tx Traffic Status: 0=No faults 1= +1.5V Power Supply Unit (Modulator Card) 2= FPGA Failed to Load (Modulator Card) 3= Symbol Rate PLL Clock 4= Tx Synthesizer Unlocked 5= Tx Digital Clock Manager Unlocked 6= I & Q Baseband Channels are Inactive 7= FPGA Temperature (Modulator Card) 8= Nyquist Filter Clipping 9= ASI Port Transmit FIFO Empty (Interface 1) A= ASI Port Transmit FIFO Empty (Interface 2) B= ASI Port Transmit FIFO Full (Interface 1) C= ASI Port Transmit FIFO Full (Interface 2) D= ASI Port Transmit Data Loss (Interface 1) E= ASI Port Transmit Data Loss (Interface 2) F= ASI Frame Not Synchronized (Interface 1) G= ASI Frame Not Synchronized (Interface 2) H= HSSI TX Clock Failure (Interface 1) I= HSSI TX Clock Failure (Interface 2) J= GBEI Card Datarate > 200 PPM K= GBEI Card Datarate < 200 PPM L= GBEI No PHY Link M= Encoder FIFO Empty N= Encoder FIFO Full O= ASI Tx Input Datarate Offset > +110PPM (Interface 1) P= ASI Tx Input Datarate Offset > +110PPM (Interface 2) Q= ASI Tx Input Datarate Offset < -110PPM (Interface 1) R= ASI Tx Input Datarate Offset < -110PPM (Interface 2) S= SERDES Parity Errors			

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
			C=Rx Traffic Status 0=No faults 1=+1.5 Demod Power Supply Unit (Demodulator Card) 2=FPGA Load (Demodulator Card) 3=Demod Unlocked 4=DSNG Sync Error 5=FPGA Temperature (Demodulator Card) 6=BER Limit Exceeded 7=AGC Level Out of Range 8=Eb/No Limit Exceeded 9=Demodulator Synth 1 PLL A=Demodulator Synth 2 PLL B= SERDES Demod to Framer C= SERDES Framer to FEC1 D= SERDES Framer to FEC2 E= Demod FAST options not installed. F= MPEG transport stream error. G=ASI Rx PLL Empty (Interface 1) H=ASI Rx PLL Full (Interface 1) I=ASI Rx PLL Lower Limit Reached (Interface 1) J=ASI Rx PLL Upper Limit Reached (Interface 1) K=ASI Rx PLL Empty (Interface 2) L=ASI Rx PLL Full (Interface 2) M=ASI Rx PLL Lower Limit Reached (Interface 2) N=ASI Rx PLL Upper Limit Reached (Interface 2) O=Rx DCM Unlocked P=ASI Rx SERDES Error (Interface 1) Q=ASI Rx SERDES DCM Unlocked (Interface 1) R=ASI Rx SERDES Error (Interface 2) S=ASI Rx SERDES DCM Unlocked (Interface 2) T=HSSI Rx Buffer Underrun (Interface 1) U=HSSI Rx Buffer Overflow (Interface 1) V=HSSI Rx Buffer Underrun (Interface 2) W=HSSI Rx Buffer Overflow (Interface 2) X=Framer SERDES Rx Fault (Interface 1) Y=Framer SERDES Rx Fault (Interface 2) Z=Rx Clock Source Fault (Interface 1) [=Rx Clock Source Fault (Interface 2)			

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
			D=New Faults 0=No new faults 1=New faults, since last check			
Firmware Revisions	N/A	1 byte	Query the version information of the system. Where: i = Bulk Image number (1 or 2) a = Firmware Image b = Firmware Revision c = Firmware Date Example: FRW?1	FRW? FRW* FRW#	FRW?i	FRW={CR}Boot:{CR}a,b,c{CR}Bulki:{CR}a,b,c{CR}a,b,c…
Gigabit FEC Enable	GFE=	2 bytes	Enables the Gigabit FEC mode. s=Slot (1, 2) n=Enable/Disable 0=Disabled 1=Enabled	GFE= GFE# GFE? GFE*	GFE?s	GFE=sn
Gigabit FEC Base Port	GFP=	6 bytes	Gigabit FEC Base Port number s=Slot (1, 2) n=Port Number (0 – 65535)	GFP= GFP# GFP? GFP*	GFP?s	GFP=snnnnn
Gigabit Management IP Address and Subnet	GIP=	19 bytes	Gigabit Management IP address and subnet mask. s=Slot (1, 2) i=IP Address n=Netmask	GIP= GIP# GIP? GIP*	GIP?s	GIP=siii.iii.iii.iii.nn
Gigabit Multicast Address	GMI=	17 bytes	Gigabit Multicast Address s=Slot (1, 2) m=Multicast Stream (1, 2) i=IP Address	GMI= GMI# GMI? GMI*	GMI?sm	GMI=smiii.iii.iii.iii
Gigabit Active Stream	N/A	2 bytes	Gigabit Active Stream s=Slot (1, 2) m=Stream (1, 2)	GSA= GSA# GSA? GSA*	GSA?s	GSA=sm

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Gigabit Source IP Address	GSI=	17 bytes	Gigabit Source IP Address s=Slot (1, 2) m=Multicast Stream (1, 2) i=IP Address	GSI = GSI # GSI? GSI *	GSI?sm	GSI=smiii.iii.iii.iii
Gigabit Primary Stream	GSP=	2 bytes	Gigabit Primary Stream s=Slot (1, 2) m=Multicast Stream (1, 2)	GSP= GSP# GSP? GSP*	GSP?s	GSP=sm
Gigabit Stream Mode	GSM=	2 bytes	Gigabit Stream Mode s=Slot (1, 2) m=Mode 1=Single Stream 2=Dual Stream (Redundancy Mode)	GSM= GSM# GSM? GSM*	GSM?s	GSM=sm
Gigabit Stream Timeout	GTO=	3 bytes	Gigabit Stream Timeout (Only used when in Dual Stream Mode). s=Slot (1, 2) t=Timeout in 100 mS intervals (0 – 10)	GTO= GTO# GTO? GTO*	GTO?s	GTO=stt
Gigabit Stream Timeout Mode	GTM=	2 bytes	Gigabit Stream Timeout Mode (Only used when in Dual Stream Mode) s=Slot (1, 2) m=Mode 0 = Non-revertive 1 = Revertive ***When in redundancy mode (GSM = 1), this parameter controls whether the Gigabit Interface switches back and forth between the two input streams for a valid MPEG stream. Revertive means the interface will switch back and forth between the two streams. Non-revertive is a latching scheme where the interface will only switch to the secondary stream.	GTM= GTM# GTM? GTM*	GTM?s	GTM=sm

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Gigabit Egress FEC Enable	GEF=	2 bytes	Gigabit Egress FEC Enable/Disable. s=Slot (1, 2) n=Enable / Disable, where 0 = Disabled 1 = Enabled	GEF= GEF# GEF? GEF*	GEF?s	GEF=sn
Gigabit Egress Multicast Group Address	GEG=	16 bytes	Gigabit Egress Multicast Group Address. The multicast stream egressing from the gigabit interface will have this ip address as the source IP address. s=Slot (1, 2) iii.iii.iii.iii=IP Address	GEG= GEG# GEG? GEG*	GEG?s	GEG=siii.iii.iii.iii
Gigabit Egress Port Numbers	GEP=	11 bytes	Gigabit Egress Port Numbers s=Slot (1, 2) nnnnn = Source Port Number (0 – 65535) ppppp = Destination Port Number (0 – 65535)	GEP= GEP# GEP? GEP*	GEP?s	GEP=snnnnnppppp
Gigabit Egress FEC Matrix	GFM=	5 bytes	Gigabit Egress FEC Matrix. s=Slot (1, 2) ll = Length, two digit number (leading zero) between 1 and 20. dd = Depth, two digit number (leading zero) between 4 and 20. **(Length x Depth, must be less than or equal to 100)	GFM= GFM # GFM? GFM*	GFM?s	GFM=slldd
Initialize Events Pointer	IEP=	None	Resets internal pointer to allow RNE? queries to start at the beginning of the stored events log.	IEP= IEP#	N/A	N/A
Boot Image	IMG=	1 byte	Boot image selection, where n is the image number: 1=Image #1 2=Image #2 Example: IMG=1 (Selects Image #1 for booting.)	IMG= IMG? IMG* IMG#	IMG?	IMG=n

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
IP Address	IPA=	18 bytes	Used to set the IP address and network prefix for the 10/100 BaseTx Ethernet management port, in the format: xxx.xxx.xxx.xxx.yy, where: xxx.xxx.xxx.xxx is the IP address, and yy is the network prefix (00..31) Example: IPA=010.006.030.001.24	IPA= IPA? IPA* IPA#	IPA?	IPA= xxx.xxx.xxx.xxx.yy
Gateway Address	IPG=	15 bytes	Used to set the Gateway IP addess for the 10/100 Base Tx Ethernet management port, in the format: xxx.xxx.xxx.xxx, where: xxx.xxx.xxx.xxx is the IP address Example: IPG = 010.006.030.001	IPG= IPG? IPG* IPG#	IPG?	IPG = xxx.xxx.xxx.xxx
Interface Type	N/A	2 bytes	Interface Type, where: s=Defines which interface slot (1 or 2) x=Defines the interface type, where: 0=ASI 1=Gigabit Ethernet 2=HSSI Example: ITF?1	ITF= ITF? ITF* ITF#	ITF?s	ITF=sx
Local/Remote Status	LRS=	1 byte	Local/Remote status, where: 0=Local 1=Serial 2=Reserved 3=Ethernet Example: LRS=1 (which is remote Serial)	LRS= LRS? LRS* LRS#	LRS?	LRS=x
Unit MAC Address	N/A	12 bytes	MAC address of the unit, reported in hexadecimal. Example: MAC=0006B000D2A7 (The MAC address of the unit is 00:06:B0:00:D2:A7)	MAC= MAC? MAC* MAC#	MAC?	MAC=AABBCCDDEEFF

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Unit Alarm Mask	MSK=	2 bytes	Alarm mask conditions, in form ab, where: a=Tx AIS (0 = Alarm, 1 =Fault, 2 = Masked) b=Spare Example: MSK = 00	MSK= MSK? MSK* MSK#	MSK?	MSK=ab
Number of Unread stored Events	N/A	3 bytes	Unit returns the Number of stored Events, which remain Unread, in the form xxx. Note: This means unread over the remote control. Example: NUE=126	N/A	NUE?	NUE=xxx
Soft Reboot	RBT=	1 byte	Soft Reboot. 1= Reboot System	RBT= RBT? RBT* RBT#	N/A	RBT=x
Enable Redundancy Switch Mode	ESW=	1 byte, value of 0 or 1	Set redundancy mode, where : 0 = Disable 1 = Enable Example: ESW=1 (Enable redundancy mode)	ESW= ESW? ESW* ESW#	ESW?	ESW=x
Redundancy State	RED=	1 byte, value of 0 or 1	Unit returns the redundancy state of the unit, where: 0 = Offline 1 = Online *** This command can be used to force the unit offline, this is done by sending RED=0. This is only valid if redundancy mode is enabled. If redundancy is not enabled, then RED=0 will return an error. The unit cannot be forced online. *** If the unit is not in redundancy mode, then the unit will always be online. Example: RED=0 (force unit offline)	RED= RED? RED* RED#	RED?	RED=x (see description of arguments)

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Retrieve next 5 unread Stored Events	N/A	75 bytes	Unit returns the oldest 5 Stored Events which have not yet been read over the remote control. Reply format: {CR}Sub-body{CR}Sub-body{CR}Sub-body{CR}Sub-body{CR}Sub-body, where Sub-body= ABCddmmyyhhmmss, A being the fault/clear indicator. F=Fault C=Clear I=Info B being the fault type where: 1=Unit 2=Rx Traffic 3=Tx Traffic 4=Log C is Fault Code numbers, as in FLT? or Info Code, which is: 0=Power Off 1=Power On 2=Log Cleared 3=Global Config Change 4=Redundancy Config Change If there are less than 5 events to be retrieved, the remaining positions are padded with zeros. If there are no new events, the response is RNE*.	N/A	RNE?	RNE={CR}ABCddmmyyhhmmss{CR}ABCddmmyyhhmmss{CR}ABCddmmyyhhmmss{CR}ABCddmmyyhhmmss{CR}ABCddmmyyhhmmss
Serial Number	N/A	9 bytes	Used to query the unit 9-digit serial number. Unit returns its S/N in the form xxxxxxxxx. Example: SNO=176500143	N/A	SNO?	SNO=xxxxxxxxx
Software Revision	N/A	5 bytes	Unit returns the value of the internal software revision installed in the unit, in the form: Boot:X.X.X Bulk1:Y.Y.Y Bulk2: Z.Z.Z Example: SWR=Boot:1.0.3 Bulk1:1.0.1 Bulk2:1.0.0	N/A	SWR?	SWR=Boot:X.X.X Bulk1:Y.Y.Y Bulk2:Z.Z.Z

Parameter Type	Command (Instruction Code and Qualifier)	Arguments for Command or Response to Query	Description of Arguments	Response to Command	Query (Instruction Code and Qualifier)	Response to Query
Real-time Clock Time	TIM=	6 bytes	A time in the form hhmmss, indicating the time from midnight, where: hh = hours (00 to 23) mm = minutes (00 to 59) ss = seconds (00 to 59) Example: TIM=231259 (23 hours:12 minutes:59 seconds)	TIM= TIM? TIM* TIM#	TIM?	TIM=hhmmss
Temperature	N/A	3 bytes	Unit returns the value of the internal temperature, in the form of sxxx (degrees C). Where s is the sign and and xxx is the number of degrees. Example: TMP=+026	N/A	TMP?	TMP=sxxx
Unit Test Mode	TST=	1 byte	Test Mode, where: 0=Normal Mode (no test) 1=IF Loop 2=I/O Loop 3=RF Loop 4=Tx CW 5=Tx Alternating 1,0 Pattern Example: TST=4 (Tx CW)	TST= TST? TST* TST#	TST?	TST=x
Test Pattern	TPT=	1 byte	Set Test Pattern , where: 0=Off 1=2047 2=2^23-1 Example: TPT=1 (2047)	TPT= TPT? TPT* TPT#	TPT?	TPT=x

Modem Global Configuration (MGC) Command

The MGC command can be used to configure the whole modem or parts of the modem. This command also contains spare bytes for future development, but the length of the command is fixed to 255 bytes. The MGC command can be used on modulator-only units, demodulator-only units, and modem units.

MGC Format

The format for the response to the MGC query/command is as follows:

MGC=TRUSI[Tx Block][Rx Block][Unit Block][Interface Block].

For a query, the first 5 bytes indicates whether the corresponding block is present in the response:

T – 'T' if transmit block is present in the response, '0' means the block is not present and 'x's are returned.
R – 'R' if receive block is present in the response, '0' means the block is not present and 'x's are returned.
U – 'U' if unit block is present in the response, '0' means the block is not present and 'x's are returned.
S – Indicates which interface slot is enabled. '1' indicates that slot 1 is enabled. '2' indicates that slot 2 is enabled.
I – Indicates the interface type for the interface block. '1' indicates ASI, '2' indicates Gigabit Ethernet interface, '3' indicates HSSI.

For a set command, the first 5 bytes indicates whether the corresponding block should be reprogrammed:

T – 'T' if transmit configuration should be changed, '0' means the Tx configuration should be skipped over.
R – 'R' if receive configuration should be changed, '0' means the Rx configuration should be skipped over.
U – 'U' if unit configuration should be changed, '0' means the unit configuration should be skipped over.
S – Indicates which slot should be enabled. '1' indicates that slot 1 should be enabled. '2' indicates that slot 2 should be enabled.
I – Indicates the interface type for the interface block. '1' indicates ASI, '2' indicates Gigabit Ethernet interface, '3' indicates HSSI.

[Tx Block] consists of 50 bytes for Transmit configuration, the format is: aaaa.aaaabcc.ccccccdefghhh.hijklmmmmmmxxxxxxxxxxxx

aaaa.aaaa = Tx Frequency (in MHz)	same as TFQ
b = Tx Mode	same as TMM
cc.cccccc = Tx Symbol Rate	same as TSR
d = Tx FEC Type	same as TFT (read-only)
e = Tx Modulation type	same as TMD
f = Tx FEC Rate	same as TCR
g = Tx Spectrum Inversion	same as TSI
hhh.h = Tx Power Level	same as TPL
i = Tx Carrier State	same as TXO
j = Tx Alpha Roll-off	same as TAR
k = Tx Frame Size	same as TFS
l = Tx Pilots	same as TPI
mmmmmm = Tx Gold Code Sequence	same as TGS
n = Tx Location of Pilot	same as TLP
xxxxxxxxxxx = Spare bytes.	

[Rx Block] consists of 50 bytes for Receive configuration, the format is: aaaa.aaaabcc.ccccccdefgggghijkllllllmm.mxxxxxxxxxxx

aaaa.aaaa = Rx Frequency (in MHz)	same as RFQ
b = Rx Mode	same as RMM
cc.cccccc = Rx Symbol Rate	same as RSR
d = Rx FEC Type	same as RFT (read-only)
e = Rx Modulation Type	same as RMD (read-only in DVB-S2 mode)
f = Rx FEC Rate	same as RCR (read-only in DVB-S2 mode)
ggg = Rx Sweep Width	same as RSW
h = Rx Adaptive Equalizer	same as AEQ
i = Rx Alpha Roll-off	same as RAR
j = Rx Frame Size	same as RFS (read-only)
k = Rx Pilots	same as RPI (read-only)
llllll = Rx Gold Code Sequence	same as RGS
mm.m = Rx EbNo Alarm Point	same as EBA
xxxxxxxxxxx = Spare bytes.	

[Unit Block] consists of 20 bytes for Unit Configuration, the format is: abccdxxxxxxxxxxxxxxx

a = Test Mode	same as TST
b = Test Pattern	same as TPT
cc = Alarm Mask	same as MSK
d = External Reference Frequency	same as ERF
xxxxxxxxxxxxxxx = Spare bytes.	

[Interface Block] consists of 130 bytes and contains the configuration of the current enabled interface on the unit. The format of the configuration bytes depend on the interface type indicated by the 5th byte in the MGC query or command.

If ASI interface then format is: abxxx…xxx

a = ASI Bandwidth	same as TAB (omit interface slot parameter)
b = ASI Port	same as TIP (omit interface slot parameter)
c = ASI Tx Frame Size	same as ATF (omit interface slot parameter)
d = ASI Rx Frame Size	same as ARF (omit interface slot parameter)
xxx…xxx = spare bytes	

If Gigabit Ethernet interface then format is:

aaa.aaa.aaa.aaabbb.bbb.bbb.bbbccc.ccc.ccc.cccddd.ddd.ddd.dddeefghiiiiijkkk.kkk.kkk.kkklmmmmmnnnnnooppxxx…xxx

aaa.aaa.aaa.aaa = Ingress Multicast Group Address #1	same as GMI (omit interface slot parameter)
bbb.bbb.bbb.bbb = Ingress Multicast Group Address #2	same as GMI (omit interface slot parameter)
ccc.ccc.ccc.ccc = Ingress Multicast Source Address #1	same as GSI (omit interface slot parameter)
ddd.ddd.ddd.ddd = Ingress Multicast Source Address #2	same as GSI (omit interface slot parameter)
ee = Buffer Timeout	same as GTO (omit interface slot parameter)
f = Primary Stream	same as GSP (omit interface slot parameter)
g = Stream Mode	same as GSM (omit interface slot parameter)
h = Ingress FEC Enable	same as GFE (omit interface slot parameter)
iiiii = Ingress UDP Port	same as GFP (omit interface slot parameter)
j = Buffer Timeout Mode	same as GTM (omit interface slot parameter)
kkk.kkk.kkk.kkk = Egress Multicast Group	same as GEG (omit interface slot parameter)
l = Egress FEC Enable	same as GEF (omit interface slot parameter)
mmmmm = Egress Source Port	same as GEP (omit interface slot parameter)
nnnnn = Egress Destination Port	same as GEP (omit interface slot parameter)
oo = FEC Matrix Length	same as GFM (omit interface slot parameter)
pp = FEC Matrix Depth	same as GFM (omit interface slot parameter)
xxx…xxx = spare bytes	

If HSSI interface, then format is:

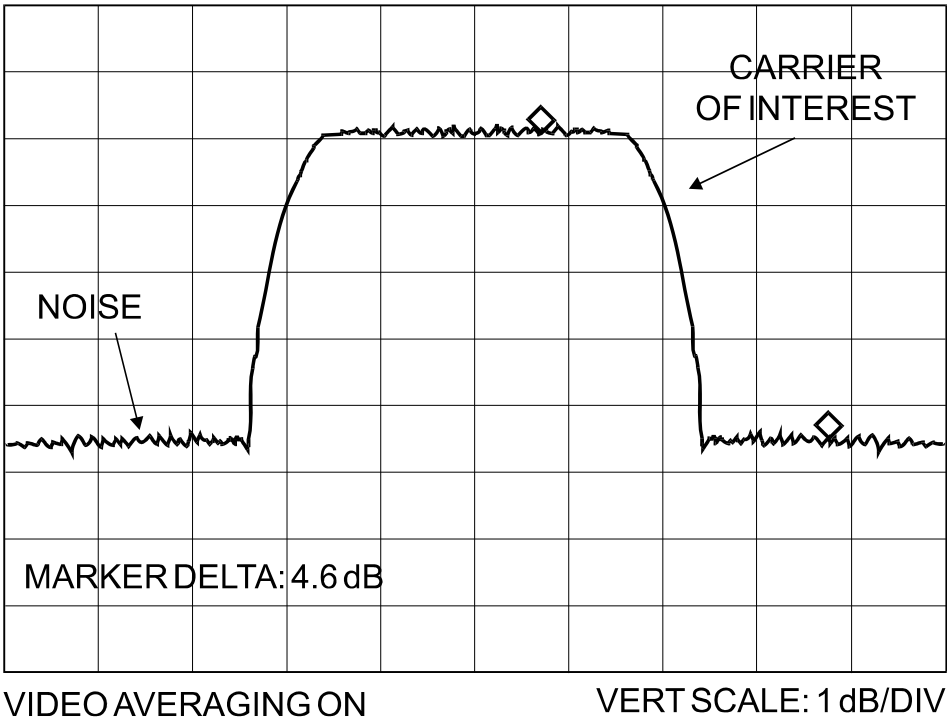
a = Tx Data Inversion	same as TDI (omit interface slot parameter)
b = Rx Data Inversion	same as RDI (omit interface slot parameter)
c = Tx Clock Inversion	same as TCI (omit interface slot parameter)
d = Rx Clock Inversion	same as RCI (omit interface slot parameter)
e = Rx Clock Source	same as RCK (omit interface slot parameter)
ff.f = Rx Buffer Size	same as RBS (omit interface slot parameter)

Note: The following codes are used in the 'Response to Command' column:

=	Message ok
?	Received ok, but invalid arguments found
*	Message ok, but not permitted in current mode
#	Message ok, but unit is not in **Remote** mode

Appendix B. Eb/No MEASUREMENT

Although the CDM-710 calculates and displays the value of receive Eb/No on the front panel of the unit, it is sometimes useful to measure the value using a spectrum analyzer, if one is available.



The idea is to accurately measure the value of (Co+No)/No, (Carrier density + Noise density/Noise density). This is accomplished by tuning the center frequency of the Spectrum analyzer to the signal of interest, and measuring the difference between the peak spectral density of the signal (the flat part of the spectrum shown) and the noise density. To make this measurement:

- Use a vertical scale of 1 or 2 dB/division.
- Set the Resolution Bandwidth of the Spectrum Analyzer to < 20 % of the symbol rate.
- Use video filtering and/or video averaging to reduce the variance in the displayed trace to a low enough level that the difference can be measured to within 0.2dB.
- Place a marker on the flat part of the signal of interest, then use the MARKER DELTA function to put a second marker on the noise to the side of the carrier. This value is (Co+No)/No, in dB.
- Use this value of (Co+No)/No in the table on the following page to determine the Eb/No. You will need to know the operating mode to read from the appropriate column.
- If the (Co+No)/No value measured does not correspond to an exact table entry, interpolate using the two nearest values.

Note that the accuracy of this method degrades significantly at low values of (Co+No)/No (approximately less than 6 dB).

Example:
In the diagram on the previous page, the (Co+No)/No measured is 4.6 dB. If Rate 1/2 QPSK is used, this corresponds to an Eb/No of approximately 2.8 dB (DVB-S2) or 3.1 dB (DVB-S).

The relationship used to derive the table values is as follows (only simple way for DVB-S2):

$$\text{Eb/No} = 10\log_{10}(10^{(\text{Co+No/No})/10} - 1) - 10\log_{10}(\text{Spectral Efficiency})$$

and:

- Eb/No and (Co+No)/No are expressed in dB
- Spectral Efficiency includes the modulation type, code rate, overhead and framing and is shown in the tables

The equation above applies to DVB-S and DVB-DSNG, or use the traditional relationship:

$$\text{Eb/No} = 10\log_{10}(10^{(\text{Co+No/No})/10} - 1) - 10\log_{10}(\text{FEC Code Rate}) - 10\log_{10}(\text{bits/symbol})$$

- Eb/No and (Co+No)/No are expressed in dB
- FEC Code Rate (Composite) = 3/4*(188/204), 7/8*(188/204) etc.
- Bits/symbol = 2 for QPSK, 3 for 8-PSK, 4 for 16-QAM
- Pay close attention to the sign of the middle term

CDM-710 Co+No/No to C/N (Es/No) and Eb/No (dB) For DVB-S And DVB-DSNG

		Code Rate									
		QPSK					8PSK			16QAM	
Spectral Efficiency		0.921569	1.228758	1.382353	1.535948	1.612745	1.843137	2.303922	2.457516	2.764706	3.225490
		1/2	2/3	3/4	5/6	7/8	2/3	5/6	8/9	3/4	7/8
(Co+No)/No	C/N = Es/No	Eb/No	Eb/No	Eb/No	Eb/No	Eb/No	Eb/No	Eb/No	Eb/No	Eb/No	Eb/No
4.0	1.8	2.1	0.9	0.4	-0.1	-0.3	-0.9	-1.8	-2.1	-2.6	-3.3
4.5	2.6	3.0	1.7	1.2	0.7	0.5	-0.1	-1.0	-1.3	-1.8	-2.5
5.0	3.3	3.7	2.5	1.9	1.5	1.3	0.7	-0.3	-0.6	-1.1	-1.7
5.5	4.1	4.4	3.2	2.7	2.2	2.0	1.4	0.4	0.2	-0.4	-1.0
6.0	4.7	5.1	3.8	3.3	2.9	2.7	2.1	1.1	0.8	0.3	-0.3
6.5	5.4	5.8	4.5	4.0	3.5	3.3	2.7	1.8	1.5	1.0	0.3
7.0	6.0	6.4	5.1	4.6	4.2	4.0	3.4	2.4	2.1	1.6	0.9
7.5	6.6	7.0	5.8	5.2	4.8	4.6	4.0	3.0	2.7	2.2	1.6
8.0	7.3	7.6	6.4	5.8	5.4	5.2	4.6	3.6	3.3	2.8	2.2
8.5	7.8	8.2	6.9	6.4	6.0	5.8	5.2	4.2	3.9	3.4	2.8
9.0	8.4	8.8	7.5	7.0	6.6	6.3	5.8	4.8	4.5	4.0	3.3
9.5	9.0	9.3	8.1	7.6	7.1	6.9	6.3	5.4	5.1	4.6	3.9
10.0	9.5	9.9	8.6	8.1	7.7	7.5	6.9	5.9	5.6	5.1	4.5
10.5	10.1	10.4	9.2	8.7	8.2	8.0	7.4	6.5	6.2	5.7	5.0
11.0	10.6	11.0	9.7	9.2	8.8	8.6	8.0	7.0	6.7	6.2	5.6
11.5	11.2	11.5	10.3	9.8	9.3	9.1	8.5	7.6	7.3	6.8	6.1
12.0	11.7	12.1	10.8	10.3	9.9	9.6	9.1	8.1	7.8	7.3	6.6
12.5	12.2	12.6	11.4	10.8	10.4	10.2	9.6	8.6	8.3	7.8	7.2
13.0	12.8	13.1	11.9	11.4	10.9	10.7	10.1	9.2	8.9	8.4	7.7
13.5	13.3	13.7	12.4	11.9	11.4	11.2	10.6	9.7	9.4	8.9	8.2
14.0	13.8	14.2	12.9	12.4	12.0	11.7	11.2	10.2	9.9	9.4	8.7
14.5	14.3	14.7	13.4	12.9	12.5	12.3	11.7	10.7	10.4	9.9	9.3
15.0	14.9	15.2	14.0	13.5	13.0	12.8	12.2	11.2	11.0	10.4	9.8
15.5	15.4	15.7	14.5	14.0	13.5	13.3	12.7	11.8	11.5	11.0	10.3
16.0	15.9	16.2	15.0	14.5	14.0	13.8	13.2	12.3	12.0	11.5	10.8
16.5	16.4	16.8	15.5	15.0	14.5	14.3	13.7	12.8	12.5	12.0	11.3
17.0	16.9	17.3	16.0	15.5	15.0	14.8	14.3	13.3	13.0	12.5	11.8
17.5	17.4	17.8	16.5	16.0	15.6	15.3	14.8	13.8	13.5	13.0	12.3
18.0	17.9	18.3	17.0	16.5	16.1	15.9	15.3	14.3	14.0	13.5	12.8
18.5	18.4	18.8	17.5	17.0	16.6	16.4	15.8	14.8	14.5	14.0	13.4
19.0	18.9	19.3	18.1	17.5	17.1	16.9	16.3	15.3	15.0	14.5	13.9
19.5	19.5	19.8	18.6	18.0	17.6	17.4	16.8	15.8	15.5	15.0	14.4
20.0	20.0	20.3	19.1	18.6	18.1	17.9	17.3	16.3	16.1	15.5	14.9
20.5	20.5	20.8	19.6	19.1	18.6	18.4	17.8	16.8	16.6	16.0	15.4
21.0	21.0	21.3	20.1	19.6	19.1	18.9	18.3	17.3	17.1	16.5	15.9
21.5	21.5	21.8	20.6	20.1	19.6	19.4	18.8	17.8	17.6	17.1	16.4
22.0	22.0	22.3	21.1	20.6	20.1	19.9	19.3	18.3	18.1	17.6	16.9

Note:
1. Includes 0.36 dB for bandwidth expansion due to Reed Solomon coding.
2. Shaded values are high error rate or unusable.

CDM-710 Co+No/No to C/N (Es/No) and Eb/No (dB) For DVB-S2 QPSK and 8-APSK

(DVB-S2 uses C/N (Es/No), and Eb/No is shown for information)

		Code Rate																
		QPSK											8PSK					
Spectral Efficiency		0.490243	0.656448	0.789412	0.988858	1.188304	1.322253	1.487473	1.587196	1.654663	1.766451	1.788612	1.779991	1.980636	2.228124	2.478562	2.646012	2.679207
		1/4	**1/3**	**2/5**	**1/2**	**3/5**	**2/3**	**3/4**	**4/5**	**5/6**	**8/9**	**9/10**	**3/5**	**2/3**	**3/4**	**5/6**	**8/9**	**9/10**
(Co+No)/No	**C/N = Es/No**	**Eb/No**	**Eb/No**	**Eb/No**	**Eb/No**	**Eb/No**	**Eb/No**	**Eb/No**	**Eb/No**	**Eb/No**	**Eb/No**	**Eb/No**	**Eb/No**	**Eb/No**	**Eb/No**	**Eb/No**	**Eb/No**	**Eb/No**
2.0	-2.3	0.8	-0.5	-1.3	-2.3	-3.1	-3.5	-4.1	-4.3	-4.5	-4.8	-4.9	-4.8	-5.3	-5.8	-6.3	-6.6	-6.6
2.5	-1.1	2.0	0.7	-0.1	-1.0	-1.8	-2.3	-2.8	-3.1	-3.3	-3.6	-3.6	-3.6	-4.1	-4.6	-5.0	-5.3	-5.4
3.0	0.0	3.1	1.8	1.0	0.0	-0.8	-1.2	-1.7	-2.0	-2.2	-2.5	-2.5	-2.5	-3.0	-3.5	-4.0	-4.2	-4.3
3.5	0.9	4.0	2.8	2.0	1.0	0.2	-0.3	-0.8	-1.1	-1.3	-1.5	-1.6	-1.6	-2.0	-2.5	-3.0	-3.3	-3.4
4.0	1.8	4.9	3.6	2.8	1.8	1.0	0.6	0.1	-0.2	-0.4	-0.7	-0.7	-0.7	-1.2	-1.7	-2.1	-2.4	-2.5
4.5	2.6	5.7	4.4	3.6	2.6	1.8	1.4	0.9	0.6	0.4	0.1	0.1	0.1	-0.4	-0.9	-1.3	-1.6	-1.7
5.0	3.3	6.4	5.2	4.4	3.4	2.6	2.1	1.6	1.3	1.2	0.9	0.8	0.8	0.4	-0.1	-0.6	-0.9	-0.9
5.5	4.1	7.2	5.9	5.1	4.1	3.3	2.8	2.3	2.1	1.9	1.6	1.5	1.6	1.1	0.6	0.1	-0.2	-0.2
6.0	4.7	7.8	6.6	5.8	4.8	4.0	3.5	3.0	2.7	2.6	2.3	2.2	2.2	1.8	1.3	0.8	0.5	0.5
6.5	5.4	8.5	7.2	6.4	5.4	4.7	4.2	3.7	3.4	3.2	2.9	2.9	2.9	2.4	1.9	1.5	1.2	1.1
7.0	6.0	9.1	7.9	7.1	6.1	5.3	4.8	4.3	4.0	3.8	3.6	3.5	3.5	3.1	2.6	2.1	1.8	1.8
7.5	6.6	9.7	8.5	7.7	6.7	5.9	5.4	4.9	4.6	4.5	4.2	4.1	4.1	3.7	3.2	2.7	2.4	2.4
8.0	7.3	10.3	9.1	8.3	7.3	6.5	6.0	5.5	5.2	5.1	4.8	4.7	4.7	4.3	3.8	3.3	3.0	3.0
8.5	7.8	10.9	9.7	8.9	7.9	7.1	6.6	6.1	5.8	5.7	5.4	5.3	5.3	4.9	4.4	3.9	3.6	3.6
9.0	8.4	11.5	10.2	9.4	8.5	7.7	7.2	6.7	6.4	6.2	5.9	5.9	5.9	5.4	4.9	4.5	4.2	4.1
9.5	9.0	12.1	10.8	10.0	9.0	8.2	7.8	7.3	7.0	6.8	6.5	6.5	6.5	6.0	5.5	5.0	4.8	4.7
10.0	9.5	12.6	11.4	10.6	9.6	8.8	8.3	7.8	7.5	7.4	7.1	7.0	7.0	6.6	6.1	5.6	5.3	5.3
10.5	10.1	13.2	11.9	11.1	10.1	9.3	8.9	8.4	8.1	7.9	7.6	7.6	7.6	7.1	6.6	6.2	5.9	5.8
11.0	10.6	13.7	12.5	11.7	10.7	9.9	9.4	8.9	8.6	8.5	8.2	8.1	8.1	7.7	7.2	6.7	6.4	6.4
11.5	11.2	14.3	13.0	12.2	11.2	10.4	10.0	9.5	9.2	9.0	8.7	8.7	8.7	8.2	7.7	7.2	7.0	6.9
12.0	11.7	14.8	13.5	12.7	11.8	11.0	10.5	10.0	9.7	9.5	9.2	9.2	9.2	8.7	8.2	7.8	7.5	7.4
12.5	12.2	15.3	14.1	13.3	12.3	11.5	11.0	10.5	10.2	10.1	9.8	9.7	9.7	9.3	8.8	8.3	8.0	8.0
13.0	12.8	15.9	14.6	13.8	12.8	12.0	11.6	11.1	10.8	10.6	10.3	10.3	10.3	9.8	9.3	8.8	8.6	8.5
13.5	13.3	16.4	15.1	14.3	13.4	12.6	12.1	11.6	11.3	11.1	10.8	10.8	10.8	10.3	9.8	9.4	9.1	9.0
14.0	13.8	16.9	15.7	14.9	13.9	13.1	12.6	12.1	11.8	11.6	11.4	11.3	11.3	10.9	10.3	9.9	9.6	9.5
14.5	14.3	17.4	16.2	15.4	14.4	13.6	13.1	12.6	12.3	12.2	11.9	11.8	11.8	11.4	10.9	10.4	10.1	10.1
15.0	14.9	18.0	16.7	15.9	14.9	14.1	13.6	13.1	12.9	12.7	12.4	12.3	12.4	11.9	11.4	10.9	10.6	10.6
15.5	15.4	18.5	17.2	16.4	15.4	14.6	14.2	13.7	13.4	13.2	12.9	12.9	12.9	12.4	11.9	11.4	11.1	11.1
16.0	15.9	19.0	17.7	16.9	15.9	15.1	14.7	14.2	13.9	13.7	13.4	13.4	13.4	12.9	12.4	11.9	11.7	11.6
16.5	16.4	19.5	18.2	17.4	16.5	15.7	15.2	14.7	14.4	14.2	13.9	13.9	13.9	13.4	12.9	12.5	12.2	12.1
17.0	16.9	20.0	18.7	17.9	17.0	16.2	15.7	15.2	14.9	14.7	14.4	14.4	14.4	13.9	13.4	13.0	12.7	12.6
17.5	17.4	20.5	19.3	18.4	17.5	16.7	16.2	15.7	15.4	15.2	15.0	14.9	14.9	14.5	13.9	13.5	13.2	13.1
18.0	17.9	21.0	19.8	19.0	18.0	17.2	16.7	16.2	15.9	15.7	15.5	15.4	15.4	15.0	14.5	14.0	13.7	13.7
18.5	18.4	21.5	20.3	19.5	18.5	17.7	17.2	16.7	16.4	16.3	16.0	15.9	15.9	15.5	15.0	14.5	14.2	14.2
19.0	18.9	22.0	20.8	20.0	19.0	18.2	17.7	17.2	16.9	16.8	16.5	16.4	16.4	16.0	15.5	15.0	14.7	14.7

Notes:

1. Eb/No = Es/No - 10 Log (Spectral Efficiency).
2. The required C/N for QEF with FECFrame = 16,200 bits is typically 0.2 to 0.3 dB higher.
3. Shaded areas are high error rate or unusable.

CDM-710 Co+No/No to C/N (Es/No) and Eb/No (dB) For DVB-S2 16-APSK and 32-APSK (DVB-S2 uses C/N (Es/No), and Eb/No is shown for information)

		Code Rate										
		16APSK						32APSK				
Spectral Efficiency		2.637201	2.966728	3.165623	3.300184	3.523143	3.567342	3.703295	3.951571	4.119540	4.397854	4.453027
		2/3	**3/4**	**4/5**	**5/6**	**8/9**	**9/10**	**3/4**	**4/5**	**5/6**	**8/9**	**9/10**
(Co+No)/No	**C/N = Es/No**	**Eb/No**	**Eb/No**	**Eb/No**	**Eb/No**	**Eb/No**	**Eb/No**	**Eb/No**	**Eb/No**	**Eb/No**	**Eb/No**	**Eb/No**
9.0	8.4	4.2	3.7	3.4	3.2	2.9	2.9	2.7	2.4	2.3	2.0	1.9
9.5	9.0	4.8	4.3	4.0	3.8	3.5	3.5	3.3	3.0	2.8	2.6	2.5
10.0	9.5	5.3	4.8	4.5	4.4	4.1	4.0	3.9	3.6	3.4	3.1	3.1
10.5	10.1	5.9	5.4	5.1	4.9	4.6	4.6	4.4	4.1	3.9	3.7	3.6
11.0	10.6	6.4	5.9	5.6	5.5	5.2	5.1	5.0	4.7	4.5	4.2	4.2
11.5	11.2	7.0	6.5	6.2	6.0	5.7	5.7	5.5	5.2	5.0	4.7	4.7
12.0	11.7	7.5	7.0	6.7	6.5	6.2	6.2	6.0	5.7	5.6	5.3	5.2
12.5	12.2	8.0	7.5	7.2	7.1	6.8	6.7	6.6	6.3	6.1	5.8	5.8
13.0	12.8	8.6	8.1	7.8	7.6	7.3	7.3	7.1	6.8	6.6	6.3	6.3
13.5	13.3	9.1	8.6	8.3	8.1	7.8	7.8	7.6	7.3	7.2	6.9	6.8
14.0	13.8	9.6	9.1	8.8	8.6	8.4	8.3	8.1	7.9	7.7	7.4	7.3
14.5	14.3	10.1	9.6	9.3	9.2	8.9	8.8	8.7	8.4	8.2	7.9	7.9
15.0	14.9	10.6	10.1	9.9	9.7	9.4	9.3	9.2	8.9	8.7	8.4	8.4
15.5	15.4	11.2	10.7	10.4	10.2	9.9	9.9	9.7	9.4	9.2	8.9	8.9
16.0	15.9	11.7	11.2	10.9	10.7	10.4	10.4	10.2	9.9	9.7	9.5	9.4
16.5	16.4	12.2	11.7	11.4	11.2	10.9	10.9	10.7	10.4	10.3	10.0	9.9
17.0	16.9	12.7	12.2	11.9	11.7	11.4	11.4	11.2	10.9	10.8	10.5	10.4
17.5	17.4	13.2	12.7	12.4	12.2	12.0	11.9	11.7	11.5	11.3	11.0	10.9
18.0	17.9	13.7	13.2	12.9	12.7	12.5	12.4	12.2	12.0	11.8	11.5	11.4
18.5	18.4	14.2	13.7	13.4	13.3	13.0	12.9	12.8	12.5	12.3	12.0	12.0
19.0	18.9	14.7	14.2	13.9	13.8	13.5	13.4	13.3	13.0	12.8	12.5	12.5
19.5	19.5	15.2	14.7	14.4	14.3	14.0	13.9	13.8	13.5	13.3	13.0	13.0
20.0	20.0	15.7	15.2	15.0	14.8	14.5	14.4	14.3	14.0	13.8	13.5	13.5
20.5	20.5	16.2	15.7	15.5	15.3	15.0	14.9	14.8	14.5	14.3	14.0	14.0
21.0	21.0	16.8	16.2	16.0	15.8	15.5	15.4	15.3	15.0	14.8	14.5	14.5
21.5	21.5	17.3	16.7	16.5	16.3	16.0	15.9	15.8	15.5	15.3	15.0	15.0
22.0	22.0	17.8	17.2	17.0	16.8	16.5	16.4	16.3	16.0	15.8	15.5	15.5
22.5	22.5	18.3	17.8	17.5	17.3	17.0	17.0	16.8	16.5	16.3	16.0	16.0
23.0	23.0	18.8	18.3	18.0	17.8	17.5	17.5	17.3	17.0	16.8	16.5	16.5
23.5	23.5	19.3	18.8	18.5	18.3	18.0	18.0	17.8	17.5	17.3	17.0	17.0
24.0	24.0	19.8	19.3	19.0	18.8	18.5	18.5	18.3	18.0	17.8	17.6	17.5
24.5	24.5	20.3	19.8	19.5	19.3	19.0	19.0	18.8	18.5	18.3	18.1	18.0
25.0	25.0	20.8	20.3	20.0	19.8	19.5	19.5	19.3	19.0	18.8	18.6	18.5
25.5	25.5	21.3	20.8	20.5	20.3	20.0	20.0	19.8	19.5	19.3	19.1	19.0
26.0	26.0	21.8	21.3	21.0	20.8	20.5	20.5	20.3	20.0	19.8	19.6	19.5

Notes:

1. Eb/No = Es/No - 10 Log (Spectral Efficiency).
2. The required C/N for QEF with FECFrame = 16,200 bits is typically 0.2 to 0.3 dB higher.
3. Shaded areas are high error rate or unusable.

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METRIC CONVERSIONS

Units of Length

Unit	Centimeter	Inch	Foot	Yard	Mile	Meter	Kilometer	Millimeter
1 centimeter	—	0.3937	0.03281	0.01094	6.214×10^{-6}	0.01	—	—
1 inch	2.540	—	0.08333	0.2778	1.578×10^{-5}	0.254	—	25.4
1 foot	30.480	12.0	—	0.3333	1.893×10^{-4}	0.3048	—	—
1 yard	91.44	36.0	3.0	—	5.679×10^{-4}	0.9144	—	—
1 meter	100.0	39.37	3.281	1.094	6.214×10^{-4}	—	—	—
1 mile	1.609×10^{5}	6.336×10^{4}	5.280×10^{3}	1.760×10^{3}	—	1.609×10^{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 Avoirdupois	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	1.0×10^{3}	35.27	32.15	2.205	2.679	—

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